Colegio de Postgraduados

Mayan herbal medicine: an option to improve respiratory health in Campeche and Chiapas, Mexico

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ABSTRACT

Objective: To document the medicinal plants used by Mayans from Campeche and Chiapas to alleviate respiratory ailments.

Design/methodology/approach: Ethnographic and ethnobotanical data were collected through the application of a semi-structured questionnaire with traditional healers and individuals who use medicinal plants for respiratory relief.

Results: A total of 28 medicinal plants were recorded, primarily sourced from agricultural fields and home gardens. These plants belong to 19 botanical families: six were registered in the village of Bolonchén de Rejón, 12 in Mazapa de Madero, and 14 in the Motozintla de Mendoza area.

Limitations/implications: The study was conducted during a single season; results may vary in other periods.

Findings/conclusions: Teas prepared mainly from leaves are used by 43% of respondents, followed by extracts and toasted plant parts.

Keywords: traditional medicine, Southern México, local knowledge, mayans.

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INTRODUCTION

In Mexico, Indigenous communities and those residing in rural areas are considered vulnerable groups due to the social inequities they face daily. These challenges reduce their capacity to respond to a range of problems, including lack of transportation, electricity, poor food distribution, and limited or non-existent healthcare services. This inequity worsened with a 16.2% increase (15.6 million people) in the population lacking access to healthcare services from 2019 to 2020 (CONEVAL, 2021). Given the urgent need for medical services to address various illnesses, these communities turn to medicinal plants as substitutes for pharmaceutical drugs (Gallegos-Zurita, 2016), a practice that remains both periodic and effective across different localities.

It is important to note that in Mexico, medicinal flora is part of the cultural, herbal, and traditional knowledge heritage that still persists among the population. These plants continue to play a vital role in meeting basic healthcare needs and are a crucial link within traditional medical systems for maintaining health (WHO, 2013). The use of these plants as medicines is so valuable that current studies investigate their biological activities and antibacterial properties to explain their mechanisms of action in detail, with the goal of

gaining a deeper understanding of the Mayan ethnopharmacopoeia (Ankli *et al.*, 2002; Sharma *et al.*, 2017).

Ethnobotanical studies on the use of medicinal plants have been conducted in various parts of Mexico, such as Papantla, Veracruz with 101 plants (Lara *et al.*, 2019a); Acanceh, Cantamayec, Tibolón, and Yaxcabá in Yucatán with 96, 123, 53, and 109 species, respectively (Méndez-González *et al.*, 2014); Hopelchén and Calakmul, Campeche with 69 plants (Cahuich-Campos, 2018); and Monterrey in the municipality of Villa de Corzo, Chiapas with 73 species (Campos-Saldaña *et al.*, 2018). In Chiapas herbariums, 16 species from the Labiatae family with medicinal potential have been documented (Domínguez-Vázquez and Castro-Ramírez *et al.*, 2002).

These plants are used to treat various conditions, including climacteric symptoms (Cahuich-Campos *et al.*, 2018), venomous bites, gastrointestinal disorders, infectious diseases (Lara *et al.*, 2019b), nervous system disorders (Castañeda *et al.*, 2022), dermatological conditions, culturally-associated illnesses, musculoskeletal issues, urinary system problems, cardiovascular diseases, female reproductive issues, emotional disorders, pain relief, nervous system conditions (Casanova-Pérez *et al.*, 2022), and kidney-related ailments (Castañeda *et al.*, 2022). However, there are few records of plants specifically used to treat respiratory diseases. Therefore, the objective of this study was to document the medicinal plants used by Mayans in Campeche and Chiapas to address respiratory ailments.

MATERIALS AND METHODS

Study Area. The research was conducted from February to June 2022 in the locality of Bolonchén de Rejón, in the state of Campeche, located at 20° 00' 17.18" N and 89° 44' 51.54" W, at an altitude of 120 masl, with an average temperature of 32 °C and an average annual rainfall of 1,044 mm. It also took place in two municipalities of the state of Chiapas: Motozintla de Mendoza, the municipal seat located at 15° 21' 48.36" N and 91° 14' 52.73" W, at an altitude of 1,300 masl, with an average temperature of 19 °C and annual rainfall ranging from 1,260 to 2,000 mm (INEGI, 2010); and Mazapa de Madero, located at 15° 23' 18.26" N and 92° 11' 72.96" W, with the municipal seat at an altitude of 1,100 masl, an average temperature of 22 °C, and annual rainfall between 800 and 1,080 mm (Figure 1).

Data Collection. Ethnographic and ethnobotanical methods were used in this research, employing directed interviews and participant observation as data collection techniques (Kawulich, 2005). For the interviews, a non-probabilistic "snowball" sampling method (Babbie, 1999) was used to identify traditional healers or individuals who use plants to improve health, reaching a total of 10 families per locality.

A questionnaire was then applied covering the following aspects: a) Sociocultural; b) Management and Conservation of medicinal plants in agroecosystems (AES) and ecosystems; and c) Uses of medicinal plants. Participant observation an essential tool in qualitative research, particularly in anthropological and sociological studies as suggested by Kawulich (2005) was employed to foster interaction with involved actors and gain a more holistic understanding of the phenomenon under study. This approach

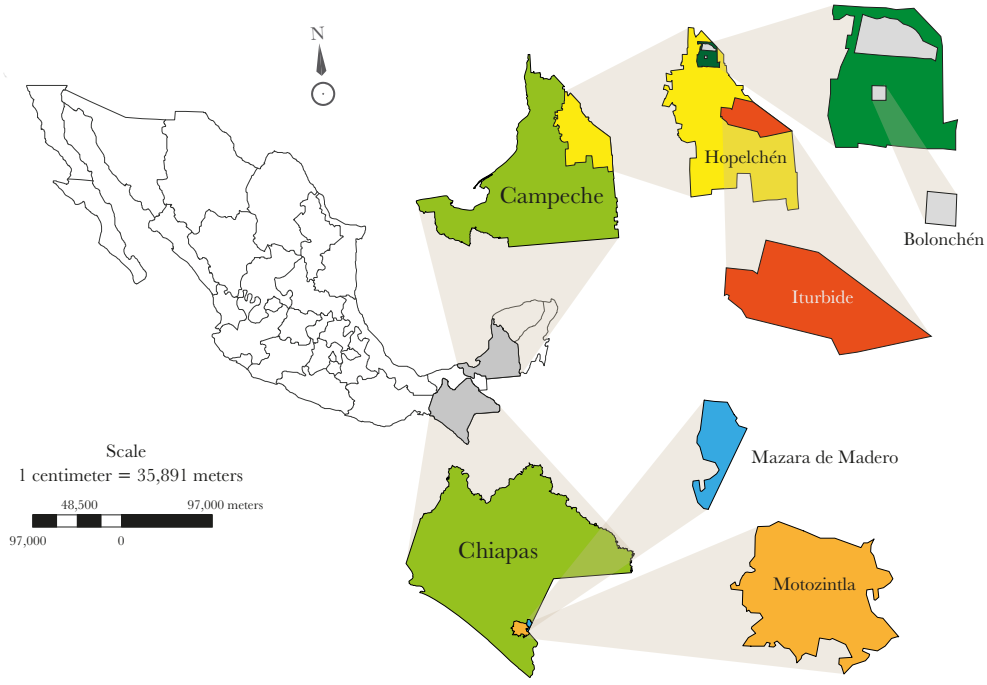

Figure 1. Mayan localities: Bolonchén de Rejón in Campeche, and Mazapa de Madero and Motozintla de Mendoza in Chiapas, Mexico.

allowed the researcher to immerse themselves in the lifestyles of the ethnic groups to learn about their organization, social structure, educational background, and the value they place on medicinal plants in various settings (Alexiades, 1996; Kawulich, 2005; Musante & DeWalt, 2010). Finally, the data were analyzed using descriptive statistics in Excel®.

RESULTS AND DISCUSSION

A total of 27 medicinal plants belonging to 19 families were recorded as being used for bronchial and respiratory ailments. The scientific names, common names, and families are listed in Table 1. The most frequently used plant was bougainvillea (*Bougainvillea glabra* Choisy.) with a usage frequency of 8.5%, followed by lime (*Citrus×aurantifolia* Christm. Swingle) and lemongrass (*Cymbopogon citratus* (DC.) Stapf), each with 7% usage frequency (Table 1). In other regions of Mexico, similar records have been made. In Actopan, Hidalgo, 19 plants were mentioned (Villanueva-Solís *et al.*, 2020); in Nacajuca, Tabasco, 22 species belonging to 15 families were reported (Magaña *et al.*, 2021); and in Julián Blanco, Guerrero, Sotelo-Leyva *et al.* (2022) reported 16 plants used for respiratory issues, including basil (*Ocimum basilicum* L.), arnica (*Heterotheca inuloides* Cass.), bougainvillea (*Bougainvillea spectabilis* Willd.), cinnamon (*Cinnamomum verum* J. Presl.), guapinol (*Hymenaea courbaril* L.), snake herb (*Zornia thymifolia* Kunth.), wild ash (*Fraxinus uhdei* Wenz. Lingelsh.), spearmint (*Mentha spicata* L.), wormwood (*Artemisia ludoviciana* Nutt.), lemon (*Citrus×limon*), muicle (*Justicia spicigera* Schltdl.), mango (*Mangifera indica* L.), oregano (*Origanum vulgare* L.), capote (*Xanthosoma robustum* Schott.),

purple sage (*Lippia alba* Mill.), and broadleaf oregano (*Plectranthus hadiensis* Forssk.). Of the plants reported by those authors, four species were also recorded in the present study, highlighting their common use in treating diseases in Mexico.

In regions closer to Bolonchén de Rejón, similar findings were reported. For example, the Mayan community of Yaxcabá, Yucatán, recorded 16 plants, with the most commonly used species being arnica (*Tithonia diversifolia*) and purple maguey (*Tradescantia spathacea* Sw.) (Méndez-González *et al*., 2014). In Xmejía, Hopelchén, Campeche, Cahuich-Campos *et al*. (2014) documented 10 plants: iresine (*Iresine celosia* L.), soursop (*Annona muricata* L.), henequen (*Agave fourcroydes* Lem.), barbasco (*Piscidia piscipula* L.), calabash tree (*Crescentia cujete* L.), purple maguey (*Tradescantia spathacea* Sw.), wild oregano (*Lantana hirta*), oak (*Ehretia tinifolia* L.), sugar apple (*Annona squamosa*), and tobacco (*Nicotiana tabacum* L.). In the state of Chiapas, Domínguez-Vázquez and Castro-

Table 1. Medicinal plants reported by the Mayans of Campeche and Chiapas, Mexico.

Scientific name	Common name	Family
Allium cepa L.	Red onion	Amaryllidaceae
Allium sativum L.	Garlic	Amaryllidaceae
Allium tuberosum Rottler ex Spreng.	Chives	Amaryllidaceae
Artemisia absinthium L.	Wormwood	Asteraceae
Borago officinalis L.	Borage	Boraginaceae
Bougainvillea glabra Choisy.	Bougainvillea	Nyctaginaceae
Brosimum alicastrum Sw.	Ramón	Moraceae
Cinnamomum verum J.	Cinnamon	Lauraceae
Citrus×*sinensis*	Orange	Rutaceae
Citrus×*aurantifolia* (Christm.) Swingle	Lemon	Rutaceae
Crescentia alata Kunth	El morro	Bignoniaceae
Cymbopogon citratus (DC.) Stapf	Lemon tea	Poaceae
Dysphania ambrosioides (L.) Mosyahin & clemants	Epazote	Amaranthaceae
Eucalyptus globulus Labill.	Eucalyptus	Myrtaceae
Laurus nobilis L.	Bay	Lauraceae
Lippia dulcis Trevir.	Orozu	Verbenaceae
Parmentiera aculeata (Kunth) Seem.	Cuajilote	Bignoniaceae
Pinus ayacahuite C. Ehrenb. ex Schltdl.	Pine	Pinaceae
Piper auritum Kunth	Herb santa	Piperaceae
Plectranthus amboinicus (Lour.) Spreng.	Oregano	Lamiaceae
Plectranthus hadiensis (Forssk.) Schweinf. ex Sprenger	Vaporub	Lamiaceae
Psidium guajava L.	Guava	Myrtaceae
Sambucus nigra L.	Elderberry	Viburnaceae
Senna occidentalis (L.) Link	Little bean	Fabaceae
Thymus L.	Thyme	Lamiaceae
Tradescanthia spathaceae Sw	Purple agave	Commelinaceae
Zingiber officinale Rosc.	Ginger	Zingiberaceae

Ramírez (2002), through a literature and herbarium review of the medicinal uses of the Labiatae family for respiratory conditions, described 16 plants, including: liniment (*Catopheria chiapanensis*), *Hyptis urticoides* Kunth, cancer herb (*Lepechinia schiediana* (Schltdl.)), basil (*Ocimum basilicum*), wild basil (*Ocimum micranthum* Willd.), field anise (*Ocimum selloi*), lavender (*Salvia lavanduloides* Kunth.), rosehip (*Rosa rubiginosa* L.), cock's herb (*Salvia tiliaefolia* Vahl), maltansi (*Satureja brownei* (Sw.) Briq.), pennyroyal (*Satureja mexicana* (Benth.) Briq.), myrtle (*Stachys coccinea* Jacq.), mugwort (*Leonurus sibiricus* L.), self-heal (*Prunella vulgaris* L.), rosemary (*Rosmarinus officinalis* L.), sage (*Salvia* sp.), and verbena (*Teucrium vesicarium* Miller). Likewise, Lara *et al.* (2019b) identified 11 plants in the highlands of Chiapas: chamomile (*Matricaria chamomilla* L.), marigold (*Tagetes erecta* L.), dandelion (*Taraxacum officinale* L.), copal (*Bursera jorullensis* (Kunth) Engl.), elderberry (*Sambucus mexicana* C. Presl ex DC.), lavender (*Salvia lavanduloides* Kunth), mint (*Mentha sativa* L.), bougainvillea (*Bougainvillea glabra* Choisy), camphor flower (*Cinnamomum camphora* (L.) J. Presl), cinnamon tree (*Cinnamomum zeylanicum* J. Presl), and mountain laurel (*Litsea glaucescens* Kunth). Finally, in seven localities in Chiapas —Emiliano Zapata, Libertad, Salto de Agua, Catazajá, Palenque, Chilón, and Benemérito— only three plants were reported for treating respiratory ailments: broadleaf oregano (*Plectranthus amboinicus* (Lour.) Spreng.), spearmint (*Mentha spicata* L.), and guaco (*Mikania laevigata* (Sch. Bip. ex-Baker)) (Martínez *et al.*, 2023).

Of the total medicinal plant families, six were found in the community of Bolonchén de Rejón, 12 were recorded in Mazapa de Madero, and 14 were documented in Motozintla de Mendoza (Figure 2). In Mazapa de Madero, the most representative families were Amaryllidaceae, Rutaceae, and Nyctaginaceae, followed by Boraginaceae, Poaceae, and Zingiberaceae. In Motozintla de Mendoza, the most prominent families were Lamiaceae, Rutaceae, and Lauraceae, followed by Nyctaginaceae, Poaceae, and Verbenaceae. In Bolonchén de Rejón, the most representative family was Fabaceae, followed by Amaryllidaceae and Commelinaceae.

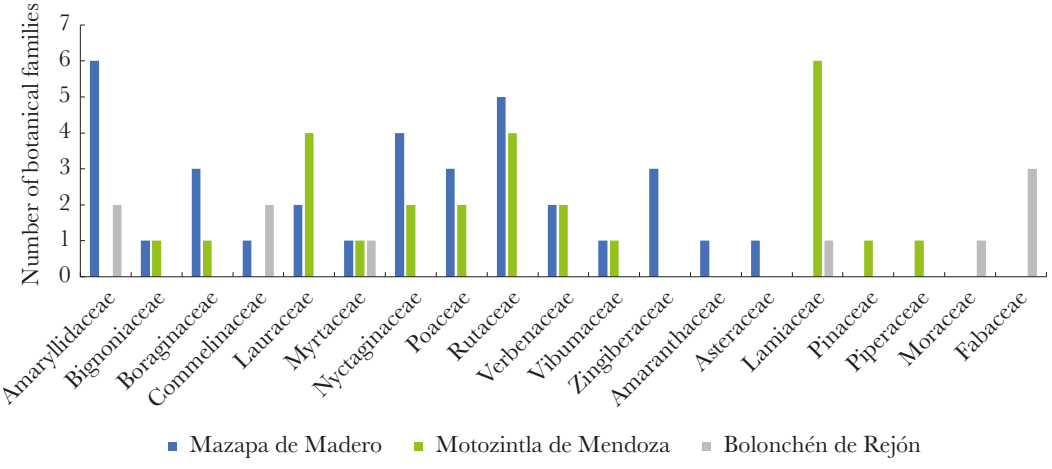

Figure 2. Representative botanical families used for respiratory ailments in Mayan communities of Campeche and Chiapas, Mexico.

The botanical families observed in Motozintla align with those recorded in Actopan, Hidalgo (Villanueva-Solís *et al.*, 2020), and Julián Blanco, Guerrero (Sotelo-Leyva *et al.*, 2022), with Lamiaceae being the most abundant family. However, these differ from findings in Loma Alta, Nevado de Toluca, Mexico; Yaxcabá, Yucatán; and the Highlands of Chiapas, where the most representative botanical family is Asteraceae (Méndez-González *et al.*, 2014; Sotero-García *et al.*, 2016; Lara *et al.*, 2019b).

Among the respiratory ailments treated with medicinal plants, interviewees primarily identified nine conditions, many of which are associated with the SARS-CoV-2 virus (COVID-19) (Table 2). These ailments include cough, flu, cold, tonsillitis, and phlegm accumulation (Sotero-García, 2016; Sotelo-Leyva *et al.*, 2022), as well as asthma and bronchitis (Méndez-González *et al.*, 2014), nasal congestion, chills, sore throat, pneumonia, colds, and hoarseness (Lara *et al.*, 2019a; Villanueva-Solís *et al.*, 2020). In Nacajuca, Tabasco, of the medicinal species reported for respiratory issues, 20 are used to treat cough, 15 for flu, 13 for asthma, nine for colds, and one for "chichimeca" (severe coughing fits accompanied by fever and suffocation) (Magaña *et al.*, 2021). To prepare remedies for these respiratory conditions, the most commonly used plant part is the leaf (43%), followed by branches (14%) and flowers (13%) (Table 2), similar to findings in Julián Blanco, Guerrero, where leaves are used in 46% of cases (Sotelo-Leyva *et al.*, 2022). However, among the Tzotzil people in the Highlands of Chiapas, usage patterns differ: they use the entire plant in 31.3% of cases, stem and leaf in 25%, flower in 12.5%, and bark in 6.3% (Lara *et al.*, 2019b).

Regarding the preparation methods of remedies using medicinal plants, three main forms were recorded. Tea (infusion) is the primary method of consumption, followed to a lesser extent by extracts and roasted preparations (Figure 3). It has been observed that tea or infusion is among the most commonly used methods for consuming medicinal plants, with usage ranging from 70% to 100% in various localities (Lara *et al.*, 2019a; Villanueva-Solís *et al.*, 2020; Sotelo-Leyva *et al.*, 2022). Notably, extract and roasted forms are used individually and only in certain communities for instance, the roasted form is preferred in Bolonchén, whereas in Chiapas communities, extracts are used more frequently than roasted preparations (Figure 3).

The plants used in the Mayan communities of Bolonchén de Rejón, Mazapa de Madero, and Motozintla de Mendoza, Chiapas, are mainly obtained from agricultural plots and home gardens/backyards (Figure 4). This aligns with findings by Magaña *et al.* (2021), who reported that, of the 22 species used in Nacajuca, Tabasco, 14 are cultivated in home gardens (backyards) and orchards (*C. aurantium*, *C. citratus*, and *P. amboinicus*), six are wild (collected in the field), and only two are purchased. Similarly, in Xmejía, Hopelchén, Campeche, most plants are sourced from gardens or household plots, followed by secondary and mature forests (monte) (Cahuich-Campos *et al.*, 2014). Likewise, Martínez *et al.* (2023) noted that in the communities of Emiliano Zapata, Libertad, Salto de Agua, Catazajá, Palenque, Chilón, and Benemérito in Chiapas, the highest percentage of medicinal plants come from backyards. These plants often coexist with edible species, contributing to food security in terms of access, utilization, and availability.

Table 2. Parts of medicinal plants used for respiratory conditions in the Mayan communities of Campeche and Chiapas.

Mayan localities	Ailments	Common name	Part of the plant
Bolonchén de Rejón	Bronchitis	Green Onion	Leaf
	Flu Cough	Purple Maguey	Branch
		Bean	Leaf
		Oregano	Leaf
		Green Onion	Branch
	Sick	Bean	Leaf
		Guava	Leaf
		Ramón	Leaf
	Shortness of breath	Purple Maguey	Leaf
		Bean	Leaf
Mazapa de Madero	Bronchitis	Orozus	Leaf
	Flu Throat infection Lung infection Cold	Eucalyptus	Leaf
		Cinnamon	Stem
		Lemon tea	Leaf
		Orange (leaf)	Leaf
		Lemon	Fruit
		Bougainvillea	Flower
		Elderberry	Flower
	Cough Bronchitis Flu Throat infection	Borage	Branch
		Bougainvillea	Flower
		Garlic	Bulb
		Red onion	Bulb
		Ginger	Rhizome
	Lung infection Cold	Borage	Branch
		Bougainvillea	Flower
		Garlic	Bulb
		Red onion	Bulb
		Ginger	Rhizome
	Bronchitis	Lemon tea	Leaf
	Flu	Matazano	Leaf
		Lemon Tea	Leaf
		Lemon	Flower
		Ginger	Rhizome
		Cinnamon	Stem
		Bougainvillea	Flower
		Purple Maguey	Leaf
		Borage	Branch
		Garlic	Bulb
		Red Onion	Bulb
		Orozus	Leaf
		Cuajilote	Fruit
		Orange	Leaf

Table 2. Continues...

Mayan localities	Ailments	Common name	Part of the plant
Motozintla de Mendoza	Dry throat	Lemon	Fruit
	Flu Throat infection Hoarseness Dry throat Flu	Orozus	Leaf
		Lemon Tea	Leaf
		Vaporub	Leaf
		Lemon Bay	Leaf
		Cinnamon	Fruit
		Bougainvillea	Stem
		Orange	Flower
		Thyme	Fruit
		Pine	Branch
	Throat infection	Epazote	Resin
		Thyme	Branch
	Hoarseness	Hierbasanta	Branch
	Cough	Thyme	Leaf
		Wormwood	Branch
		Borage	Leaf
		El Morro	Branch
		Bay	Fruit
		Vaporub	Leaf
		Oregano	Leaf
		Eucalyptus	Leaf
		Orozus	Leaf
		Elderberry	Flower
		Bougainvillea (flower)	Flower
		Cinnamon	Stem
		Lemon	Fruit
		Lemon Tea	Leaf
		Lemon Tea	Leaf

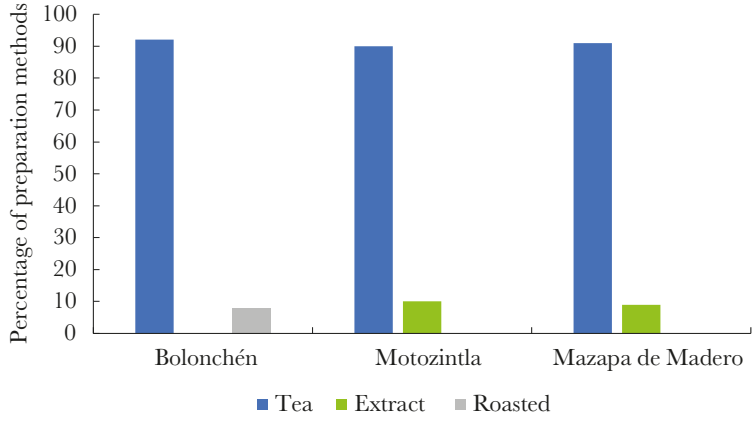

Figure 3. Preparation methods for medicinal plants used in the Mayan communities of Campeche and Chiapas, Mexico.

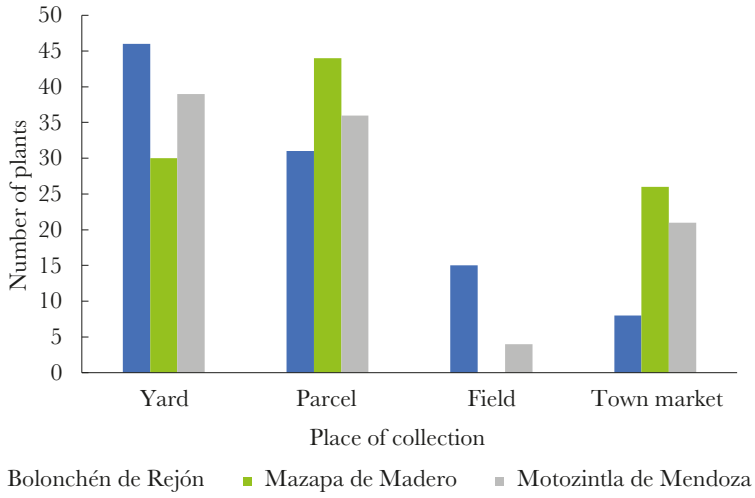

Figure 4. Location of medicinal plants obtained to treat respiratory conditions reported by Mayans from Campeche and Chiapas, Mexico.

CONCLUSIONS

In the Mayan community of Motozintla de Mendoza, Chiapas, a greater number of medicinal plants are used to alleviate respiratory illnesses, followed by Mazapa de Madero, Chiapas with 14 species, and Bolonchén de Rejón, Campeche, where only six plants were recorded. The most commonly used plants across the three localities are bougainvillea and lime, primarily consumed as tea (infusion). The most frequently used medicinal plants are sourced from home gardens and agricultural plots.

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