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Ethnopharmacological study of medicinal plants with activity on the Central nervous system in the Eastern Region of Cuba

Estudio etnofarmacológico de plantas medicinales con actividad sobre el Sistema Nervioso Central, en la región oriental de Cuba

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Abstract

In the eastern region of Cuba, there is a traditional use of medicinal plants for various pharmacological purposes, although an inventory of these plant species necessary for the future search for new phytomedicines does not exist in all cases. This is the case for those used to treat central nervous system (CNS) disorders. To evaluate the traditional knowledge in two regions of Eastern Cuba: Santiago de Cuba and Holguín, regarding the use of medicinal plants with sedative, hypnotic, and anxiolytic effects, an ethnopharmacological study was conducted in two health areas of the main municipalities of these two provinces. A total of 400 people were surveyed, performing the socio-demographic characterization of the evaluated population as well as the qualitative characterization and evaluation of quantitative ethnopharmacological indicators such as the use value index and the significant use level of the medicinal plants used. The surveyed population in both provinces was predominantly female and over 60 years old, with a high level of preparation and professional training. A total of 27 plants were reported in the interviews conducted among the 1637 citations obtained, with similar results between the two provinces. The highest number of citations in both regions corresponded to plants used as sedatives, followed by hypnotics, and finally anxiolytics. Among the most used parts of these plants, the use of leaves prepared in the form of infusions predominated. Of the 8 plant species with the highest acceptance by the population, the plants *P. neochilus, J. pectoralis, L. inermis*, and *P. incarnata* obtained the best values for the evaluated ethnopharmacological indicators.

Keywords: Medicinal plants, Sedative, Hypnotic, and Anxiolytic Properties.

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Resumen

En la región oriental de Cuba existe un uso tradicional de plantas medicinales con diferentes fines farmacológicos, no existiendo en todos los casos el inventario de estas especies vegetales necesario para la futura búsqueda de nuevos fitomedicamentos, tal es el caso de las que se usan para tratar afecciones del sistema nervioso central. Con el objetivo de evaluar el conocimiento tradicional de dos regiones del Oriente de Cuba: Santiago de Cuba y Holguín sobre el empleo de plantas medicinales con efectos sedantes, hipnóticos y ansiolíticos, se realizó un estudio etnofarmacológico en dos áreas de salud de los principales municipios de estas dos provincias. Se encuestaron un total de 400 personas, realizando la caracterización socio-demográfica de la población evaluada, así como la caracterización cualitativa y evaluación de los indicadores etnofarmacológicos cuantitativos índice de valor de uso y el nivel de uso significativo de las plantas medicinales empleadas. La población encuestada de ambas provincias fue predominantemente del sexo femenino y en edades superiores a los 60 años, con un alto nivel de preparación y formación profesional. Se refirieron en las entrevistas realizadas un total de 27 plantas entre las 1637 citaciones obtenidas, con resultados similares entre ambas provincias. La mayor cantidad de citaciones en ambas regiones correspondieron a las plantas empleadas como sedantes, seguido de las hipnóticas y finalmente las ansiolíticas. Dentro de las partes más empleadas de estas plantas predominó el uso de las hojas, preparadas en forma de infusión. De las 8 especies vegetales con mayor aceptación por parte de la población, las plantas *P. neochilus, J. pectoralis, L. inermis* y *P. incarnata* obtuvieron los mejores valores de indicadores etnofarmacológicos evaluados.

Palabras claves: Plantas medicinales, propiedades sedantes, hipnóticas y ansiolíticas.

Introduction

Medicinal plants have been used since ancient times for the treatment of various diseases and ailments, being an important source of natural therapeutic compounds. Over the years, the traditional knowledge of medicinal plants and their use in different cultures has been one of the main objectives of ethnopharmacological studies, which have proven to be a useful tool for identifying and validating bioactive compounds (Upadhyay, 2023). Moreover, considering the need to make sustainable use of natural resources, contemporary society has become aware of the economic importance of biodiversity and recognized the contribution of traditional knowledge to science and society. This has an important role in the discovery process of new species and the suggestion of their pharmacological activities (Salmerón-Manzano et al., 2020).

The central nervous system (CNS) is one of the most important systems in the human body, and its proper functioning is essential for maintaining health. However, various diseases and disorders can affect the CNS, such as depression, anxiety, Alzheimer's disease, Parkinson's disease, among others (Rahman *et al*., 2021). Therefore, the identification of natural compounds that act on the CNS and can be used as complementary or alternative therapies is of great interest to the pharmaceutical industry (Wahid et al., 2020). In this regard, in recent years, ethnopharmacological studies have allowed the identification of a wide variety of medicinal plants with activity on the CNS, and research has been conducted to identify the bioactive compounds present in these plants and study their mechanism of action (Luthra & Roy, 2022).

The combination of ethnopharmacology and preclinical investigations has enabled the discovery of new medicinal plants with therapeutic potential for CNS diseases and disorders (Sharifi-Rad et al., 2020). Furthermore, these studies have also provided valuable information about traditional medicinal plants used by local populations (Chaachouay et al., 2020).

In Cuba, the use of medicinal plants is deeply rooted in its population. This practice has its roots in Caribbean aboriginal, African, Spanish, Arab, and Asian cultures, and its vast diversity of plant species (Puig et al., 2019). The eastern region of Cuba is known for its rich flora and for having a large number of plants with medicinal properties. Many of these are used by local communities to treat a wide variety of ailments, including CNS diseases. Ethnobotanical and ethnopharmacological studies conducted by Cuban authors in recent years have documented in international scientific literature the long tradition in the use of

medicinal plants by the Cuban population, especially in this area of the country. These studies have shown that the Cuban population, based on traditional knowledge transmitted from generation to generation, makes extensive use of a significant number of plants that have been identified and classified to treat various diseases. Additionally, the widespread use of these plants across the island is similar regardless of the geographical region where these plants are used (Heredia-Díaz et al., 2018).

However, there are still insufficient reports of ethnopharmacological studies focused on the use of certain medicinal plants in the eastern region of Cuba, especially in the treatment of important conditions such as CNS disorders, which could not only lead to the discovery of new drugs but also contribute to the preservation of the region's plant variety and promote the sustainable use of natural resources. Considering also that the cities of Santiago de Cuba and Holguín within this region are the most important from a population, economic, and cultural standpoint, this study seeks to characterize the ethnopharmacological use of medicinal plants with action on the CNS in these two provinces of the eastern region of Cuba.

Theoretical Framework

Ethnobotany: Ethnobotany is the science that studies the relationship between humans and plants. It is an interdisciplinary field that consists of studying the biological, ecological, and cultural foundations of the interactions and relationships between plants and humans over time, evolution, and socio-geographical space. This science studies the relationships between plants and different cultures throughout history and how they influence the development of a community's traditions (Pirintsos et al., 2022).

Ethnopharmacology: Ethnopharmacology is the interdisciplinary scientific exploration of the traditional use of indigenous drugs and active biomolecules. This science combines information acquired from the traditional use of medicinal plants by local communities and the results of phytochemical and pharmacological studies conducted in specialized laboratories (Pirintsos et al., 2022).

Sedative medicinal plants or drugs are those that reduce the activity of the central nervous system (CNS), causing a calming and relaxing effect (Rang et al., 2016). In contrast, a drug or substance with **hypnotic** properties acts on certain receptors in the brain to slow down brain activity and promote sleep. They are effective in helping people fall asleep faster and stay asleep longer (Kryger et al., 2010). On the other hand, according to the American Psychiatric Association (2013), drugs or medicinal plants used to treat anxiety symptoms such as feelings of fear, terror, discomfort, and muscle tension that can occur in response to stress are known as **anxiolytics**. Most anxiolytics block the action of certain chemicals in the nervous system.

Materials and Methods

Research Characteristics

An ethnopharmacological study with a qualitative and quantitative approach was conducted to characterize the use of medicinal plants with action on the CNS during the period from May to November 2022. The study was conducted in the communities of the "Camilo Torres" health area in Santiago de Cuba province and "Pedro Díaz Coello" health area in Holguín province, both corresponding to the main municipalities of each province.

Description of the Study Area

The provinces of Holguín and Santiago de Cuba are part of the so-called eastern region of Cuba, located in the eastern part of the island. This region has a tropical climate with a rainy season starting in May and ending in October and another dry season. The average annual temperature ranges between 24 and 27 degrees Celsius. Additionally, the eastern provinces of Cuba are characterized by having a mountainous topography with the presence of the Sierra Maestra and the Sierra Cristal, which gives the region great biodiversity in its botanical richness (high endemism) but also combines some flat areas that give rise to different types of vegetation: coastal xerophytic scrub and tropical forests.

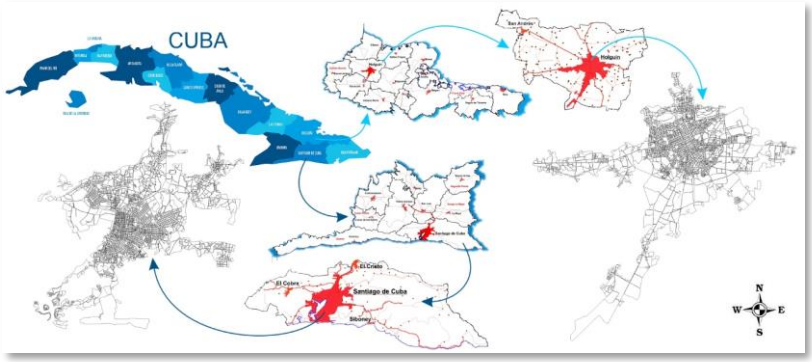

Figure 1. Geographical location of the study areas.
Source: National Institute of Physical Planning. https://www.ipf.gob.cu/es/content/mapas

The study was conducted in two health areas belonging to the provincial capitals, where the urban population predominated. This population was characterized by having workers from various sectors where the industrial sector predominates with a good level of preparation, and another significant portion represents retirees.

Sample Selection

The study universe consisted of all the inhabitants of both health areas. The sample was heterogeneous, selected through non-probabilistic random sampling, including people of both sexes of legal age, workers, housewives, retirees, students, professionals, and sellers of medicinal plants from the study areas. Always considering that the informants gave their consent to collaborate with the research.

Information Collection

A face-to-face interview was conducted using a semi-structured questionnaire designed for the study to collect information about ethnopharmacological use. The questionnaire was designed following the requirements established by the Applied Research Program for Caribbean Folk Medicine (TRAMIL) with minor modifications that respond to the research objectives (Germosén-Robineau, 1995).

The variables collected in the questionnaire were of two types: socio-demographic and ethnopharmacological. Socio-demographic variables included: sex, educational level, occupation, and age. In the case of ethnopharmacological variables, they included: forms of use and preparation, administration routes, part of the plant used, and medicinal use of the plant species. In this study, medicinal uses were established for sedative, hypnotic, and anxiolytic properties, for which a group of experts consisting of 3 psychologists, 5 doctors, and 5 pharmacists included terms in the surveys related to the use of the plant for: stress, mental or emotional tension, sleep disorders, insomnia, anxiety, restlessness, worry, depression, sadness, nervousness, agitation.

To determine the medicinal uses of the plants, the testimonies of the interviewees were analyzed, taking into account the diseases they mentioned. These diseases were subsequently classified and grouped into homogeneous pharmacological categories. Plants with sedative action were defined as those that the interviewees reported using to calm the state of nervous excitement, hypnotic when used to induce drowsiness and facilitate the onset and maintenance of sleep. And in the case of plants with anxiolytic effects, only those that the interviewees used to calm the state of anxiety without producing a state of sedation or sleep.

Collection and Taxonomic Identification of Plant Species

According to the survey results, the plants were classified and grouped by Family, scientific name, and vernacular name. The most reported families of the total plants informed were determined. All species were

taxonomically identified by specialists from the Center for Environmental Research and Services (CISAT) in Holguín province and the Eastern Center for Ecosystems and Biodiversity (BIOECO) in Santiago de Cuba province. The methods employed by the interviewees for the preparation of the plants, the parts most frequently used, the most used administration routes, and their usage knowledge were determined. Considering:

Forms of use: Fresh plant, dried, indistinctly, other. Forms of preparation: Decoction, infusion, maceration, poultice, amulet, other. Administration routes: Internal route (oral, sublingual, inhalation, other), External route (dermal). Part used: Leaf, foliage, fruit, seed, root, bark, flowers, whole plant, latex, resin.

Qualitative Analysis

The ethnopharmacological information collected in each interview was organized in Excel sheets for subsequent statistical processing (statistical program). The comparison between provinces of parameters with a binomial nature, such as sex, was performed using the Chi-square test (χ^2) for independent samples. For parameters with responses considering multiple options, the Kruskal-Wallis mean comparison test was used.

Calculation of Quantitative Ethnopharmacological Indicators

For the quantitative analysis, the ethnobotanical indices were determined: use value index (UVI) and significant use level (SUL), which are related below.

Use Value Index (UVI): It is a quantitative method used to demonstrate the relative importance of locally known species considering the number of uses mentioned by an informant for a particular medicinal plant species. UVI is useful for determining the most frequently indicated plants in the treatment of a disease. The calculation was performed for each of the plant species according to the methodology proposed by Phillips (1996), using the equation:

$$UVI = \Sigma Uvis / Nis \text{ [Equation 1]}$$

Where: Uvis: number of uses mentioned by each informant (i) for each species (s). Nis: number of informants interviewed.

Significant Use Level (SUL): For each species and to verify its cultural acceptance, the methodology proposed by Germosén-Robineau (1995) was used, where those medicinal uses cited with a frequency equal to or greater than 20% by the interviewed people who use plants as the first resource for a particular health problem can be considered significant and therefore deserve scientific evaluation and validation. The equation used is:

$$SUL = (\text{Use species (s)} * 100) / Nis \text{ [Equation 2]}$$

Where: Use species (s): number of citations for each species. Nis: number of informants interviewed.

The plants with the most citations by the interviewees were collected and organized by botanical families, searching for information through databases such as ScienceDirect, Wiley, Springer, PubMed, and Google Scholar, as well as specialized scientific journals such as: Journal of Ethnopharmacology, Phytochemistry, British Journal of Phytotherapy, Journal of Natural Products, Chinese Medical Journal, Plantes Medicinales et Phytotherapie, Revista Paulista Medica (Brazil), Revista Cubana de Plantas Medicinales, Revista Brasileira de Farmacognosia, and the Latin American and Caribbean Bulletin of Medicinal and Aromatic Plants (BLACPMA), among others, about the reported pharmacological properties and active chemical compounds responsible for the biological activity.

Results and Discussion

Characterization of the Study Sample

A total of 400 interviews were conducted, of which 200 were conducted with people belonging to the "Camilo Torres" health area of Santiago de Cuba province and 200 people belonging to the "Pedro Díaz Coello" health area of Holguín province. Of the total respondents, 252 (63.00%) were female, and 148 (27.00%) were male. The average age in both sexes was over 60 years, results that are in line with the population aging in these areas, with 42.50% of the total for women surveyed, while for men, it was 14.00% of the total. According to the National Office of Statistics and Information (ONEI) of the Republic of Cuba, in the report issued in 2023, 22.5% of the population of Holguín municipality is over 60 years old, while Santiago de Cuba municipality has an aging rate of 21.7% of its total population (ONEI, 2023).

This is related to the fact that women must take care of household chores and health-related tasks of the family, so cultural and popular knowledge about the use of home remedies based on medicinal plants is transmitted to them from generation to generation, and for this reason, they generally have a greater understanding of how to cure different ailments with medicinal plants. Similar results have been reported by different authors in this type of research in Cuba, Mexico, Peru, China, and Brazil (Urdaneta et al., 2022; Leyva et al., 2022; Gao et al., 2019).

Regarding the level of education and occupation, people with a university education level predominated among the interviewees (192 for 48.00% of the total), followed by people with a high school education level (92 for 23.00% of the total). 71.75% of the respondents (287 people) were people with active professions in both the state and private sectors, where health professionals, pharmacists, medicinal plant sellers, and workers in commerce and gastronomy predominated. Only 28.25% (113 people) of the respondents were not employed, with retirees, housewives, and students predominating. Therefore, it is observed that there are many users of traditional medicine who are detached from working life due to their age, but the use of medicinal plants as an alternative route for the treatment of various diseases does not demonstrate a relationship with the level of education or occupation; rather, it is an established and common practice among the population of the two studied localities.

Report on Medicinal Plants with Sedative, Hypnotic, and Anxiolytic Properties

The survey results showed a total of 1637 citations corresponding to all the reports of plants by each informant for both provinces. Of this total, 873 citations corresponded to Santiago de Cuba province and 764 to Holguín. The average number of plants used by each respondent was 4. The lowest number of plants used was 2, while the highest reports in the surveys were of more than 6 plants administered alone or in combinations with other plants.

A total of 27 medicinal plants with action on the CNS are used by the population of the eastern provinces of Cuba. These medicinal plants belong to 16 families, with the Lamiaceae, Asteraceae, and Rutaceae families standing out with the highest number of species. Table 1 lists the same, reflecting the species consumed in each eastern region, scientific and popular names, parts used, and preparation method. These results are consistent with other similar studies conducted in rural areas of Eastern Cuba (Urdaneta et al., 2022) and other research conducted in Brazil, Ethiopia, India, Peru, and other regions where these families are the most used by the population to treat various diseases, including those affecting the CNS (Malla, 2015; López Sáez & Pérez Soto, 2010; Teixeira Pires Gomides et al., 2022; Gebre & Chinthapalli, 2021; Rao, 2019; Mostacero-León et al., 2022).

It is also noteworthy that there were no marked differences in the consumption of medicinal plants between both regions of Eastern Cuba, as the total number of species used in Santiago was 25, while in Holguín, it was 26. However, when comparing the number of citations, it can be seen that Santiago de Cuba reached the highest number. Of the 27 species cited, only the species Pluchea carolinensis (Jacq.) D. Don (Salvia) was found to be consumed only in Santiago de Cuba and not in Holguín, and in the case of the species Bursera graveolens (Kunth) Triana & Planch, the opposite occurred.

Table 1.
List of the most used medicinal plants to treat CNS disorders.

No	Scientific name/ Family	Local name	Part used/ Plant state	Preparation	Use reports		Total reports
					Santiago de Cuba	Holguín	
1	*Argemone mexicana* L. APAVERACEAE	Cardo santo	Flower, root, seeds/ Fresh, dried	Infusion	22	17	39
2	*Bursera graveolenss (*Kunth) Triana & Planch. BURSERACEAE	Sasafrá o Palo Santo	Aerial parts/ Fresh	Aroma-therapy	-	2	2
3	*Citrus aurantiifolia (Christm.)* Swingle RUTACEAE	Limón	Leaves/ Fresh	Decoction	10	13	23
4	*Citrus sinensis (L.)* Osbeck RUTACEAE	Naranja dulce	Leaves/ Fresh	Decoction	18	25	43
5	*Citrus x aurantium* L. RUTACEAE	Naranja agria	Leaves/ Fresh	Decoction	30	24	54
6	*Eugenia caryophyllata* Thumb.	Clavo de olor	Buttons/ Dried	Decoction	5	11	16
7	*Pilea micropylla* L. URTICACEAE	Lloviznita o Frescura	Aerial parts/ Fresh	Infusion	65	12	77
8	*Hibiscus rosa-sinensis* L MALVACEAE	Amapola o marpacífico	Flower/ Fresh	Infusion	32	29	61
9	*Hypericum perforatum* HYPERICACEAE	Hierva de San Juan	Aerial parts/ Dried	Infusion	-	11	11
10	*Justicia pectoralis Jacq.* ACANTHACEAE	Tilo	Stem/ Fresh	Infusion	79	99	178
11	*Lactuca sativa*	Lechuga	Stem/ Fresh	Infusion	10	2	12
12	*Lawsonia inermis* L. LYTHRACEAE	Resedá	Leaves, Flower/ Fresh	Infusion, Decoction	79	86	165
13	*Phania matricaroides* (Spreng.) Griseb. ASTERACEAE	Manzanilla	Aerial parts/ Fresh, Dried	Infusion	36	59	95
14	*Melissa officinalis* L.	Toronjil	Aerial parts/ Fresh	Decoction	27	21	48
15	*Mentha spicata* L. LAMIACEAE	Yerba buena	Leaves/ Fresh	Decoction	24	16	40
16	*Mimosa pudica* L. FABACEAE	Morivivi, dormilona	Aerial parts/ Dried	Decoction, combustion	35	4	39
17	*Moringa oleífera* Lam MORINGACEAE	Moringa	Flower/ Fresh	Infusion	31	20	51
18	*Ocimum basilium* L. LAMIACEAE	Albahaca blanca	Aerial parts/ Fresh	Infusion	34	22	56
19	*Ocimum tenuiflorum* L. LAMIACEAE	Albahaca morada	Aerial parts/ Fresh	Infusion	81	12	93
20	*Origanum majorana* L. LAMIACEAE	Mejorana	Aerial parts/ Fresh	Decoction	26	25	51
21	*Passiflora incarnata* L. PASSIFLORACEAE	Pasiflora	Leaves, Flower, Fruit/ Fresh	Infusion	48	77	125
22	*Plectranthus neochilus Schltr* LAMIACEAE	Meproba-mato	Aerial parts / Fresh	Infusion, Decoction	125	138	263
23	*Portulaca oleracea* PORTULACACEAE	Verdolaga	Aerial parts/ Fresh	Infusion	5	7	12
24	*Pluchea carolinensis* (Jacq.) D.Don LABIACEAE	Salvia	Leaves/ Fresh	Decoction, Infusion	8	-	8
25	*Tagetes erecta* L. ASTERACEAE	Copetúa	Flower/ Fresh	Infusion	10	8	18
26	*Tradescantia spathacea* Sw. COMMELINACEAE	Barquito o Cordobán	Leaves/ Fresh	Infusion	15	9	24
27	*Valeriana scandens L.*	Valeriana	Aerial parts/ Dried	Infusion	18	15	33
	Total				**873**	**764**	**1637**

Some authors report that the predominant use of one species or another can vary regardless of geographical location, the flora of the place, sociodemographic characteristics, and prevailing health problems. In this study, very few differences were observed in the species used to treat CNS disorders (Hurtado et al., 2010). Regarding the use of plants for their properties on the CNS, 1183 citations were for medicinal plants used as sedatives, 393 citations for plants used for their hypnotic properties, and 61 as anxiolytics. It is noteworthy that in both regions, there was a similar behavior, as shown in Figure 2. Of the reported species, only three of them, *Justicia pectoralis* Jacq. (Tilo), *Matricaria recutita* L. (Chamomile), and *Passiflora incarnata* L. (Passion flower), are included in the National Formulary of Phytopharmaceuticals and Apipharmaceuticals of the Republic of Cuba with sedative pharmacological action, whose biological activity has been demonstrated (MINSAP, 2017). The species *Ocimum basilicum* L. (Basil) was excluded from this formulary since 2010 due to reports of mutagenicity and moderate cytotoxicity, so it is necessary to alert the health authorities of this locality about the use of this species by the population. The rest of the medicinal plants lack experimental verification for the attributed activity, although their traditional use for this purpose is reported in the literature.

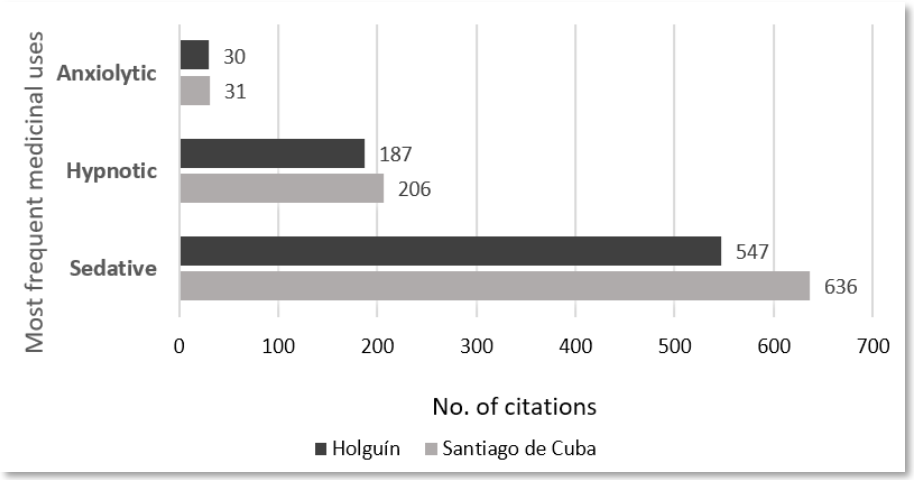

Figure 2. Most frequent medicinal uses in both provinces.

Among the main methods employed by the respondents for the preparation of medicinal plants is in their fresh form (see Table 2), values that coincided for both provinces, although many respondents stated that they use the fresh or dried form of the plant indistinctly in periods when the plants are not in their optimal vegetative state.

Table 2.
Forms in which the interviewed population of both provinces uses medicinal plants.

Main ways in which respondents use medicinal plants		**Santiago de Cuba**		**Holguín**	
		No.	**%**	**No.**	**%**
Plant state	Fresh	631	72.28	594	77.75
	Dried	175	20.05	119	15.58
	Indistinctly	67	7.67	51	6.68
Total		873	100	764	100
Preparation	Decoction	256	29.32	302	39.53
	Infusion	561	64.26	440	57.59
	Others	56	6.41	22	2.88
Total		873	100	764	100
Part used	Leaves	518	59.34	452	59.16
	Aerial parts	235	26.92	166	21.73
	Flowers	40	4.58	70	9.16
	Whole plant	55	6.30	60	7.85
	Fruits	25	2.86	11	1.44
	Others	-	-	5	0.65
Total		873	100	764	100

Leaves were the most used plant organ (970 citations of the total respondents), followed by aerial parts. These observations are likely related to the fact that they are the most abundant and accessible parts of the plant, regenerate faster, their use allows for proper management, and preservation of the plant species. However, many respondents report using more than one plant organ in some species, such as *Passiflora incarnata* L. (known by the popular name passionflower or maracuja), where the population uses leaves, flowers, and fruits.

Regarding the administration route, 100% of the respondents stated that they use the internal route, and within this route, the oral route (98%) was predominant, being the most convenient and most used by the population. It is important to highlight the use of the inhalation route within internal administrations. Several studies agree with the use of decoction and infusion as a popular way of obtaining plant extracts. Both are simple and quick preparation methods, do not require equipment, only an appropriate container that can be glass or stainless steel, and also use water as the menstruum; being very economical.

There were no marked differences in the plants consumed in both localities of the Eastern region of Cuba nor in the uses attributed to the species by the interviewees, parts used, preparation methods, and other aspects analyzed. Ethnobotanical studies conducted in these regions emphasize the broad culture that Eastern populations have regarding the use of medicinal plants, which has been transmitted from generation to generation. For these reasons, quantitative indicators were calculated.

Quantitative Analysis

The uses of the identified medicinal plant species with effect on the CNS were described, and the Use Value Index (UVI) and Significant Use Level (SUL) were determined (Table 3). Both indices express the ethnobotanical knowledge of a species by the studied population, where species that reach values greater than 20% indicate that the plant is used more frequently to treat a specific health problem.

Of the 27 identified species, eight plant species exceeded 20%. In the Santiago de Cuba region, the species with the highest SUL are: *P. neochilus* (62.5%), *J. pectoralis* (39.5%), *L. inermis* (39.5%), *O. tenuiflorum* (44.5%), *P. incarnata* (24%), and *P. micropylla* (32.5%). Similarly, the species with the highest SUL in the Holguín region are: *P. neochilus* (69%), *J. pectoralis* (49.5%), *L. inermis* (43%), *P. incarnata* (38.5%), *P. oleracea* (35%), and the species *P. Matricaroide* (29.5%), demonstrating a high coincidence among the most used species. Only differ between one region and another in the plants *O. tenuiflorum*, *P. micropylla*, *P. oleracea*, and *P. Matricaroide*.

Table 3.
Use Value Index (UVI) and Significant Use Level (SUL) of medicinal plants reported by the interviewees in the eastern region of Cuba.

No	Scientific name/ Family	Local name	Medicinal uses	UVI		SUL	
				SCU	H	SCU	H
1	*Argemone mexicana* L. PAPAVERACEAE	Cardo santo	Sedative, Hypnotic	0.110	0.085	11.0	8.5
2	*Bursera graveolenss (*Kunth) Triana & Planch. BURSERACEAE	Sasafrá o Palo Santo	Sedative	-	0.010	-	1
3	*Citrus aurantiifolia (Christm.)* Swingle RUTACEAE	Limón	Sedative, Anxiolytic	0.050	0.065	5.0	6.5
4	*Citrus sinensis (L.)* Osbeck RUTACEAE	Naranja dulce	Sedative, Anxiolytic	0.090	0.125	9.0	12.5
5	*Citrus x aurantium* L. RUTACEAE	Naranja agria	Sedative, Anxiolytic	0.150	0.120	15.0	12
6	*Eugenia caryophyllata* Thumb.	Clavo de olor	Sedative	0.025	0.055	2.5	5.5
7	*Pilea micropylla* L. URTICACEAE	Lloviznita o Frescura	Sedative	0.325	0.060	32.5	6
8	*Hibiscus rosa-sinensis* L MALVACEAE	Amapola o marpacífico	Sedative, Hypnotic, Anxiolytic	0.160	0.145	16.0	14.5
9	*Hypericum perforatum* HYPERICACEAE	Hierva de San Juan	Sedative, Hypnotic	-	0.055	-	5.5

10	*Justicia pectoralis Jacq.* ACANTHACEAE	Tilo	Sedative	0.395	0.495	39.5	49.5
11	*Lactuca sativa*	Lechuga	Sedative, Hypnotic	0.050	0.010	5.0	1.0
12	*Lawsonia inermis* L. LYTHRACEAE	Resedá	Sedative	0.395	0.430	39.5	43.0
13	*Phania matricaroides* (Spreng.) Griseb. ASTERACEAE	Manzanilla	Sedative, Hypnotic	0.180	0.295	18	29.5
14	*Melissa officinalis* L.	Toronjil	Sedative, Hypnotic	0.135	0.105	13.5	10.5
15	*Mentha spicata* L. LAMIACEAE	Yerba buena	Sedative	0.120	0.080	12.0	8.0
16	*Mimosa pudica* L. FABACEAE	Morivivi, dormilona	Sedative, Hypnotic, Anxiolytic	0.175	0.020	17.5	2
17	*Moringa oleífera* Lam MORINGACEAE	Moringa	Sedative	0.155	0.100	15.5	10
18	*Ocimum basilium* L. LAMIACEAE	Albahaca blanca	Sedative, Hypnotic	0.015	0.110	1.5	11
19	*Ocimum tenuiflorum* L. LAMIACEAE	Albahaca morada	Sedative	0.445	0.060	44.5	6.0
20	*Origanum majorana* L. LAMIACEAE	Mejorana	Sedative	0.130	0.125	13.0	12.5
21	*Passiflora incarnata* L. PASSIFLORACEAE	Pasiflora	Sedative, Hypnotic	0.240	0.385	24.0	38.5
22	*Plectranthus neochilus Schltr* LAMIACEAE	Meprobamato	Sedative, Hypnotic	0.625	0.690	62.5	69.0
23	*Portulaca oleracea* PORTULACACEAE	Verdolaga	Sedative	0.025	0.350	2.5	35.0
24	*Pluchea carolinensis* (Jacq.) D.Don LABIACEAE	Salvia	Sedative	0.040	-	4.0	-

The species *Plectranthus neochilus* Schltr., known popularly as Meprobamato, is a recently introduced plant in Cuba, and its cultivation has spread throughout the island due to the medicinal properties attributed by the Cuban population, where it is widely used for its sedative and hypnotic effect. These ethnomedicinal uses are different from those reported in other South American countries, as the species used in other latitudes is employed to treat respiratory diseases, digestive disorders, as an antimicrobial and antiparasitic mainly. Rodríguez-Ferreiro in 2023 identified 18 compounds in the water extract of *P. neochilus* leaves, corresponding to 8 flavonoids and 10 abietane diterpenes, which could be responsible for its action on the CNS, showing a variation in behavior and motor coordination in OF1 male mice at a dose of 500 mg/kg. The gene expression study showed a positive modulation of the expression of genes related to the dopamine/opioid system, as well as the concomitant inhibition of GABAergic pathways, metabolic-energetic signaling, inflammation, and muscle contraction (Rodríguez-Ferreiro, 2023).

The plant *Justicia pectoralis*, known as Tilo, is reported for its analgesic, anti-inflammatory, antiasthmatic, expectorant, diuretic, sedative, anxiolytic, antidiabetic, antihypertensive, antibacterial, and other properties in regions of Ecuador, Cuba, and Colombia (Lima et al., 2020; Guimarães et al., 2020). Similarly, ethanolic extracts of Tilo leaves have been reported for the treatment of epilepsy and anxiety in *in-vitro* and *in-vivo* studies, demonstrating their ability to inhibit the enzyme GABA transaminase (GABA-T) or bind to the GABA-A benzodiazepine receptor, two main pharmacological targets in epilepsy and anxiety. Heredia and collaborators, in an ethnobotanical study of medicinal plants used by the inhabitants of Holguín, highlight that 16 species had citations for their effect on the CNS (Heredia et al., 2018).

In the case of the species *Lawsonia inermis*, the scientific literature indicates that it has antihypertensive, anticatarrhal, anti-inflammatory, antimicrobial properties and is used to treat diabetes and rheumatism, among other ailments, but its most important effect is its action on the CNS due to its sedative properties. These results coincide with the study conducted in Santiago de Cuba in the José Martí District by Urdaneta and collaborators in 2020, where among all the reported uses for this species, calming the nerves was the most cited (Urdaneta et al., 2020). This use could be associated with the pharmacological activity exhibited by secondary metabolites present in the chemical composition of the species. According to reports, the presence of essential oils and coumarins has been identified, metabolites responsible for hypnotic and sedative action (Moutawalli et al., 2023).

Passiflora incarnata is another of the most used species to treat CNS disorders and is internationally recognized for its sedative and hypnotic effects due to its rich composition in flavonoids such as apigenin, luteolin, vitexin, quercetin, orientin, among others. It also contains indole alkaloids derived from β-carboline, such as harmalol, harmol, harmaline, phenolic acids, maltol, among other metabolites. The tea made from this plant has been used as a sedative and also to cure subjects affected by opioid dependence in India. Additionally, preclinical studies conducted on mice have shown that a dose of 60-250 mg/kg body weight of an extract made with 30% or 40% ethanol resulted in reduced movement in mice. The 40% ethanol extract dose increased sleep duration at 60 mg/kg body weight, while the 50 mg/kg body weight dose delayed the onset of seizures. Similarly, the evaluation of an aqueous extract at a dose of 160-250 mg/kg body weight reduced seizures, increased sleep duration, and decreased motor movement (Gupta and Yadav, 2023; Nikolova et al., 2024). Similarly, Zanardi and collaborators in 2023 conducted a study on 186 depressed and anxious patients undergoing long-term treatment with benzodiazepines using dried drug capsules of this plant. The results obtained suggest that this phytomedicine can be used as an effective complementary treatment during the reduction of benzodiazepine doses (Zanardi et al., 2023).

Regarding medicinal use, only two species were used by the population concerning the three surveyed pharmacological properties, these were *H. rosa-sinensis* L. and *M. pudica* L., respectively. The species *H. rosa-sinensis* L. has shown anxiolytic and sedative effects in albino mice after treatment with alcoholic extracts of the leaves of this plant (Begum & Younus, 2018; Khalid et al., 2014). For its part, Hossain and Sultana demonstrated that extracts of the plant *M. pudica L*. have anxiolytic and sedative activity in albino mice similar to the effect of benzodiazepines (Hossain & Sultana, 2019; Sultana & Hossain, 2019), while Naldi and collaborators showed the hypnotic and sedative effects of ethanolic extracts of the leaves of this plant in male mice (Naldi et al., 2022).

These results demonstrate the traditional roots of these species by the population of eastern Cuba, who use them in many cases as therapeutic substitutes for drugs obtained by chemical synthesis. This constitutes evidence that contributes to the validation of their ethnopharmacological use and, consequently, points towards the search for new therapeutic alternatives with certified quality, safety, and efficacy, which is an interest and priority today for the National Health System of the Republic of Cuba, allowing for a more rational, safe, and effective use of them.

Conclusions

This research allowed us to evaluate the traditional knowledge of two regions of Eastern Cuba: Santiago de Cuba and Holguín, regarding the use of medicinal plants to treat CNS disorders. An ethnomedicinal pattern was identified with similar behavior in both communities of the Eastern region, where the use of leaves as a source of medicinal remedies predominated and infusion was the most used preparation method. The most frequent use was sedative, followed by hypnotic and anxiolytic. Of the eight species that achieved good popular acceptance, the medicinal plants: *P. neochilus*, *J. pectoralis*, *L. inermis*, and *P. incarnata* coincide in both regions. The research highlights the importance of preserving this ancestral knowledge and exploring the therapeutic potential of the identified species for the treatment of central nervous system disorders.

Bibliographic References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5*). American Psychiatric Association.

Begum, Z., & Younus, I. (2018). *Hibiscus rosa sinensis* mediate anxiolytic effect via modulation of ionotropic GABA-A receptors: possible mechanism of action. *Metabolic brain disease, 33*, 823-827. https://doi.org/10.1007/s11011-018-0188-4

Chaachouay, N., Benkhnigue, O., & Zidane, L. (2020). Ethnobotanical study aimed at investigating the use of medicinal plants to treat nervous system diseases in the Rif of Morocco. *Journal of chiropractic medicine, 19*(1), 70-81. https://doi.org/10.1016/j.jcm.2020.02.004

Ferreiro, A. O. R. (2023*). Neuropharmacological activity of leaf extract of Plectranthus neochilus Schltr. grown in Cuba* (Doctoral dissertation), University of Antwerp.

Gao, L, Wei, N, Yang, G, Zhang, Z, Liu, G, & Cai, C. (2019). Ethnomedicine study on traditional medicinal plants in the Wuliang Mountains of Jingdong, Yunnan, China. *J. ethnobiol. Ethnomed, 15*(41), 1-20. https://doi.org/10.1186/s13002-019-0316-1

Gebre, T., & Chinthapalli, B. (2021). Ethnobotanical study of the traditional use and maintenance of medicinal plants by the people of Aleta-Chuko woreda, south Ethiopia. *Pharmacognosy Journal, 13*(5). http://dx.doi.org/10.5530/pj.2021.13.142

Germosén-Robineau, L. (1995). *Hacia una farmacopea vegetal caribeña. Edición TRAMIL 7*. Santo Domingo: Enda Caribe, UAG & Universidad de Antioquia.

Guimarães, T. L. F., Silva, L. M. R. D., Lima, C. D. B., Magalhães, F. E. A., & Figueiredo, E. A. T. D. (2020). Antimicrobial activity of microcapsules with aqueous extract of chambá (*Justicia pectoralis* Jacq). *Revista Ciência Agronômica, 51*(2), e20186471. https://doi.org/10.5935/1806-6690.20200033

Gupta, A., & Yadav, J. S. (2023). A Review On Miraculous Herb For The Treatment Of Depression: *Passiflora Incarnata*. *Journal of Survey in Fisheries Sciences*, 3886-3892. https://doi.org/10.53555/sfs.v10i1.1782

Heredia-Díaz, Y., García-Díaz, J., López-González, T., Chil-Nuñez, I., Arias-Ramos, D., Escalona-Arranz, J. C., ... & Martínez-Figueredo, Y. (2018). An ethnobotanical survey of medicinal plants used by inhabitants of Holguín, Eastern Region, Cuba. *Bol Latinoam Caribe Plant Med Aromat, 17*(2), 160-196.

Hossain, M. L., & Sultana, S. (2019). *In-vivo* assessment of neuropharmacological activity of methanol bark extract of *Mimosa pudica* in mice. *Adv. Pharmacol. Pharm, 7*(2), 33-37. https://doi.org/10.13189/app.2019.070202

Hurtado R., & Moraes, M. (2010). Comparación del uso de plantas por dos comunidades campesinas del bosque tucumano-boliviano de Vallegrande (Santa Cruz, Bolivia). *Ecología en Bolivia, 45*(1), 20-54.

Khalid, L., Rizwani, G. H., Sultana, V., Zahid, H., Khursheed, R., & Shareef, H. (2014). Antidepressant activity of ethanolic extract of *Hibiscus rosa sinenesis* Linn. *Pakistan Journal of Pharmaceutical Sciences, 27*(5).

Kryger, M. H., Roth, T., & Dement, W. C. (2010). *Principles and Practice of Sleep Medicine-E-Book: Expert Consult-Online and Print*. Elsevier Health Sciences.

Leyva, C. S., Tagle, L. J., Teofilo, C. A., Hernández, J. G., Cordero, S. C., Franco, G. F., & Sánchez, D. O. S. (2022). Estudio etnofarmacológico y fitoquímico de las plantas medicinales de mayor uso en Julián Blanco, Guerrero, México. *Acta Agrícola y Pecuaria, 8*(1), 1-13. https://doi.org/10.30973/aap/2022.8.0081012

Lima, A. R. S., Lôbo, L. A. C., Costa, T. L. D. C., Peixoto, J. D. C., Borges, L. L., Amaral, V. C. D. S., & Paula, J. A. M. D. (2020). Eco-friendly extraction and simultaneous determination of two coumarins in *Justicia pectoralis* (Acanthaceae). *Rodriguésia, 71*, e01132019. https://doi.org/10.1590/2175-7860202071041

López Sáez, J. A., & Pérez Soto, J. (2010). Permanencia y transmisión del acervo botánico etnomedicinal en la Isla de Ometepe (Nicaragua). *Revista Española de Antropología Americana, 40*(2), 125-144

Luthra, R., & Roy, A. (2022). Role of medicinal plants against neurodegenerative diseases. *Current pharmaceutical biotechnology, 23*(1), 123-139. https://doi.org/10.2174/1389201022666210211123539

Malla, B., Gauchan, D. P., & Chhetri, R. B. (2015). An ethnobotanical study of medicinal plants used by ethnic people in Parbat district of western Nepal. *Journal of ethnopharmacology, 165*, 103-117. https://doi.org/10.1016/j.jep.2014.12.057

Ministerio de Salud Pública [MINSAP]. (2017). *Formulario Nacional de Fitofármacos y Apifármacos.* Segunda Edición. La Habana, Cuba: Editorial Ciencias Médicas.

Mostacero-León, J., García-Izquierdo, L. G., López-Medina, S. E., Anthony, J., & Gil-Rivero, A. E. (2022). Valor de uso medicinal de la flora empleada por la Comunidad Andina de Jesús, Cajamarca, Perú. *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas, 21*(5), 561-576. https://doi.org/10.37360/blacpma.22.21.5.34

Moutawalli, A., Benkhouili, F. Z., Doukkali, A., Benzeid, H., & Zahidi, A. (2023). The biological and pharmacologic actions of *Lawsonia inermis* L. *Phytomedicine Plus, 3*(3), 100468. https://doi.org/10.1016/j.phyplu.2023.100468

Naldi, J., Ginting, I., Rudang, S. N., & Ramadayanti, S. (2022). Sedative Test of Ethanol Extract of Putri Malu Leaves (*Mimosa Pudica* Linn.) in Mice (*Mus Musculus*) With Standardized Herbal Medicine Lelap as Comparison. *Journal La Medihealtico*, *3*(2), 110-115. https://doi.org/10.37899/journallamedihealtico.v3i2.579

Nikolova, K., Velikova, M., Gentscheva, G., Gerasimova, A., Slavov, P., Harbaliev, N., ... & Gavrilova, A. (2024). Chemical Compositions, Pharmacological Properties and Medicinal Effects of Genus *Passiflora* L.: A Review. *Plants*, *13*(2), 228. https://doi.org/10.3390/plants13020228

Oficina Nacional de Estadística e Información (ONEI). (2023). *El envejecimiento de la población. Cuba y sus territorios 2022. República de Cuba*. http://www.onei.gov.cu/sites/default/files/envejecimiento_2022_.pdf

Puig, P. L., Millian, A. J. G., Carbonell, L. A., Perdomo, J., & Pérez, A. S. (2019). Integration of Cuban natural and traditional medicine in the health system. *Revista Cubana de Salud Pública*, *45*(2), 1-24.

Rahman, M. H., Bajgai, J., Fadriquela, A., Sharma, S., Trinh, T. T., Akter, R., ... & Lee, K. J. (2021). Therapeutic potential of natural products in treating neurodegenerative disorders and their future prospects and challenges. *Molecules*, *26*(17), 5327. https://doi.org/10.3390/molecules26175327

Rang, H. P., Dale, M. M., Ritter, J. M., & Moore, P. K. (2016). *Pharmacology*. Elsevier.

Rao, R. R. (2019). Medicinal plants of India: diversity, conservation and bioprospection-concerns and strategies for 21st century. *Medicinal plants of India: Conservation and sustainable use*, *1*, 1-38.

Salmerón-Manzano, E., Garrido-Cardenas, J. A., & Manzano-Agugliaro, F. (2020). Worldwide research trends on medicinal plants. *International journal of environmental research and public health*, *17*(10), 3376. https://doi.org/10.3390/ijerph17103376

Sharifi-Rad, M., Lankatillake, C., Dias, D. A., Docea, A. O., Mahomoodally, M. F., Lobine, D., ... & Sharifi-Rad, J. (2020). Impact of natural compounds on neurodegenerative disorders: from preclinical to pharmacotherapeutics. *Journal of Clinical Medicine*, *9*(4), 1061. https://doi.org/10.3390/jcm9041061

Sultana, S., & Hossain, M. L. (2019). Evaluation of Anxiolytic and Antibacterial Activity of Methanol Extract of Leaves of Mimosa pudica. *Universal Journal of Plant Science*, *7*(3), 44-49. https://doi.org/10.13189/ujps.2019.070302

Teixeira Pires Gomides, N. A. M., Guarim Neto, G., Pereira Martins, M., Kato, L., & Pasqualotto Severino, V. G. (2022). Ethnobotanical and ethnopharmacological survey of medicinal species utilized in the Coqueiros Community, Brazil. *Boletin Latinoamericano y Del Caribe de Plantas Medicinales y Aromaticas*, *21*(6). https://doi.org/10.37360/blacpma.22.21.6.42

Upadhyay, H.C. (2023). Exploring Nature's Treasure for Drug Discovery. *Letters in Drug Design & Discovery*, *20*(4), 373-374. https://doi.org/10.2174/1570180820042301131444O4

Urdaneta, Y. F., González, T. L., & Pacheco, A. O. (2022). Folklore medicinal del culantro (*Eryngium foetidum* L.). *Orange Journal*, *4*(7), 45-55. https://doi.org/10.46502/issn.2710-995X/2022.7.04

Urdaneta-Laffita, I., Padró-Rodríguez, L., Tur-Naranjo, E., & Nápoles-Garzón, I. (2021). Etnofarmacología de plantas medicinales con efectos sedantes en la comunidad Songo, Santiago de Cuba. *Orange Journal*, *3*(6), 4-13. https://doi.org/10.46502/issn.2710-995X/2021.6.01

Wahid, M., Ali, A., Saqib, F., Aleem, A., Bibi, S., Afzal, K., ... & Bin Asad, M. H. H. (2020). Pharmacological exploration of traditional plants for the treatment of neurodegenerative disorders. *Phytotherapy research*, *34*(12), 3089-3112. https://doi.org/10.1002/ptr.6742

Zanardi, R., Carminati, M., Fazio, V., Maccario, M., Verri, G., & Colombo, C. (2023). Add-On Treatment with *Passiflora incarnata* L., herba, during Benzodiazepine Tapering in Patients with Depression and Anxiety: A Real-World Study. *Pharmaceuticals*, *16*(3), 426. https://doi.org/10.3390/ph16030426