THE ETHNOBOTANY OF BRYOPHYTES IN MEXICO LA ETNOBOTÁNICA DE BRIOFITAS EN MÉXICO

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Abstract

Background: Mexico has an extensive record of vascular plants that are used by humans and associated with traditional ecological knowledge (TEK). However, for non-vascular plants like bryophytes, there is no consensus on how many and which species have any TEK associated with them.

Questions: How many bryophyte species are used by humans in Mexico? What TEK is associated with them? Why is it important to document ethnobotanical information on bryophytes?

Studied species: Bryophytes *sensu lato*.

Study site and dates: Mexican territory. Time span covered by the studies reviewed was from 1552 to 2020.

Methods: Information in published materials, repositories, and personal fieldwork records were used to build a database on bryophyte taxa associated with some TEK in Mexico.

Results: According to available data, the bryophyte flora with some associated TEK in Mexico includes 36 species belonging to 30 genera and 23 families. The main use is ceremonial, although craft, environmental, medicinal, and ornamental uses are also reported.

Conclusions: This study updates the number of bryophytes used as non-forest timber resources. Ethnobotanical records for Mexico are among the highest in countries that use bryophytes in human enterprises.

Keywords: Ethnobotany, liverworts, mosses, non-vascular plants, traditional ecological knowledge.

Resumen

Antecedentes: México tiene un extenso registro de plantas vasculares que son utilizadas por humanos y que están asociadas con algún conocimiento ecológico tradicional (CET). Sin embargo, para las plantas no vasculares como las briofitas, no hay un consenso sobre cuántas y cuáles especies tienen algún CET asociado.

Preguntas: ¿Cuántas especies de briofitas son utilizadas por humanos en México? ¿Cuál es el CET asociado a ellas? ¿Por qué es importante documentar la información etnobotánica sobre las briofitas?

Especies de estudio: Briofitas *sensu lato*.

Sitio y años de estudio: Territorio mexicano. El periodo de tiempo cubierto por los estudios revisados fue de 1552 a 2020.

Métodos: La información en trabajos publicados, repositorios y registros personales de trabajo de campo se utilizaron para construir una base de datos sobre taxones de briofitas con algún CET en México.

Resultados: De acuerdo con los datos disponibles, la flora de briofitas con algún CET en México comprende 36 especies en 30 géneros y 23 familias. El uso principal es ceremonial, aunque también se reportan usos artesanales, ambientales, medicinales y ornamentales.

Conclusiones: Este estudio actualiza el número de especies de briofitas utilizadas como recursos forestales no maderables. Los registros etnobotánicos para México están entre los más numerosos para los países que usan briofitas en su vida diaria.

Palabras clave: Conocimiento ecológico tradicional, etnobotánica, hepáticas, musgos, plantas no vasculares.

Traditional ecological knowledge (TEK) includes the understanding, innovations, and practices of indigenous and local communities throughout the world ([Brush 1993](#), [Berkes 1999](#)). TEK is developed from experience over time, adapted to the local culture and environment, and is transmitted orally from generation to generation. It is collectively owned, and represented in stories, songs, folklore, cultural values, beliefs, rituals, community laws, local language and agricultural practices, including the production of plant and animal species ([Berkes et al. 2000](#), [CBD 2020](#)). Traditional knowledge of bryophytes (mosses, liverworts, and hornworts) has been reported around the world but is often neglected ([Berkes 1993](#), [Harris 2008](#)) in formal research. The study of the relationship between humans and these non-vascular plants is called ethnobryology ([Flowers 1957](#)). However, this term is not often used in ethnobiology, perhaps because there are few studies on bryophytes ([Harris 2008](#)). According to the last author, there are around 150 bryophyte species of ethnobotanical interest recorded worldwide. The highest number of reports have been made from such countries as China, India, the United States, and Canada; the most common ethnobotanical use for bryophytes is for medicinal purposes ([Harris 2008](#), [Alam 2016](#)). Numerous examples are cited by [Glime \(2017b\)](#).

Mexico is one of the countries with the highest biological and cultural diversity in the world ([Sarukhán et al. 2009](#), [Toledo et al. 2019](#)). About 25 % of the vascular plant species (approximately 7,461 species) are used in traditional ways ([Mapes & Basurto 2016](#)). Thus, the flora is an essential part of traditions and customs in many regions of the country. Nevertheless, bryophytes are usually neglected in ethnobotanical studies about traditional knowledge.

Recent estimations report 1,591 species of bryophytes living in different ecosystems in Mexico ([Delgadillo 2014](#), [Delgadillo & Juárez-Martínez 2014](#), [Ellis et al. 2018](#), [Escolástico-Ortiz & Juárez-Martínez 2018](#)). Use of bryophytes has been documented since about 500 years for medicinal purposes and 180 years for religious purposes ([De la Cruz 1552](#), [Calderón de la Barca 1843](#)); however, it is likely that they were also used in pre-Columbian times. [Harris \(2008\)](#) indicated that four species are used for handicrafts, and [Delgadillo & Cárdenas \(1990\)](#) reported the use of at least three moss species that are sold during the Christmas season. However, there is no consensus on which species are used and what their associated TEK is in different regions of Mexico. This study seeks to answer the following questions: how many bryophyte species are used by humans in Mexico? Is there any TEK associated with them? Specifically, the work intends 1) to obtain a checklist of useful bryophytes, including their use or associated TEK,

and 2) to discuss the importance of these results for ethnobotany and for bryophyte conservation in Mexico.

Recording TEK associated with bryophytes updates knowledge of the use of non-timber forest resources, especially for a neglected group of plants. This work also seeks to stimulate the inclusion of bryophytes in ethnobotanical studies in Mexico, and in other countries with high biocultural diversity.

Materials and methods

The literature review searched for peer-reviewed articles and books in the Scopus and Google Scholar databases. Keywords included "bryophytes or moss or liverwort or hornwort" and "ethnobotany or traditional uses or traditional ecological knowledge or traditional knowledge or non-timber forest resources" (in English and Spanish) somewhere in the document. To obtain most records, all available works to date (2020) were considered. The Ethnobotanical Database of Plants of Mexico (BADEPLAM; [Caballero & Cortés 1982-2020](#)), the Digital Library of Traditional Mexican Medicine ([Zolla & Argueta 2009](#)), and the Herbarium of Medicinal Plants of the Mexican Institute of Social Security were reviewed. Also, personal records obtained between 2008 and 2017 in the state of Oaxaca, specifically in the municipalities of Ixtlán de Juárez (17° 19' 51" N, 96° 29' 15" W), Santiago Comaltepec (17° 33' 57" N, 96° 32' 54" W), and Miahuatlán de Porfirio Díaz (16° 19' 33" N, 96° 35' 31" W) were included. Personal records included species sampled for taxonomic determination; these were compared against specimens at MEXU.

The data were organized in a spreadsheet that included names of taxa, source document, and recorded locality. Local common names in native or indigenous languages were included, as well as an English and Spanish translation when possible. Traditional uses were arranged according to the classification by [Bernal-Ramírez et al. \(2019\)](#) which considers nine categories that are applicable to bryophytes: food, environmental, crafts, ceremonial, construction, fuel, medicinal, ornamental, and veterinary. Species sold during the Christmas season ([Anastacio-Martínez et al. 2017a, b](#), [Martínez-López et al. 2017](#)), were classified in the "ceremonial" category.

Moss nomenclature was updated according to a revised version of LATMOSS ([Delgadillo 2010](#)) and for families based on [Goffinet & Buck \(2020\)](#); for liverworts and hornworts the classification accepted by [Söderström et al. \(2016\)](#) was followed. A TEK map showing the distribution of reports for bryophytes in Mexico was prepared.

Results

Few publications document TEK and use of bryophytes in Mexico (~30). Based on these references, the southern states contribute most records, particularly Oaxaca (15), Puebla (10), and Michoacán (8) ([Figure 1](#)). Mexican bryophytes with a use and TEK included 36 species in 30 genera and 23 families ([Appendix 1, Figure 2](#)). Literature on Mexican bryophytes does not report use as food, fuel, construction, or veterinary medicine. Mosses are the group with most uses (29), whereas liverworts only contributed 3 species. No references included information on hornworts.

The most relevant use of bryophytes is ceremonial during the Christmas period, though it is not the only religious activity where they are used. The mosses *Thuidium delicatulum* (Hedw.) Schimp., *Hypnum amabile* (Mitt.) Hampe, *Dendropogonella rufescens* (Schimp.) E. Britton, and those in the genera *Dicranum* and *Campylopus*, were mostly used for this purpose over the last five decades. Other uses, including TEK, such as crafts, environmental, medicinal, and ornamental have also been documented ([Appendix 1, Table 1](#)). Results include native language names of species, but also generic names, to identify mosses as a group ([Table 2](#)). In some native languages, bryophytes are classified locally based on the substrates where they grow ([Table 3](#)). These languages include Huastec, Maya, Mixe, Nahuatl, Popoluca, Seri, Tarahumara, Totonac, Tzeltal, and Zapotec ([Appendix 1, Tables 1-3](#)).

Discussion

This study reports 36 species of bryophytes with their use or TEK. These results place Mexico among the countries with the highest number of ethnobryological records, third only to China (63 spp.) and India (58 spp.), and with a similar number as the United States ([Harris 2008](#)). Most reports come from areas with high biological diversity, humidity, and ethnic group's presence such as the states of Oaxaca and Chiapas. This relationship agrees with [Toledo's \(1990, 2019\)](#) suggestion regarding the presence of greater traditional knowledge in bio-culturally diverse areas. Species richness and lush growth in mild climates, however, are conditions that undoubtedly have favored and given ample opportunity for human interaction with potentially useful bryophyte species in certain areas of Mexico.

A traditional classification of mosses is reported for Chiapas, in Tzeltal and Maya languages, according to the substrate in which they grow ([Berlin *et al.* 1974](#), [Delgadillo 2000](#)). In other regions of Mexico, there are traditional generic names that include liverworts and some lichens ([Table 2](#)) ([Felger & Moser 1985](#), [Luna-José & Rendón-Aguilar 2012](#)). However, the translation of these terms refers to “moss” because it is the closest word to describe these cryptogams due to similarity in growth form, size, and appearance. Bryophytes may have different generic names within the same native language, possibly due to linguistic

Figure 1. Map of reports of useful bryophytes with associated TEK in different states of Mexico (black circles).

Figure 2. Some bryophytes species used in México with ceremonial (A. *Campylopus* sp., B. *Dendropogonella rufescens*, C. *Dicranum* sp., D. *Meteorium* sp., E. *Pilotrichella flexilis*, F. *Thuidium delicatulum*), craft (G. *Bryum* sp.), and medicinal (H. *Marchantia* sp., I. *Pleurochaete squarrosa*) proposes.

variations. The most evident cases of linguistic variations occur in Nahuatl, the language with the highest extant speaker number, and with the most variants in the country (Moseley 2007). Zapotec in Oaxaca state also has name variations, where the terms to describe mosses are different even between localities in the same region (Rueggsegger & Rueggsegger 1955, Luna-José & Rendón-Aguilar 2012).

Traditional moss uses related to Christmas or as decorative material are the most common. These results are in contrast with the worldwide trend of medicinal use that includes few records in Mexico (Alcorn 1984, Delgadillo 2000, Harris 2008, López-Santiago 2015, Glime 2017b). Using mosses to decorate Nativity scenes resulted from a Christmas tradition that began in the nineteenth century and has continued until today (Anastacio-Martínez et al. 2017b). Due to the large volumes harvested for this purpose, this represents a threat to bryophyte (moss) diversity and

individual populations. On a national scale, the annual harvest can exceed 900 tons (Zamora-Martínez et al. 2008). Gómez-Peralta & Wolf (2001) documented the harvest of approximately 50 tons of bryophytes in the Monarch Butterfly Reserve in Michoacán state. Accordingly, 14 species were recorded for Christmas use in Mexico, and there may be more. However, this is not the only religious activity in which bryophytes are used. Other examples are the Patamban flower carpets in Michoacán state, as well as rituals in Zapotec communities in the northern Oaxaca state (Martínez-López et al. 2015, 2017, Cornejo-Tenorio & Ibarra-Manríquez 2019). For handicrafts, records of bryophytes included a dubious report on the manufacture of codex paper -making in ancient Mexico, and as filling material to lighten heavy loads by Tzeltales in Chiapas state (Berlin et al. 1974, Bay & Linares 2016).

Table 1. Traditional knowledge records that do not specify moss taxa. Information includes locality, native name (with the native language name), associated TEK description, and source. Use categories are represented by CE: Ceremonial, CR: Craft, EN: Environmental and ME: Medicinal.

Locality	Native name	Use category and description	Reference
Center of Mexico	<i>Tepitoton teamoxtli</i> , Náhuatl	ME: Treatment of various illnesses by the Aztecs.	De la Cruz (1552)
Mexico City		CE: Used as decoration material to make the nativity scenes in post-independent Mexico.	Calderón de la Barca (1843)
Center of Mexico	<i>Amoxtli</i> , Náhuatl.	CR: An aquatic moss (of unknown source) was used to make codices in pre-Hispanic times. This report is dubious and could include other organisms like algae.	Bay & Linares (2016)
San Pedrito (Otomi-Tepegua ethnicity), Hidalgo.		EN: Women of the community observed reduction in the availability of mosses in the forest. They record this knowledge because they are the group in charge of the use and management of the non-wood forest products.	Vázquez-García (2015)
Las Brisas, Barra de Cahoacán, Chiapas.		EN: Mosses growing on bamboo (<i>Otatea acuminata</i> (Munro) C.E. Calderón & Soderstr.) are used as indicators of its maturity. This criterium is to choose those stems useful in the construction of rural housing.	Moreno-Martínez et al. (2012)
North of Michoacán state.		EN: The presence of mosses is considered essential for the establishment of agave plantlets (<i>Agave inaequidens</i> K. Koch) because it is related to adequate moisture conditions. This agave species is important in the local production of mezcal.	Torres et al. (2015)

Moss genera used for ceremonial and crafts purposes (e.g., *Dicranum*, *Hypnum*, *Polytrichum*, *Thuidium*) typically have intense colors, large size, abundance, and attractive growth forms ([Anastacio-Martínez et al. 2017a, b](#), [Cornejo-Tenorio & Ibarra-Manríquez 2019](#)). These traits can be important for the development of productive and conservation activities of bryophytes ([Grout 1934](#), [Thieret 1956](#)). In the Ixtlán de Juárez community, in Oaxaca state, these plants are part of the criteria to designate ecotourism areas, an important economic activity for the local population ([Fuente-Carrasco & Ramos-Morales 2013](#)). Bryophytes are the visual attraction of trails for visitors,

where they form a large part of the plant biomass; this use promotes their conservation (*pers. obs.*). Thus, while some traditional practices represent a risk, others have positive effect on bryophyte conservation. Nevertheless, bryophytes used for medicinal and environmental purposes do not necessarily have aesthetic characteristics, suggesting an in-depth traditional knowledge of some of their phytochemical properties and ecological features. Some examples are the use of *Sematophyllum adnatum* to prepare medicinal teas in Yucatán ([Glime 2017b](#)), and small bryophyte species growing on the bamboo stem to estimate its maturity in Barra de Cahoacán, Chiapas ([Moreno-Martínez et al. 2012](#)).

Table 2. Terms for “moss” in some native languages in Mexico.

Native term	Language	Locality	Source
<i>Con</i>	Tzeltal	Chiapas state	Berlin et al. (1974)
<i>Tecata</i>	Spanish	Capécuaró, Michoacán	Delgadillo (2000)
<i>Tsot-zé</i>	Tzeltal	Lacanjá and laguna El Suspiro, Chiapas	Delgadillo (2000)
<i>Tsa'nk</i>	Mixte	Santa María Tlahuitoltepec, Oaxaca	Gallardo-Jiménez (2013)
<i>Xibeu'</i>	Zapotec	Miahuatlán District, Oaxaca	Rueggsegger & Rueggsegger (1955)
<i>Mbaxhs*</i>	Zapotec	Buenavista Loxicha, Oaxaca	Luna-José & Rendón-Aguilar (2012)
<i>Yamasa*</i>	Seri	Sonora state	Felger & Moser (1985)

* According to the source, the term also applies to liverworts and lichens.

Table 3. Terms in native languages in Mexico to classify mosses according to the substrates where they grow.

Native languages, localities, and source			
Substrate	Tzeltal, Chiapas (Berlin et al. 1974)	Náhuatl, Mexico (De la Cruz 1952)	Mayan, Lacanja and laguna El Suspiro, Chiapas (Delgadillo 2000)
			Zapotec, San Agustín Loxicha, Oaxaca (Luna-José & Rendón-Aguilar 2012)
Trees	<i>Con te?</i> = Tree moss		<i>Much-I-ché</i> = Attached to trees <i>Ushushem-ché</i> = Living attached to trees
Rocks		<i>Teamoxtli</i> = Rock-inhabiting moss	<i>Kushem-tunich</i> = Attached to a rock
Soil	<i>Con lumilal</i> = Ground moss		<i>Mbaxs lad ble</i> = Growing on the ground

[De la Cruz's \(1952\)](#) work can be considered as the oldest record of medicinal use of bryophytes in Mexico. However, there is a knowledge gap until new medicinal reports appeared in recent decades ([Alcorn 1984](#), [Delgadillo 2000](#), [López-Santiago 2015](#), [Glime 2017a](#)). Bryophytes have a wide variety of secondary metabolites and they are used for antibiotics and pharmaceutical production ([Pandey & Alam 2020](#)). In Mexico, plants reported with antibacterial activity used in traditional medicine do not include bryophytes ([Sharma et al. 2017](#)). Therefore, the species presented in this review point to the necessity of such studies.

Regarding environmental uses, [Torres et al. \(2015\)](#) show that mosses are considered a suitable substrate for germination and seed development by farmers, of such species as *Agave inaequidens* K. Koch in Michoacán state. The capacity of bryophyte layers to promote seed germination has been previously reported; they reduce the risk of predation and maintain stable conditions of temperature and humidity necessary for their development ([Tooren 1988](#), [Soudzilovskaia et al. 2011](#)). Another example of environmental use is cited by [Jasso-Arriaga et al. \(2016\)](#), where people conserve mosses layers in the forest floor to maintain the harvest of wild mushrooms in the state of Mexico. Other reports provide information on changes in bryophyte diversity in some regions of Mexico. For example, [Vázquez-García \(2015\)](#) shows that women in the community of San Pedrito, Hidalgo, observed a reduction in moss populations in the forest over time. Although it is not clear if the women knew the importance and roles of bryophytes in the forest, this information is a reference to possible effects of habitat degradation and climate change on a local scale ([Wolverton et al. 2014](#)). The environmental uses of bryophytes are among the rarest worldwide. Therefore, these represent an important antecedent of traditional ecological knowledge of bryophytes in Mexico thus far overlooked.

Mexico has an extensive heritage of useful plants, and bryophytes are part of this biocultural wealth. The

information on the uses and traditional knowledge of bryophytes may increase with their inclusion in ethnobotanical works. It is not clear why bryophytes are not considered in these studies. Some reasons may include, for example, the assumption that bryophytes used in different parts of Mexico are the same species, the development of research limited to vascular flora, and the low value given by researchers to the identity of bryophyte species and their TEK ([Kimmerer 2003](#)). Collaboration between bryologists, ethnobiologists, and local people can improve this situation and avoid the risk of losing valuable information, especially when languages and traditional knowledge are at risk of disappearing ([Moseley 2007](#), [Campbell & Belew 2018](#)).

This work provides a first list of the bryophyte's species used in Mexico, as well as associated TEK. Thus, this study updates the information of useful bryophyte species in the country and highlights the ethnobotanical knowledge of a group of neglected plants.

Acknowledgments

Authors thank L. Cortés Zárraga, M. Gómez Peralta and M. D. Luna-Krauletz for sharing information on useful bryophyte records in Mexico. Also, to J. López-Santiago and J. A. Cruz López for sharing bryophyte pictures. We appreciate valuable comments of I. Santiago Bedolla, D. Escolástico Ortiz, Corrige-moi group, and the Laboratory of Bryology of the Université du Québec en Abitibi-Témiscamingue in the development of the document. Finally, we thank two anonymous reviewers and the associate editor for comments to improve the document.

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Associate editor: Arturo de Nova

Author contributions: EHR conceived the study, and the review. EHR and CDM wrote the document.

Appendix 1. Traditional knowledge of Mexican bryophytes. The table includes division, family, and species. Updated scientific names of species are in square brackets. The records include locality and, in some cases, native name (in italics, and English translation when possible), and name of the native language. The category and description of the associated use of each species are presented when information was available in the original publication. Use categories are represented by CE: Ceremonial, CR: Craft, ME: Medicinal, and OR: Ornamental.

Division, family, and species		Description of the associated traditional knowledge		
	Locality	Native name	Use category and description	Reference
Marchantiophyta				
Lophocoleaceae				
<i>Chiloscyphus orizabensis</i> Gottsche	Chiapas	<i>Con č'en</i> (cave moss in Tzeltal).	CR: Sometimes used as a filling for bedding or to ease the weight of backloads. CE: As ornament for religious purposes.	Berlin et al. (1974)
Marchantiaceae				
<i>Marchantia</i> sp.	Northeastern Mexico.	<i>P-mim ha</i> (water lady or mother in Huastec Mayan).	ME: Used in combination with <i>Begonia</i> L. and <i>Lithachne pauciflora</i> (Sw.) P. Beauv., for mouth sores and fever.	Alcorn (1984)
Zoopsidoideae				
<i>Lepidozia muenchiana</i> Steph	Chiapas state.	<i>Con č'en</i> (cave moss in Tzeltal).	CR: Same uses as <i>Chiloscyphus orizabensis</i> .	Berlin et al. (1974)
Bryophyta				
Anomodontaceae				
<i>Herpetineuron toccoe</i> (Sull. & Lesq.) Cardot	Tlayehualancingo, Puebla.	<i>Shakuwaki</i> (moss in Totonac)		Delgadillo (2000)
Brachytheciaceae				
<i>Brachythecium plumosum</i> (Hedw.) Schimp.	San Francisco Ixquihuacán, Puebla.	<i>Tipach</i> (rock hair in Náhuatl).		Delgadillo (2000)
<i>Squamidium</i> sp.	Santa Catarina Ixtepeji, Oaxaca.	<i>Musgo de encino</i> (oakmoss in Spanish).	CE: Harvested in the forest and sold in the Christmas period.	Mondragón & Villa-Guzmán (2008)
Bryaceae				
<i>Bryum</i> spp.	Chiapas state.	<i>Con č'en</i> (cave moss in Tzeltal).	CR: Same uses as <i>Chiloscyphus orizabensis</i> and <i>Lepidozia muenchiana</i>	Berlin et al. (1974)
	Patamban, Tangancícuaro, Michoacán.	<i>Flor de Piedra</i> (Stone flower in Spanish).	CE: Used with other 148 species of vascular plants, to make the "Patamban flower carpets". This activity is related to the Cristo Rey religious ceremony in October. The bryophyte is chosen for its useful green color to decorate the carpets, and it is harvested from pine-oak forests.	Cornejo-Tenorio & Ibarra-Manríquez (2019)

Division, family, and species	Description of the associated traditional knowledge			
	Locality	Native name	Use category and description	Reference
<i>Brachymenium spirifolium</i> (Müll. Hal.) A. Jaeger	San Francisco Ixquihuacán, Puebla.	<i>Ipachllolima</i> (lime hair in Náhuatl).		Delgadillo (2000)
<i>Bryum argenteum</i> Hedw.	San Francisco Ixquihuacán, Puebla.	<i>Tipach</i> (rock hair in Náhuatl).		Delgadillo (2000)
<i>Bryum procerum</i> Schimp. ex Besch.	Jesús del Monte and San Miguel del Monte, Michoacán.	<i>Musgo</i> or <i>gusano</i> (moss or worm in Spanish).	CE: Used for Christmas nativity scenes	Gómez-Peralta & Angón-Torres (2004)
Cryphaceae				
<i>Cryphaea patens</i> Hornsch. ex Müll. Hal.	San Francisco Ixquihuacán, Puebla.	<i>Limpach</i> (lime hair in Náhuatl).		Delgadillo (2000)
<i>Dendropogonella rufescens</i> (Schimp.) E. Britton	Oaxaca City, Oaxaca.		CE: It is sold, with other vascular plants and lichens, at the Christmas market in the Oaxaca city.	Rees (1976)
			OR: To decorate tables for handicrafts made with radishes (<i>Raphanus sativus</i> L.) in the celebration "Night of radishes" every December 23.	Pers. obs. (E Hernández-Rodríguez 116, MEXU)
	Ixtlán de Juárez, Oaxaca.		CE: For the elaboration of an arch for the celebration of the "Virgen de la Soledad", a local religious ceremony held on December 18. Also, to decorate the main entrance of the community and the church of "Santo Tomás Apóstol" every December 21.	Pers. obs. (E Hernández-Rodríguez 408, MEXU)
	Santiago Comaltepec, Oaxaca.		CE: To decorate arches placed at the entrance of the community church on the celebration of "Santiago Apóstol" in July.	Pers. obs. (E Hernández-Rodríguez 116, MEXU)
<i>Sphaerotheciella pinnata</i> (Schimp.) Manuel	San Francisco Ixquihuacán, Puebla.	<i>Bopash</i> (trees hair in Náhuatl).		Delgadillo (2000)
Dicranaceae				
<i>Dicranum</i> spp.	Oaxaca state.	<i>Lama verde</i> (green sheet in Spanish).	CE: To make Christmas nativity scenes.	Campos-Villanueva et al. (1992)
	Santa Catarina Lachatao, Oaxaca.	<i>Musgo</i> (Moss in Spanish).	OR: Used as a decorative plant in home gardens.	López-Mendoza (2020)
	Oaxaca City, Oaxaca.		CE: It is sold, with other vascular plants and lichens, at the Christmas market in the Oaxaca city.	Rees (1976)
Entodontaceae				
<i>Entodon beyrichii</i> (Schwägr.) Müll. Hal.	Tlayehualancingo, Puebla.	<i>Shakuwaki</i> (moss in Totonaco).		Delgadillo (2000)

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Division, family, and species	Description of the associated traditional knowledge			
	Locality	Native name	Use category and description	Reference
	San Francisco Ixquihiuacán, Puebla.	<i>Tizonpach</i> (rock hair in Náhuatl).		Delgadillo (2000)
Hedwigiaceae				
<i>Braunia secunda</i> (Hook.) Bruch & Schimp.	Guachochic, Norte de Humira and Tejaban, Sur de Cusarare, Chihuahua.	<i>Ré eke bowara</i> , (rock mustache in Tarahumara).	ME: It is boiled in water, then used as a wash for the head to relieve headache.	Delgadillo (2000)
	San Juan Mixtepec, Oaxaca.	<i>Bzhàazh-nguìè</i> (in Zapotec, no English translation available).		Delgadillo (2000)
<i>Braunia</i> sp.	Jesús del Monte and San Miguel del Monte, Michoacán.	<i>Musgo</i> or <i>cáscara</i> (moss or husk in Spanish).	CE: Harvested and sold for the elaboration of Christmas nativity scenes	Gómez-Peralta & Angón-Torres (2004)
Hypnaceae				
<i>Hypnum amabile</i> (Mitt.) Hampe	Mexico State.		CE: Harvested in forests of the Nevado de Toluca volcano to be sold during the Christmas period in Mexico City.	García-Ávila (2019)
	Monarch Butterfly Biosphere Reserve, Michoacán.		CE: Harvested to be sold in Mexico City.	Gómez-Peralta & Wolf (2001)
	Jesús del Monte and San Miguel del Monte, Michoacán.	<i>Musgo</i> or <i>palmilla</i> (moss or little palm in Spanish).	CE: Harvested with <i>Braunia</i> sp. to be sold for the elaboration of Christmas nativity scenes in Morelia, Michoacán.	Gómez-Peralta & Angón-Torres (2004)
	Santa Catarina Lachatao, Oaxaca.	<i>Musgo</i> (moss in Spanish).	OR: Used as a decorative plant in home gardens.	López-Mendoza (2020)
<i>Hypnum</i> spp.	Oaxaca state.	<i>Colchoncitos</i> (small mattresses in Spanish).	CE: To make Christmas nativity scenes.	Campos-Villanueva et al. (1992)
	Oaxaca City, Oaxaca.		CE: Sold at the Christmas market in the Oaxaca city.	Rees (1976)
	Mexico (country).		CR: To make bonsai trees.	Glime (2017a)
			CE: Used in the Christmas period.	Delgadillo & Cárdenas (1990)
Lembophyllaceae				
<i>Pilotrichella flexilis</i> (Hedw.) Ångstr.	Miahuatlán de Porfirio Díaz, Oaxaca.	<i>Musgo</i> (moss in Spanish).	CE: It is sold in the local market for Christmas.	Pers. obs. (E Hernández-Rodríguez 146, MEXU)
Leucobryaceae				
<i>Campylopus</i> spp.	Oaxaca state.	<i>Musgo</i> (moss in Spanish).	CE: For the elaboration of Christmas nativity scenes	Campos-Villanueva et al. (1992)
	Oaxaca City, Oaxaca.		CE: Sold at the Christmas market in the Oaxaca city.	Rees (1976)

Division, family, and species	Description of the associated traditional knowledge			
	Locality	Native name	Use category and description	Reference
	México (country)		CE: Used in the Christmas period.	Delgadillo & Cárdenas (1990)
			CR: Used to decorate bonsai trees.	Glime (2017b)
Meteoriaceae				
<i>Meteorium deppei</i> (Hornsch. ex Müll. Hal.) Mitt. [<i>Papillaria deppei</i> (Hornsch. ex Müll. Hal.) A. Jaeger]	San Francisco Ixquihucacán, Puebla.	<i>Popachxi</i> (lime hair in Náhuatl).		Delgadillo (2000)
<i>Meteorium nigrescens</i> (Sw. ex Hedw.) Dozy & Molk. [<i>Papillaria nigrescens</i> (Sw. ex Hedw.) A. Jaeger]	Chicana archaeological zone, Campeche.	<i>Barbita de viejo</i> (old man's beard in Spanish).		Delgadillo (2000)
<i>Meteorium</i> sp. [<i>Papillaria</i> sp.]	Capulálpam de Méndez, Oaxaca.	<i>Musgo amarillo</i> (yellow moss in Spanish).	CE: Used in community ceremonies and rituals.	Martínez-López et al. (2015)
	Santa María Jaltianguis, Oaxaca.	<i>Yát-tzi</i> (moss in Zapotec).	CE: Used in community ceremonies and rituals.	Martínez-López et al. (2017)
Plagiotheciaceae				
<i>Herzogiella cylindricarpa</i> (Cardot) Z. Iwats.	Santa Catarina Lachatao, Oaxaca.	<i>Musgo</i> (moss in Spanish).	OR: As decoration in home gardens.	López-Mendoza (2020)
Polytrichaceae				
<i>Polytrichum</i> spp.	Santa María Jaltianguis, Oaxaca.	<i>Pastu toóh</i> (little grass in Zapotec).	CE: Used in community ceremonies and rituals.	Martínez-López et al. (2017)
	Capulálpam de Méndez, Oaxaca.	<i>Musgo verde</i> or <i>tapete</i> (green moss or carpet in Spanish).	CE: Used in community ceremonies and rituals.	Martínez-López et al. (2017)
	México (country)		CE: Used in the Christmas period.	Delgadillo & Cárdenas (1990)
Pottiaceae				
<i>Leptodontium</i> spp.	Oaxaca City, Oaxaca.		CE: Sold at the Christmas market in the Oaxaca city.	Rees (1976)
	México (country)		CE: Sold during the Christmas period in Mexico City.	Delgadillo & Cárdenas (1990) , García-Ávila (2019)
<i>Mironia ehrenbergiana</i> (Müll. Hal.) R.H. Zander [<i>Morinia ehrenbergiana</i> (Müll. Hal.) Thér.]	Jesús del Monte and San Miguel del Monte, Michoacán.	<i>Musgo</i> or <i>gusano</i> (moss or worm in Spanish).	CE: Used for making Christmas nativity scenes.	Gómez-Peralta & Angón-Torres (2004)

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Division, family, and species	Description of the associated traditional knowledge			
	Locality	Native name	Use category and description	Reference
<i>Pleurochaete squarrosa</i> (Brid.) Lindb.	San Juan Luvina, Oaxaca.	<i>Ixxi' chiinku</i> (little grass in Zapotec).	ME: To prepare tea to relieve stomachache. Also, it can be boiled and then placed on a wound promote healing.	López-Santiago (2015)
<i>Syntrichia amphidiacea</i> (Müll. Hal.) R.H. Zander [<i>Tortula amphidiacea</i> (Müll. Hal.) Broth.]	San Francisco Ixquihiuacán, Puebla.	<i>Bopash</i> (trees' hair in Náhuatl).		Delgadillo (2000)
Pterobryaceae				
<i>Pterobryon densus</i> Hornsch.	Miahuatlán de Porfirio Diaz, Oaxaca.	<i>Musgo</i> (moss in Spanish).	CE: Sold locally at Christmas time. Unlike other epiphytic species, this one is sold attached to the branches on which it grows.	Pers. obs. (E Hernández-Rodríguez 125a, MEXU)
<i>Pterobryopsis mexicana</i> (Renauld & Cardot) M. Fleisch.	Tlayehualancingo, Puebla.	<i>Shakuwaki</i> (moss in Totonaco).		Delgadillo (2000)
Racopilaceae				
<i>Racopilum tomentosum</i> (Hedw.) Brid.	Sur de Coatepec, Veracruz.	<i>Puñic</i> (moss in Popoluca).		Delgadillo (2000)
Sematophyllaceae				
<i>Sematophyllum adnatum</i> (Michx.) E. Britton	Yucatán.		ME: To prepare medicinal teas.	Glime (2017b)
Stereophyllaceae				
<i>Entodontopsis leucostega</i> (Brid.) W.R. Buck & Ireland	San Blas, Nayarit and Victoria de Cortazar, Michoacán.	<i>Flor de Piedra</i> (Stone flower in Spanish).		Delgadillo (2000)
Thuidiaceae				
<i>Thuidium delicatulum</i> (Hedw.) Schimp.	Mexico state.		CE: Harvested in forests of the Nevado de Toluca volcano to be sold in the Christmas period in México City.	García-Ávila (2019)
	Monarch Butterfly Biosphere Reserve, Michoacán.		CE: Sold in the Christmas period in Morelia, Michoacán.	Gómez-Peralta & Wolf (2001)
	Jesús del Monte and San Miguel del Monte, Michoacán.	<i>Musgo</i> or <i>plumilla</i> (moss or small fine feather in Spanish).	CE: Sold for Christmas nativity scenes.	Gómez-Peralta & Angón-Torres (2004)
	San Bartolo Oxtotitlán, Mexico state.		CE: Harvested in the Christmas period with other non-timber forest products such as edible mushrooms and plants.	Anastacio-Martínez et al. (2017a, b)

Division, family, and species	Description of the associated traditional knowledge			
	Locality	Native name	Use category and description	Reference
<i>Thuidium</i> spp.	Patamban, Tangancicuaro, Michocán.	<i>Flor de piedra</i> (stone flower in Spanish).	CE: Used for making the "Patamban flower carpets", activity related to the Cristo Rey religious ceremony in October; chosen for its green color to decorate the carpets; harvested from pine-oak forests.	Cornejo-Tenorio & Ibarra-Manríquez (2019)
	Santa Catarina Lachatao, Oaxaca.	<i>Musgo</i> (moss, in Spanish).	OR: Used locally as a decorative plant in home gardens.	López-Mendoza (2020)
	Mexico (country)		OR: Used to decorate bonsai trees.	Glime (2017b)