Useful plants of the archaeological site Cerro de Las Ventanas, Zacatecas, México: an approach from floristic and ethnobotanical data*

López García, Raúl
Unidad Académica de Agronomía, Universidad Autónoma de Zacatecas, México
Correo electrónico: logr@chapingo.uruza.edu.mx
Sánchez Salas, Jaime
Facultad de Ciencias Biológicas, Universidad Juárez del Estado de Durango, México
Correo electrónico: j.sanchez@ujed.mx
Muro Pérez, Gisela
Facultad de Ciencias Biológicas, Universidad Juárez del Estado de Durango, México
Correo electrónico: giselamuro@ujed.mx
Estrada Castillón, Eduardo
Facultad de Ciencias Forestales, Universidad Autónoma de Nuevo León, México
Correo electrónico: aeduardoestradac@prodigy.net.mx
Ruan Soto, Felipe
Instituto de Ciencias Biológicas, Universidad de Ciencias y Artes de Chiapas, México
Correo electrónico: felipe.ruan@unicach.mx
Reyes Escutia, Felipe
Instituto de Ciencias Biológicas, Universidad de Ciencias y Artes de Chiapas, México
Correo electrónico: felipe.reyes@unicach.mx

Abstract

The useful flora of the Mexican archaeological zone Cerro de Las Ventanas is addressed. The data were obtained through interviews in the municipality of Juchipila. 88 useful species belonging to 72 genera and 41 botanical families were recorded. The results indicate that the most relevant plants are Prosopis laevigata, Stenocereus queretaroensis, Arundo donax, Pithecellobium dulce and Leucaena esculenta. Cerro de Las Ventanas protects not only cultural heritage, but also botanical heritage.

Key words : Cerro de Las Ventanas , archaeological zone , biocultural heritage , Zacatecas , México

Plantas útiles de la zona arqueológica Cerro de Las Ventanas, Zacatecas, México: una aproximación desde datos florísticos y etnobotánicos

Resumen

Se aborda la flora útil de la zona arqueológica mexicana Cerro de Las Ventanas. Los datos fueron obtenidos mediante entrevistas en el municipio de Juchipila. 88 especies útiles pertenecientes a 72 géneros y 41 familias botánicas fueron registradas. Los resultados indican que las plantas con mayor relevancia son Prosopis laevigata, Stenocereus queretaroensis, Arundo donax, Pithecellobium dulce y Leucaena esculenta. Cerro de Las Ventanas resguarda no sólo patrimonio cultural, sino también botánico.

Palabras Clave: Cerro de Las Ventanas, zona arqueológica,patrimonio biocultural, Zacatecas, México

*Fecha de recepción: 20-02-2024. Fecha de aceptación:02-04-2024.

1. INTRODUCTION

Ethnobotanical studies near archaeological sites are a strategy for investigate the interaction between humans and plants (Gómez-Pompa et al. 1987, Levis et al. 2012, Balée et al. 2014, Pavlik et al. 2021), and also provides detailed information of phytogeographical and conservation value (Minissale and Sciandrello 2017, Santos et al. 2019).

Floristic inventories realized in some archaeological sites of México reports 434 species for Chalcatzingo (Cerros-Tlatilpa et al. 2020), 274 for Cerro Metecatl (Hernández-Cruz et al. 2016), 484 for Palenque (Gómez-Domínguez et al. 2015) and 250 for Teotihuacan (Torres 2001). Despite México has the fourth largest floristic richness in the world (Villaseñor 2016), Zacatecas state remains ethnobotanically unexplored (Lara-Reimers et al. 2018) and for several decades has been considered one of the least explored states regarding of its flora (Guzmán and Vela 1960, Dávila and Sosa 1994, Villaseñor 2004, Ramírez 2016, Ramírez-Prieto et al. 2016, Hurtado-Reveles et al. 2021), particularly the southwestern region where the Cerro de Las Ventanas is located.

The archaeological site Cerro de Las Ventanas was the most important Caxcan settlement in the Juchipila Canyon (Caretta 2012), at least during the Postclassic period and the time of Spanish contact (1200-1530 d.C.). The main archaeological structures are a cliff-house, a pyramid-altar-square complex, terraces and residential houses (Rodríguez 2008). Archaeologists suggest that Cerro de Las Ventanas was included in an exchange network from northwestern Mesoamerica to Teotihuacan city (Jiménez and Darling 2000). This region corresponds with the cultural and biological corridors complex pointed out by Zizumbo and García (2008).

Ethnohistorical sources of the XVI century provides little information about useful plants in the Cerro de Las Ventanas and surrounding areas. Some common names such as mezquites (*Prosopis*), magueyes (*Agave*), algodón (*Gossypium*), cacao (*Theobroma*), frijoles (*Phaseolus*), tomates (*Solanum*), chiles (*Capsicum*) and aguacates (*Persea*) are mentioned in the Relación

de Francisco Acazitli (Garcia-Icazbalceta 1866). The study area has been explored for medicinal plants (Ramírez 2009), registering species such as Hintonia latiflora, Amphipterygium molle and Stenocereus queretaroensis. Therefore, this study aims to identify and describe the current useful flora of this mexican archaeological site in the Juchipila Canyon, as well as the identification of the species of greatest cultural significance.

2. MATERIALS AND METHODS

2.1 Study area description

The archaeological site Cerro de Las Ventanas is located in the municipality of Juchipila, towards the southwestern region of Zacatecas state (Figure 1), within the Priority Terrestrial Region 065 Sierra de Morones (Arriaga-Cabrera et al. 2000). The hill has a northeast-southwest orientation with an altitudinal range between 1230 and 1430 m a.s.l. In the upper part it has some flat areas bordered by rocky cliffs that are up to 50 meters high and hillsides with an approximate slope of 45°. According to the Köppen climate classification system modified by García (1998), the climate type in the Juchipila Valley is semi-arid semi-warm with rains in summer (BS_1hw), average annual temperature of 22 °C and average annual rainfall of 720 mm.

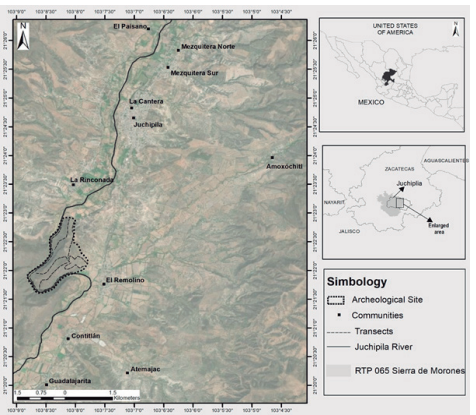

Figure 1. Geographical location of the archaeological site Cerro de Las Ventanas, Zacatecas, Mexico

Based on the classification of Rzedowski (1978) and González-Elizondo et al. (2012), there are three vegetation types in the study area: tropical deciduous forest, aquatic and subaquatic vegetation and subtropical scrub (Figure 2). Tropical deciduous forest is the predominant vegetation type in the Cerro de Las Ventanas (Figure 3). In the upper part and hillsides, it is common to find *Amphipterygium molle*, *Bursera simaruba*, *Ceiba aesculifolia*, *Ipomoea intrapilosa*, *candelabriform* cacti and legumes. There are some patches of candelabriform cacti (*Pachycereus pecten-aboriginum* and *Stenocereus queretaroensis*) associated to the terraces of the southeast hillside. Interestingly, these patches are taller and denser than those distributed in other parts of the hill and stand out in marked contrast against the most widespread legume species (*Leucaena* spp; *Lysiloma acapulcense* and *Senegalia interior*). The aquatic and subaquatic vegetation is distributed at the foot of the hill following the river course, with small areas of gallery forest consisting of *Salix* spp. and *Taxodium mucronatum*. Cattails (*Typha domingensis*) and reeds (*Arundo donax*) frequently formed dense populations on the river bank. The subtropical scrub is scarcely distributed in the upper parts of the hill, as well as in the eastern hillside. It is characterized by the presence of *Agave angustifolia*, *Bursera schlechtendalli*, *Erythrina flabelliformis*, *Jatropha dioica*, *Lippia graveolens*, *Pachycereus pecten-aboriginum*, *Prosopis laevigata* and *Opuntia* spp.

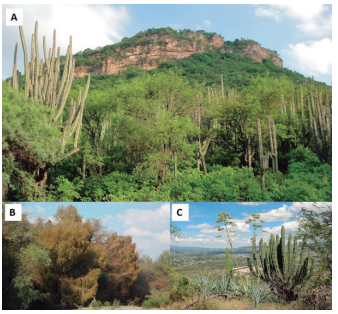

Figure 2. Vegetation types within the archaeological site Cerro de Las Ventanas. A) Tropical deciduous forest, B) Aquatic and subaquatic vegetation, C) Subtropical scrub.

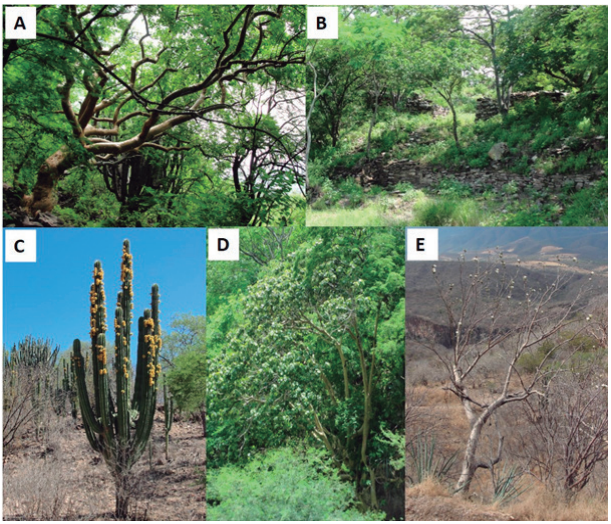

Figure 3. Some representative species of the tropical deciduous forest. A) Bursera simaruba, B) Amphipterygium molle, Ceiba aesculifolia and legumes, C) Pachycereus pecten-aboriginum, D) Ficus petiolaris, E) Ipomoea intrapilosa.

2.2 Data collection and analyses

The field work was carried out mainly between 2018 and 2020 years during 18 field trips in the archaeological site. As a first approach to identify main plant resources we employed the inventory/interview method, which consists of involve key informants (local guides from El Remolino) in the active collection of plants specimens and the subsequent interviews about common names and uses. Sampling was realized along the altitudinal gradient in seven transects, covering the three vegetation types. The study polygon (190 hectares) was delimited by the Juchipila River and towards the north and eastern hillside by cultivated fields (milpas) and areas cleared for livestock. Special care was taken to abide by the regulations of the archaeological site and the Federal Law on Monuments and Archaeological, Artistic and Historical Zones (DOF 1972). Later, semi-structured individual interviews were conducted to knowledgeable elderly people, identified by snowball sampling method (Bailey 1994), using photographs and

botanical specimens (fresh or dried) as support material. The first question was wether the informant recognizes and has a name for the plant, the second was wether the species is used for any purpose. If the informants provide a use for a particular species, they were again asked whether it might have any additional use. Questionings continues until the informants responds that they know of no other use. In this way, with the prior consent of each informant, a total of 71 interviews were conducted to mestizo people, born and raised in the Juchipila Valley, between 40 and 90 years, and dedicated mainly to agriculture, livestock and plant gathering. These informants were permanent residents in the following communities of the Juchipila municipality: El Remolino (24), Juchipila (11), Contitlán (7), La Cantera (6), El Paisano (5), Mezquitera Norte (5), Atemajac (3), Mezquitera Sur (3), La Rinconada (3), Amoxóchitl (2) and Guadalajarita (2). Data were complemented with additional collections and direct observations during 2022 and 2023 years in family orchards, agricultural fields, tianguis market and traditional festivities.

Botanical samples were collected with conventional techniques (Lot and Chiang 1986) and identified with taxonomic keys available in Flora Novo Galiciana (McVaugh 1983, 1984, 1987, 1989, 1992, 1993), Bajío y Regiones Adyacentes (Fryxell 1993, Rzedowski and Calderón 1998, 2002, Lira 2001, Carranza 2007, Espejo and López 2010) and North America (Ball et al. 2003); as well as specialized literature (Herrera-Arrieta et al. 2010, De la Cerda-Lemus 2011, Sahagún-Godínez et al. 2014, Sánchez-Ken 2019). Taxonomic identification was verified in the herbarium of the Universidad Autónoma de Zacatecas, with specimens collected in the Juchipila Valley. Plants processed were deposited in the Jorge Arturo Alba Ávila herbarium (HJAAA) of the Universidad Juárez del Estado de Durango, and duplicates were sent to CIIDIR, IBUG, ANSM, HUAA herbaria (Thiers 2023). Despite the present study focused on the useful plants, we collected plant species that were present but are not used. This is

justified due to the importance of floristic studies at a local level in conservation and management (Hurtado-Reveles et al. 2021, Hurtado and Burgos 2023). For more details on these specimens, voucher information is available in the Red de Herbarios del Noroeste de México (2023) and herbarium of the Universidad Autónoma de Zacatecas.

In order to analyze richness and floristic composition of the useful flora, the information of taxonomic identity (family, genus, specific epithet, author) was captured in a database and complemented with local names and uses. These data resulted in a floristic list with the families, genera, species and infraspecific taxa presented in alphabetical order, following the classification system proposed by PPG (2016) for lycophytes, Christenhusz et al. (2011) for gymnosperms and APG (2016) for angiosperms. Species nomenclature was standardized with the Tropicos database (2023). The usage categories are mainly based according to Caballero et al. (1998); however, we adapted other categories that are part of certain cultural practices, not exactly utilitarian (ceremonial, recreational, ornamental). Finally, we calculate the sum of uses and the use value of each species as an easy approach to evaluate the cultural significance of the useful plants in the study area (Boom 1989, Phillips and Gentry 1993). To calculate the use value of each species (UVs), before must calculate the value use index (UVis) of each species per informant. We used the formula:

$$UVis = \Sigma Uis/Nis$$

in which Uis = the number of uses mentioned for the species s by the informant i; Nis = the number of events in which the informant i mentioned a use for the species s. Then UVs was calculated with the following formula:

$$UVs = \Sigma UVis/Nis$$

in which Nis = the total number of informants interviewed for the species s.

3. RESULTS AND DISCUSSION

3.1 Richness and floristic composition

The field work and herbarium specimens allowed to update the floristic list of the Cerro de Las Ventanas in 322 recorded species, of which the useful flora comprises 88 species (27 %), grouped in 72 genera and 41 botanical families. In terms of conservation status, there were not species included in the Mexican Official Norm NOM-059 (SEMARNAT 2010). Eudicots were the best represented taxonomic group with 73 species, followed by monocots with 12, lycophytes with 2, and gymnosperms with 1 species (Table 1). The 10 families with the highest number of useful species and genera (Figure 4) were: Fabaceae (10 spp; 9 genera), Asteraceae (7 spp; 7 genera), Solanaceae (7 spp; 4 genera), Cactaceae (6 spp; 5 genera), Poaceae (5 spp; 3 genera), Apocynaceae (3 spp; 3 genera), Burseraceae (3 spp; 1 genera), Convolvulaceae (3 spp; 1 genera), Euphorbiaceae (3 spp; 3 genera) and Verbenaceae (3 spp; 2 genera).

Taxonomic group	Families	Genera	Species	Varieties
Licophytes	1	1	2	-
Gymnosperms	1	1	1	-
Monocots	7	9	12	-
Eudicots	32	61	73	1
Total	41	72	88	1

Table 1. Floristic composition of the useful flora in the archaeological site Cerro de Las Ventanas, Zacatecas, México.

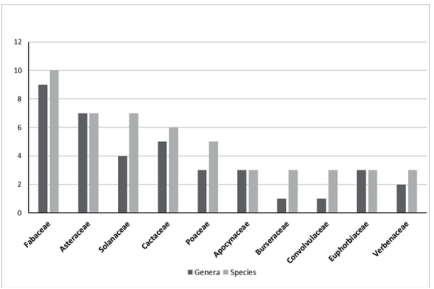

Figure 4. Families with the highest number of useful species and genera.

Floristic studies in other parts of the country with predominance of tropical deciduous forest, frequently show Asteraceae, Burseraceae, Cactaceae, Euphorbiaceae, Fabaceae and Poaceae as the families with the highest species richness (Lott et al. 1987, Arriaga and León 1989, Gallardo-Cruz et al. 2005, Castillo-Campos et al. 2007, Alanís-Rodríguez et al. 2010, Dzib-Castillo et al. 2014). The richest genera were *Bursera*, *Ipomoea* and *Solanum* (3 species each), then *Selaginella*, *Tillandsia*, *Cenchrus*, *Chloris*, *Ruellia*, *Opuntia*, *Salix*, *Physalis* and *Lippia* (2 species each). Four of the genera with the highest species number in the study area (*Bursera*, *Ipomoea*, *Solanum*, *Tillandsia*) coincide with the most diverse genera indicated by Villaseñor for the vascular flora of Mexico (2004, 2016), and they are also included (with the exception of *Solanum*) in the genera with most species distributed preferentially or exclusively in the tropical deciduous forest, from a total of 749 genera reported for this vegetation type (Rzedowski and Calderón 2013).

Among the plant species that were present but are not used, in this paper we report *Ipomoea alba*, *Polyclathra cucumerina*, *Solanum adscendens* and *Veronica americana* as new records for the flora of Zacatecas, according to the checklist of the native vascular plants of Mexico (Villaseñor 2016), which includes the most complete floristic record list for Zacatecas state. These new records demonstrate the deficient floristic knowledge of Zacatecas, considering that these are not rare species and even though the study area is within the Priority Terrestrial Region 065 Sierra de Morones (Arriaga-Cabrera et al. 2000). In this regard, the Mexican Strategy for Plant Conservation (CONABIO 2012) established that botanical exploration and the number of records and collections, mainly from little-known and priority regions, must be increased for an adequate and sufficient knowledge of the country's plant diversity, which was reiterated by Villaseñor (2015).

3.2 Useful flora

The floristic list of useful plants comprises 88 species with its local names, use categories and use values (Appendix 1). The three main use categories were medicinal (49 spp.), food (27 spp.) and ornamental (22 spp.). Other uses such as forage, for handicrafts, construction, tools, recreational, firewood, ceremonial and fiber registered between five and three species (Figure 5). The results are similar to inventories of useful species in other parts of the country (Medellín-Morales et al. 2018, Benz et al. 1994, Sánchez-Velázquez et al. 2002, Martínez-Moreno et al. 2016, Martínez-Pérez et al. 2012, Casas et al. 2001, Estrada-Castillón et al. 2017, Paredes-Flores et al. 2007), and confirm those of Caballero et al. (1998) regarding the main use categories and families with the highest number of useful species in Mexico.

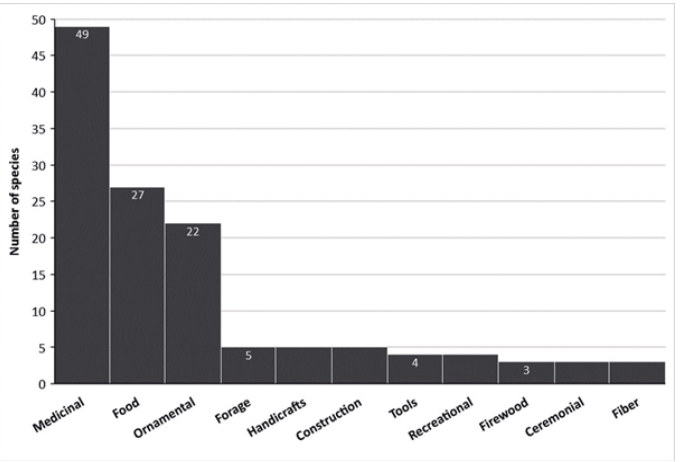

Figure 5. Number of species registered for use categories.

In order to carry out a quantitative assessment of the species of greatest cultural significance, we calculate the use value. The 10 species that presented higher values (between 1.00 and 0.79) was: *Prosopis laevigata*, *Stenocereus queretaroensis*, *Arundo donax*, *Pithecellobium dulce*, *Leucaena esculenta*, *Psidium guajava*, *Agave angustifolia*, *Leucaena leucocephala*, *Physalis angulata* and *Pachycereus pecten-aboriginum* (Table

2). In contrast, *Mammillaria petterssonii*, *Asclepias curassavica*, *Selaginella rupincola*, *Ruellia* spp; *Bauhinia pringlei*, *Ipomoea alba*, *Selaginella lepidophylla*, *Cyperus esculentus* and *Tillandsia recurvata* registered the lower values (≤ 0.10). Some species with values between 0.77 and 0.11 was: *Lysiloma acapulcense*, *Portulaca oleracea*, *Typha domingensis*, *Opuntia* spp; *Hintonia latiflora*, *Porophyllum macrocephalum*, *Malpighia mexicana*, *Cascabela ovata* and *Valeriana sorbifolia*.

Species	Local name	Use value
Prosopis laevigata	mezquite	1.00
Stenocereus queretaroensis	pitayo	0.97
Arundo donax	carrizo	0.90
Pithecellobium dulce	guamúchil	0.89
Leucaena esculenta	guais colorado	0.87
Psidium guajava	guayaba	0.87
Agave angustifolia	maguey de cerro	0.85
Leucaena leucocephala	guais blanco	0.83
Physalis angulata	tomatillo	0.82
Pachycereus pecten-aboriginum	órgano	0.79

Table 2. Species with the highest use value and its local names in the Juchipila Valley

Prosopis laevigata stands out as a multipurpose species with the highest sum of uses (7), then *Washingtonia filifera* (5) and *Agave angustifolia* (4); whereas the other 85 species registered between three and one uses. There are species that have the same specific use (food) but different UVs like *Leucaena esculenta* (0.87) and *Malpighia mexicana* (0.23); this indicates that most of informants recognizes *L. esculenta* as an edible plant compared with *M. mexicana*. The above results suggest that *Prosopis laevigata* (1.00) best reflects the botanical knowledge of the inhabitants in the Juchipila Valley (Figure 6). The wood of this species is used as firewood and raw material for charcoal, tools,

handicrafts and house construction; resin and leaves are used for medicinal purposes. The resin is also consumed as a candy locally known as gomitas. The pods are used as supplemental forage and for human food. To prepare beverages the people use mainly fresh pods. The dried pods are processed for flour in wood mortars of the same species and then marketed as mezquitamal. Also, this species gives the name of some localities such as Mezquitera Sur, Mezquitera Norte and Mezquituta. In addition to above, burnt seeds probably from *Prosopis* associated with pottery material was reported in excavations realized within the terraces system of the archaeological site (Rodríguez 2008), which may be of major significance to understand the role of *Prosopis* gathering and pod processing in cultural evolution along the Holocene (Capparelli 2022).

Figure 6. Some local uses of Prosopis laevigata. A) edible as mezquitamal, B) edible as candy, C) tools and handicrafts, D) wood as material construction, E) wood mortar.

On the other side, *Stenocereus queretaroensis* (0.97) is well known in the Juchipila Canyon by its sweet edible fruits locally known as pitayas, which are gathered during the months

of April, May and June. The culms of *Arundo donax* (0.90) are used in construction with the ancient technique bajareque, also this plant is a resource for fibers employed in the basketry and manufacture of rustic tools employed in the gathering of pitayas and other fruits. The wood of *Pithecellobium dulce* (0.89) is used as firewood and the fresh pods (guamara) contain an edible aril with sweet-acid flavor. The green seeds of Leucaena esculenta (0.87) and *L. leucocephala* (0.83) are eaten to accompany some meals. *Psidium guajava* (0.87) has edible fruits and the leaves are prepared as infusion to medicinal use. The fresh flowers and the flower stalk (quiote) of *Agave angustifolia* (0.85) are eaten after being cooked, the root is employed to medicinal uses, the base of the leaves are used as fiber to clean metates and molcajetes (grinding utensils), whereas the whole plant is used as ornamental. The roasted fruits of *Physalis angulata* (0.82) and *P. philadelphica* (0.77) are prepared in a typical sauce with Capsicum annuum and Allium sativum. The fruits of Pachycereus pecten-aboriginum (0.79) have both medicinal and edible use. It is interesting to note that some species may have low sume of uses possibly related to cultural erosion processes at a local level, but also may be the result of poor knowledge about other potential uses.

The useful species ocurring in the archaeological site are under different management forms in the Juchipila Valley and it is frequent to see some of them sold in the weekly market Tianguis del Palo Verde (Figure 7). Most of the species (49) are obtained only through gathering, whereas the rest have some degree of incipient management (Casas et al. 1997) going from tolerated plants, promoted, protected and cultivated. For example, incipient management was observed in *Stenocereus queretaroensis*, *Pithecellobium dulce*, *Spondias purpurea* and *Malpighia mexicana*; which are tolerated, promoted and protected in natural vegetation, but also collected from the wild and then cultivated in the border of milpas and family orchards. Native elderly people reported that some areas of Cerro de Las Ventanas were cleared approximately until 70 years ago for the establishment of an

itinerant agroforestry system. Species such as *Prosopis laevigata*, *Myrtillocactus geometrizans*, *Stenocererus queretaroensis* and *Opuntia* spp. are tolerated by mestizo people in a similar agroforestry system known as "huamil", which is classified as agroforestry system with middle managament intensity (Moreno-Calles et al. 2013). These practices could contribute to explain the processes that led to the origins of agriculture in this region. In fact, we collected *Phaseolus micranthus*, *Solanum lycopersicum* var. cerasiforme and *Zea mays* ssp. *mexicana*, which are not common within the archaeological site and they are considered wild relatives of the domesticated species of beans, tomatos and maize (Delgado-Salinas et al. 1999, Rodríguez-Guzmán et al. 2009, Moreno-Letelier et al. 2020). Simultaneously, we also collected *Gossypium hirsutum*, *Nicotiana tabacum* and *Campsicum annuum* in ruderal habitats of the Juchipila Valley. The persistance of useful plants in the archaeological site is an important aspect of this study. We suggest that vegetation of Cerro de Las Ventanas results of plant management practices along the time and some useful species may have fell in disuse. Thus, it is worth to carry out studies to clarify if the plants in the archaeological are relicts of marginal crops.

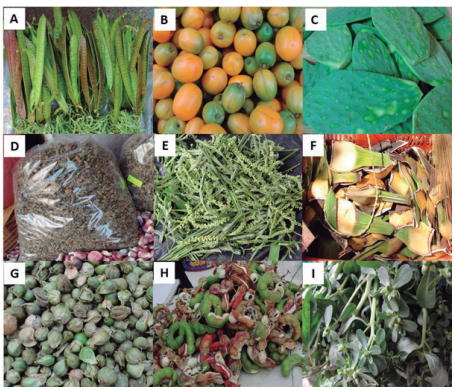

Figure 7. Some species marketed in the Tianguis del Palo Verde. A) Leucaena leucocephala, B) Spondias purpurea, C) Opuntia velutina, D) Lippia graveolens, E) Lysiloma acapulcense, F) Agave angustifolia, G) Physalis angulata, H) Pithecellobium dulce, I) Portulaca oleracea.

Although it should be noted that the current recording of useful plants does not imply that they have been used by the ancient inhabitants of the Cerro de Las Ventanas, the importance of this study and the collected specimens lies in that these can be the basis for future research with arqueobotanical remains, according to the methodology proposed by several authors (Rodríguez and Rúgolo 1999, Roque et al. 2003, Rodríguez et al. 2006).

4. CONCLUSIONS

The archaeological site Cerro de Las Ventanas safeguards not only cultural, but also biological heritage. In particular, the useful flora found in the Cerro de Las Ventanas must be protected with great care because it represents an important heritage that enriches the value of the archaeological site.

Floristic inventories linked to local knowledge are fundamental for planning strategies for the sustainable use and conservation of the biocultural heritage. Therefore, the inventory of useful flora presented in this study could be enriched through further surveys focused in other localities of the Juchipila Canyon with different vegetation types.

Projects and other strategies should be developed in the region for conservation of the biocultural heritage. The results lead us to suggest that conservation of biocultural heritage could be carried out with the establishment of an ethnobiological garden in situ; understood as a space for the visiblity, recovery, protection, diffusion and interchange of ethnobiological knowledge.

ACKNOWLEDGEMENTS

The authors thank to CONAHCYT and División de Estudios de Posgrado FCB-UJED for the financial support. We acknowledge the Instituto Nacional de Antropología e Historia and the Cerro de Las Ventanas Archaeological Project, specially to Arqgla. Laura Solar-Valverde for their assistance during fieldwork. We also thank M. E. Siqueiros-Delgado and J. A. Villarreal-Quintanilla who reviewed Poaceae and Asteraceae families, respectively.

Initial support during fieldwork was provided by Biol. Emmeth Rodríguez. We are indebted to the residents of the Juchipilla Valley for sharing their valuable knowledge about useful plants.

Appendix 1.

Floristic list of useful plants in the archaeological site Cerro de las Ventanas, Zacatecas, Mexico. Uses: medicinal (M), food (F), ornamental (O), forage (Fo), handicrafts (H), construction (C), tools (T), recreational (R), ceremonial (Ce), fiber (Fi), firewood (Fw).

TAXA	LOCAL NAME	USES	UVs
LICOPHYTES			
SELAGINELLACEAE			
Selaginella lepidophylla (Hook. & Grev.) Spring	flor de peña	M, O	0.10
Selaginella rupincola Underw.	heno	O	0.07
GYMNOSPERMS			
CUPRESSACEAE			
Taxodium mucronatum Ten.	sabino	C, M	0.25
ANGIOSPERMS			
MONOCOTS			
ARECACEAE			
Washingtonia filifera (Gloner ex Kerch., Burv., Pynaert, Rodigas & Hull) de Bary	palma	H, C, Ce, Fi, O	0.38
ASPARAGACEAE			
Agave angustifolia Haw.	maguey	F, Fi, M, O	0.85
BROMELIACEAE			
Tillandsia caput-medusae É. Morren	gallinita	O	0.17
Tillandsia recurvata (L.) L.	paistle	M, O	0.10
COMMELINACEAE			
Commelina diffusa Burm. f.	hierba del pollo	M, O	0.13
CYPERACEAE			
Cyperus esculentus L.	coquito	F	0.10
POACEAE			
Arundo donax L.	carrizo	H, C, T	0.90
Cenchrus ciliaris L.	zacate bufalo	Fo	0.18
Cenchrus incertus M.A. Curtis	abrojo	M	0.35
Chloris gayana Kunth	pata de gallo	Fo	0.13
Chloris virgata Sw.	pata de gallo	Fo	0.11

Appendix 1.

Floristic list of useful plants in the archaeological site Cerro de las Ventanas, Zacatecas, Mexico. Uses: medicinal (M), food (F), ornamental (O), forage (Fo), handicrafts (H), construction (C), tools (T), recreational (R), ceremonial (Ce), fiber (Fi), firewood (Fw).

TAXA	LOCAL NAME	USES	UVs
TYPHACEAE			
Typha domingensis Pers.	tule	H, C	0.55
EUDICOTS			
ACANTHACEAE			
Ruellia hookeriana (Nees) Hemsl.	petunia	O	0.07
Ruellia simplex C. Wright	petunia	O	0.07
AMARANTHACEAE			
Amaranthus hybridus L.	quelite	F, Fo	0.45
Chenopodium murale L.	quelite de perro	M	0.15
ANACARDIACEAE			
Amphipterygium molle (Hemsl.) Hemsl. & Rose	cuachalala	M	0.45
Spondias purpurea L.	ciruela de hueso	F	0.39
APIACEAE			
Eryngium carlinae F.Delaroche	hierba del sapo	M	0.15
APOCYNACEAE			
Asclepias curassavica L.	cancerina	O	0.06
Cascabela ovata (Cav.) Lippold	hueso de fraile	H, O	0.18
Plumeria rubra L.	cacalosúchil	Ce, O	0.31
ASTERACEAE			
Adenophyllum cancellatum (Cass.) Villarreal	coronilla	F, Ce, R	0.34
Bidens odorata Cav.	aceitilla	M	0.31
Porophyllum macrocephalum DC.	hierba del venado	F, M	0.28
Pseudognaphalium luteoalbum (L.) Hilliard & B.L. Burtt	gordolobo	M	0.39
Tagetes lunulata Ortega	coronilla	F	0.39
Xanthium strumarium L.	toritos	R	0.23
Zinnia peruviana (L.) L.	mal de ojo	O	0.27
BIGNONIACEAE			
Tecoma stans (L.) Juss. ex Kunth	retama	R, M, O	0.25
BORAGINACEAE			
Heliotropium procumbens Mill.	hierba del arlomo	M	0.32

Appendix 1.

Floristic list of useful plants in the archaeological site Cerro de las Ventanas, Zacatecas, Mexico. Uses: medicinal (M), food (F), ornamental (O), forage (Fo), handicrafts (H), construction (C), tools (T), recreational (R), ceremonial (Ce), fiber (Fi), firewood (Fw).

TAXA	LOCAL NAME	USES	UVs
BURSERACEAE			
Bursera bipinnata (DC.) Engl.	copal	M	0.23
Bursera palmeri S. Watson	mostoche	M	0.27
Bursera simaruba (L.) Sarg.	papelillo	M	0.20
CACTACEAE			
Mammillaria petterssonii Hildm.	biznaga	F, M, O	0.03
Myrtillocactus geometrizans (Mart. ex Pfeiff.) Console	garambullo	F, O	0.41
Opuntia tomentosa Salm-Dyck	nopal güero	F, M	0.44
Opuntia velutina F.A.C. Weber	nopal negrito	F, M	0.51
Pachycereus pecten-aboriginum (Engelm. ex S. Watson) Britton & Rose	órgano	F, M	0.79
Stenocereus queretaroensis (F.A.C.Weber) Buxb.	pitayo	F, M, O	0.97
CAPRIFOLIACEAE			
Valeriana sorbifolia Kunth	valeriana	M	0.15
CONVOLVULACEAE			
Ipomoea alba L.	hiedra	O	0.08
Ipomoea intrapilosa Rose	osote	M	0.35
Ipomoea purpurea (L.) Roth	hiedra	O	0.11
CUCURBITACEAE			
Apodanthera undulata A. Gray	cualaista	F	0.38
EUPHORBIACEAE			
Cnidoscolus spinosus Lundell	mala mujer	M	0.55
Euphorbia berteroana Balb. ex Spreng.	hierba de la golondrina	M	0.15
Jatropha dioica Sessé ex Cerv.	sangre de grado	M	0.30
FABACEAE			
Bauhinia pringlei S. Watson	pata de vaca	M, O	0.08
Erythrina flabelliformis Kearney	colorín	M, R	0.59
Eysenhardtia polystachya (Ortega) Sarg.	varaduz	T, M	0.51
Leucaena esculenta (DC.) Benth.	guais colorado	F	0.87

Appendix 1.

Floristic list of useful plants in the archaeological site Cerro de las Ventanas, Zacatecas, Mexico. Uses: medicinal (M), food (F), ornamental (O), forage (Fo), handicrafts (H), construction (C), tools (T), recreational (R), ceremonial (Ce), fiber (Fi), firewood (Fw).

TAXA	LOCAL NAME	USES	UVs
Leucaena leucocephala (Lam.) de Wit	guais blanco	F	0.83
Lysiloma acapulcense (Kunth) Benth.	temachaca	F	0.72
Pithecellobium dulce (Roxb.) Benth.	guamúchil	F, Fw	0.89
Prosopis laevigata (Humb. & Bonpl. ex Willd.) M.C. Johnst.	mezquite	F, H, C, Fo, T FW, M	1.00
Senegalia interior Britton & Rose	uña de gato	T, M	0.27
Vachellia farnesiana (L.) Wight & Arn.	huizache	M	0.41
LAMIACEAE			
Salvia tiliifolia Vahl	chia cimarrona	F	0.32
LORANTHACEAE			
Psittacanthus calyculatus (DC.) G. Don	injerto	M	0.28
MALPIGHIACEAE			
Malpighia mexicana A. Juss.	costocoal	F	0.23
MALVACEAE			
Ceiba aesculifolia (Kunth) Britten & Baker f.	pochote	Fi	0.46
Malvastrum bicuspidatum (S. Watson) Rose	babosilla	M	0.20
MARTYNIACEAE			
Proboscidea louisianica (Mill.) Thell.	vaquita	F	0.68
MORACEAE			
Ficus petiolaris Kunth	texcalame	M	0.31
MYRTACEAE			
Psidium guajava L.	guayabo	F, M	0.87
NYCTAGINACEAE			
Mirabilis jalapa L.	maravilla	O	0.55
OXALIDACEAE			
Oxalis decaphylla Kunth	jocoyol	F	0.35
PAPAVERACEAE			
Argemone mexicana L.	chicalote	M	0.72
POLYGONACEAE			
Antigonon leptopus Hook. & Arn.	listón	O	0.15
PORTULACACEAE			
Portulaca oleracea L.	verdolaga	F, M	0.63

Appendix 1.
Floristic list of useful plants in the archaeological site Cerro de las Ventanas, Zacatecas, Mexico. Uses: medicinal (M), food (F), ornamental (O), forage (Fo), handicrafts (H), construction (C), tools (T), recreational (R), ceremonial (Ce), fiber (Fi), firewood (Fw).

TAXA	LOCAL NAME	USES	UVs
RUBIACEAE			
Hintonia latiflora (DC.) Bullock	canelillo	M	0.44
SALICACEAE			
Salix bonplandiana Kunth	sauz	M	0.48
Salix nigra Marshall	sauz	M	0.52
SAPINDACEAE			
Serjania schiedeana Schltdl.	palo de las tres costillas	M	0.32
SOLANACEAE			
Datura stramonium L.	toloache	M	0.41
Nicotiana glauca Graham	gigante	M	0.32
Physalis angulata L.	tomatillo	F	0.82
Physalis philadelphica Lam.	tomatillo		0.77
Solanum lycopersicum var. cerasiforme Fosberg	tomate	F	0.55
Solanum nigrescens M. Martens & Galeotti	hierba mora	M	0.31
Solanum rostratum Dunal	mancamula	M	0.38
VERBENACEAE			
Lantana achyranthifolia Desf.	suegra y nuera	O	0.24
Lippia alba (Mill.) N.E.Br. ex Britton & P. Wilson	manzanilla de coyote	M	0.11
Lippia graveolens Kunth	orégano de cerro	F, M	0.41

5. BIBLIOGRAPHY

ALANÍS-RODRÍGUEZ, Eduardo; Aranda-Ramos, Rafael; Mata-Balderas, José M; Canizales-Velázquez, Pamela A; Jiménez-Pérez, Javier; Uvalle-Sauceda, José I; Valdecantos-Dema, Alejandro; Ruiz-Bautista, Milton G. (2010). Riqueza y diversidad de especies leñosas del bosque tropical caducifolio en San Luis Potosí, México. Ciencia UANL 13: 287-293.

APG [Angiosperm Phylogeny Group]. (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society 181: 1-20. DOI: https://doi.org/10.1111/boj.12385

ARRIAGA, Laura and León, José L. (1989). The Mexican tropical deciduous forest of Baja California Sur: a floristic and structural approach. Vegetatio 84: 45-52.

ARRIAGA-CABRERA, Laura; Espinoza-Rodríguez, José M; Aguilar-Zúniga, Claudia; Martínez-Romero, Eduardo; Gómez-Mendoza, Leticia; Loa-Loza, Eleazar. (2000). Regiones terrestres prioritarias de México. México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad.

BAILEY, Kenneth D. (1994). Methods of social research. New York: The Free Press.

BALÉE, William; Schaan, Denise P; Whitaker, James A; Holanda, Rosângela. (2014). Florestas antrópicas no Acre: inventario florestal no geoglifo Três Vertentes, Acrelândia. Amazônica: Revista de Antropologia. 6 (1): 140-169.

BALL, Peter W; Reznicek, A. A; Murray, David F. (2003). Cyperaceae. Flora of North America North of Mexico, Provisional Publication. Flora of North America Association. September 25, 2019. http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=10246 (accesed September 25, 2019).

BENZ, Bruce F; Santana, Francisco; Pineda, Rosario; Cevallos, Judith; Robles, Luis HL, De Niz, Domitila. (1994). Characterization of mestizo plant use in the Sierra de Manantlán, Jalisco-Colima, México. Journal of Ethnobiology 14 (1): 23-41.

BOOM, Brian M. (1989). Use of plant resources by the Chácobo. Advances in Economic Botany 7: 78-96.

CABALLERO, Javier; Casas, Alejandro; Cortés, Laura; Mapes, Cristina. (1998). Patrones en el conocimiento, uso y manejo de plantas en pueblos indígenas de México. Estudios Atacameños 16: 181-195.

CAPPARELLI, Aylen. (2022). Ethnobotany of Prosopis spp., past evidence of the fruit use and experimental archaeology applied to the interpretation of ancient food proccesing. In: Puppo, María C. and Felker, Peter (Eds.), Prosopis as a heat-tolerant nitrogen-fixing desert food legume. Prospects for Economic Development in Arid Lands (pp.105-138). London, UK: Elsevier.

CARETTA, M. Nicolás. (2012). Asentamientos caxcanes en el Cañón de Juchipila y el primer intento del Camino Real de Guadalajara a Zacatecas. Relaciones 130: 69-90. ISSN0185-3929

CARRANZA, Eleazar. (2007). Flora del Bajío y de Regiones Adyacentes. Fascículo 151: Familia Convolvulaceae. Instituto de Ecología, A.C. Centro Regional del Bajío, Pátzcuaro, México.

CASAS, Alejandro; Caballero, Javier; Mapes, Cristina; Zárate, Sergio. (1997). Manejo de la vegetación, domesticación de plantas y origen de la agricultura en Mesoamérica. Boletín de la Sociedad Botánica de México 61: 31-47.

CASAS, Alejandro; Valiente, Alfonso; Viveros, Juan L; Caballero, Javier; Cortés, Laura; Dávila, Patricia; Lira, Rafael; Rodríguez, Isela. (2001). Plant resources of the Tehuacán-Cuicatlán Valley, México. Economic Botany 55 (1): 129-166.

CASTILLO-CAMPOS, Gonzalo; Dávila-Aranda, Patricia; Zavala-Hurtado, José A. (2007). La selva baja caducifolia en una corriente de lava volcánica en el centro de Veracruz: lista florística de la flora vascular. Boletín de la Sociedad Botánica de México 80: 77-104. DOI: https://doi.org/10.17129/botsci.1747

CERROS-TLATILPA, Rosa; Ceja-Romero, Jaqueline; Mendoza-Ruiz, Aniceto; Flores-Morales, Alejandro; Jaramillo-Sánchez, Mayo. (2019). Inventario florístico de los cerros La Cantera y Delgado, Jantetelco, Morelos, México. Acta Botánica Mexicana 127: 1-34. DOI: https://doi.org/10.21829/abm127.2020.1565

CONABIO [Comisión Nacional para el Conocimiento y Uso de la Biodiversidad]. (2012). Estrategia Mexicana para la Conservación Vegetal 2012-2030. México: Comisión Nacional

para el Conocimiento y Uso de la Biodiversidad. ISBN: 978-607-7607-68-7

CHRISTENHUSZ, Maarten J. M; Reveal, James L; Farjon, Aljos; Gardner, Martin F; Mill, Robert R; Chase, Mark W. (2011). A new classification ad linear sequence of extant gymnosperms. Phytotaxa 19:55-70.

DÁVILA, Patricia and Sosa, Victoria. (1994). El conocimiento florístico de México. Boletín de la Sociedad Botánica de México 55: 21-27. DOI: https://doi.org/10.17129/botsci.1443

DE LA CERDA-LEMUS, Margarita. (2011). Familia Euphorbiaceae en el Estado de Aguascalientes, México. Aguascalientes, México: Universidad Autónoma de Aguascalientes. ISBN: 978-6077745754

DELGADO-SALINAS, Alfonso; Turley, Tom; Richman, Adam; Lavin, Matt. (1999). Phylogenetic analysis of the cultivated and wild species of Phaseolus (Fabaceae). Systematic Botany 24 (3): 438-460.

DOF [Diario Oficial de la Federación]. (1972). Ley Federal sobre Monumentos y Zonas Arqueológicos, Artísticos e Históricos. Última reforma DOF 16-02-2018.

DZIB-CASTILLO, Benito; Chanatásig-Vaca, Cristina; González-Valdivia, Noel A. (2014). Estructura y composición en dos comunidades arbóreas de la selva baja caducifolia y mediana subcaducifolia en Campeche, México. Revista Mexicana de Biodiversidad 85:167-178. DOI: https://doi.org/10.7550/rmb.38706

ESPEJO Serna, Adolfo and López-Ferrari, Ana R. (2010). Flora del Bajío y de Regiones Adyacentes. Fascículo 165: Familia Bromeliaceae. Instituto de Ecología, A.C. Centro Regional del Bajío, Pátzcuaro, México.

ESTRADA-CASTILLÓN, E; Villarreal-Quintanilla, José A; Rodríguez-Salinas, María M; Encinas-Domínguez, Juan A; González-Rodríguez, Humberto; Romero-Figueroa, Guillermo; Arévalo, José R. (2017). Ethnobotanical Survey of Useful

Species in Bustamante, Nuevo León, México. Human Ecology. DOI: https://doi.org/10.1007/s10745-017-9962-x

FRYXELL, Paul A. (1993). Flora del Bajío y de Regiones Adyacentes. Fascículo 16: Familia Malvaceae. Instituto de Ecología, A.C. Centro Regional del Bajío, Pátzcuaro, México.

GALLARDO-CRUZ, José A; Meave, Jorge A; Pérez-García, Eduardo A. (2005). Estructura, composición y diversidad de la selva baja caducifolia del Cerro Verde, Nizanda (Oaxaca), México. Boletín de la Sociedad Botánica de México 76: 19-35. DOI: https://doi.org/10.17129/botsci.1701

GARCÍA, Enriqueta. (1998). Climas (Clasificación de Köpen, modificada por García) Escala 1:1 000 000. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. México, D.F.

GARCÍA-ICAZBALCETA, J. (1866). Relación de la jornada de Francisco de Sandoval Acazitli, in: Colección de documentos para la historia de México, tomo II. pp. 307-332. México, Antigua Librería, Portal de Agustinos No. 3

GÓMEZ-DOMÍNGUEZ, Hector; Pérez-Farrera, Miguel A; Espinosa-Jiménez, Josefa A; Márquez-Reynoso, Mirna I. (2015). Listado florístico del Parque Nacional Palenque, Chiapas, México. Botanical Sciences 93 (3): 559-578. DOI: https://doi.org/10.17129/botsci.151

GÓMEZ-POMPA, Arturo; Flores, José S; Sosa, Victoria. (1987). The 'pet kot': a man-made tropical forest of the Maya. Interciencia 12: 10-15.

GONZÁLEZ-ELIZONDO, M. Socorro; González-Elizondo, Martha; Tena-Flores J. A; Ruacho-González, Lizeth; López-Enríquez, I. Lorena. (2012). Vegetación de la Sierra Madre Occidental, México: una síntesis. Acta Botanica Mexicana 100: 351-405.

GUZMÁN, Gastón and Vela-Gálvez, Luciano. (1960). Contribución al conocimiento de la vegetación del suroeste del estado de Zacatecas. Boletín de la Sociedad Botánica de México 25:46-61. DOI: https://doi.org/10.17129/botsci.1065

HERNÁNDEZ-CRUZ, Marina J; Koch-Olt, Stephen D; Pulido-

Salas, María T. P; Luna-Cavazos, Mario; García-Villanueva, Eduardo. (2016). Estudio florístico del cerro Metecatl, del complejo montañoso Tetzcutzingo, Texcoco, Estado de México, México. Botanical Sciences 94 (2): 377-392. DOI: https://doi.org/10.17129/botsci.240

HERRERA-ARRIETA, Yolanda; Peterson, Paul M; Cortés-Ortiz, Armando. (2010). Gramíneas de Zacatecas, México. Fort Worth, Texas: Brit Press. ISBN: 13 978-1889878-31-7

HURTADO-REVELES, Leopoldo; Burgos-Hernández, Mireya; Vázquez-Sánchez, Monserrat; López-Acosta, Juan C. (2021). Contribución al conocimiento florístico de la Sierra de los Cardos, Susticacán, Zacatecas, México. Botanical Sciences 100 (1): 247-262. DOI: https://doi.org/10.17129/botsci.2882

HURTADO Reveles, Leopoldo and Burgos-Hernández, Mireya. (2023). Estudios florísticos locales ¿son importantes? La maravillosa y poco conocida flora de Susticacán, Zacatecas, México. Desde el Herbario CICY 15: 91-96. ISSN: 2395-8790

JIMÉNEZ Betts, Peter and Darling, J. Andrew. (2000). Archaeology of Southern Zacatecas: The Malpaso, Juchipila, and Valparaiso-Bolaños Valleys. In: Foster, M. and Gorenstein, S. (Eds.), Greater Mesoamerica. The Archaeology of West and Northwest Mexico. (pp.155-180). Utah, USA: The University of Utah Press.

LARA-REIMERS, Eduardo A; Fernández-Cusimamani, E; Lara-Rodríguez Eduardo A; Zepeda del Valle, Juan M; Zbynek, Polesny; Pawera, Lukas. (2018). An ethnobotanical study of medicinal plants used in Zacatecas state, Mexico. Acta Societatis Botanicorum Poloniae 87 (2): 3581. DOI: https://doi.org/10.5586/asbp.3581

LEVIS, Carolina; Figueira de Souza, Priscila; Schietti, Juliana; Emilio, Thaise; Purri da Veiga Pinto, José L; Clement, Ch. R; Costa, Flavia. (2012). Historical human footprint on modern tree species composition in the Purus-Madeira interfluve, Central Amazonia. Plos One 7: 1-10.

LOT, Antonio and Chiang, Fernando. (1986). Manual de Herbario. Administración, Manejo de Colecciones, Técnicas de Recolección y Preparación de Ejemplares Botánicos. México, DF: Consejo Nacional de la Flora de México A.C. ISBN: 968-6144-00-5

LOTT, Emily J; Bullock, Stephen H; Solis-Magallanes, J. Arturo. (1987). Floristic Diversity and Structure of Upland and Arroyo Forests of Coastal Jalisco. Biotropica 19: 228-235.

LIRA Saade, Rafael. (2001). Flora del Bajío y de Regiones Adyacentes. Fascículo 92: Familia Cucurbitaceae. Instituto de Ecología, A.C. Centro Regional del Bajío, Pátzcuaro, México.

MARTÍNEZ-PÉREZ, Aniceto; López, Pedro A; Gil-Muñoz, Abel; Cuevas-Sánchez, J. Axayácatl. (2012). Plantas silvestres útiles y prioritarias identificadas en la Mixteca Poblana, México. Acta Botanica Mexicana 98: 73-98.

MARTÍNEZ-MORENO, David; Reyes-Matamoros, Jenaro; Andrés-Hernández, Agustina R; Pérez-Espinosa, Liliana. (2016). Flora útil de la comunidad "Rancho El Salado" en Jolalpan, México. Revista Iberoamericana de Ciencias 3: 1-15. ISSN2334=2501

McVAUGH, Rogers. (1983). Flora Novo-Galiciana 14. Graminae. University of Michigan Press. Ann Arbor, Michigan.

McVAUGH, Rogers. (1984). Flora Novo-Galiciana 12. Compositae. University of Michigan Press. Ann Arbor, Michigan.

McVAUGH, Rogers. (1987). Flora Novo-Galiciana 5. Leguminosae. University of Michigan Press. Ann Arbor, Michigan.

McVAUGH, Rogers. (1989). Flora Novo-Galiciana 15. Bromeliaceae. University of Michigan Press. Ann Arbor, Michigan.

McVAUGH, Rogers. (1992). Flora Novo-Galiciana 17. Gymnosperms and Pteridophytes. University of Michigan Press. Ann Arbor, Michigan.

McVAUGH, Rogers. (1993). Flora Novo-Galiciana 13. Limnocharitaceae to Typhaceae. University of Michigan Press. Ann Arbor, Michigan.

MEDELLÍN-MORALES, Sergio G; Barrientos-Lozano, Ludivina;

Mora-Olivo, Arturo; Almaguer-Sierra, Pedro; Mora-Ravelo, Sandra G. (2018). Conocimiento tradicional y valoración de plantas útiles en Reserva de Biósfera El Cielo, Tamaulipas, México. Agricultura, Sociedad y Desarrollo 15: 354-377.

MINISSALE, Pietro and Sciandrello, Saverio. (2017). The wild vascular flora of the Archaeological Park of Neapolis in Syracuse and surrounding areas (Sicily, Italy). Biodiversity Journal 8 (1): 87-104.

MORENO-CALLES, Ana Isabel; Toledo, Victor M; Casas, Alejandro. (2013). Los sistemas agroforestales tradicionales de México: una aproximación biocultural. Botanical Sciences 91 (4): 375-398.

MORENO-LETELIER, Alejandra; Aguirre-Liguori, Jonás A; Piñero, Daniel; Vázquez-Lobo, Alejandra; Eguiarte, Luis E. (2020). The relevance of gene flow with wild relatives in understanding the domestication process. The Royal Society Open Science 7: 191545. DOI: https://dx.doi.org/10.1098/rsos-191545

PAREDES-FLORES, Martín; Lira-Saade, Rafael; Dávila-Aranda, Patricia D. (2007). Estudio etnobotánico de Zapotitlán Salinas, Puebla. Acta Botanica Mexicana 79: 13-61.

PAVLIK, Bruce M; Louderback, Lisbeth A; Vernon, Kenneth B; Yaworsky, Peter M; Wilson, Cynthia; Clifford, Arnold; Codding, Brian F. (2021). Plant species richness at archaeological sites suggests ecological legacy of indigenous subsistence on the Colorado Plateau. Proceedings of the National Academy of Sciences of the United States of America 18 (21): 2-5. DOI: https://doi.org/10.1073/pnas.2025047118

PHILLIPS, Oliver and Gentry, Alwyn H. (1993). The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. Economic Botany 47 (1): 15-32.

PPG (Pteridophyte Phylogeny Group). (2016). A community-derived classification for extant lycophytes and ferns: PPG I. Journal of Systematics and Evolution. 54 (6): 563-603. DOI: https://doi.org/10.1111/jse.12229

RAMÍREZ Prieto, Juan. (2009). Inventario y uso de plantas medicinales en el municipio de Juchipila, Zacatecas (Tesis de licenciatura). Universidad Autónoma de Zacatecas. Zacatecas, México.

RAMÍREZ Diaz, Claudia J. (2016). El que "no puede ser nombrado": Zacatecas, un estado de cuya flora se conoce poco. Desde el Herbario CICY 8:170-173. ISSN:2395-8790

RAMÍREZ-PRIETO, Juan; Koch-Olt, Stephen; Balleza-Cadengo, José J; Adame-González, Miguel; Romero-Nápoles, Jesús. (2016). Flora de la cima de la Mesa Alta, Jerez, Zacatecas, México. Botanical Sciences 94 (2): 357-375. DOI: https://doi.org/10.17129/botsci.246

RED DE HERBARIOS DEL NOROESTE DE MÉXICO. (2023). http//:www.herbanwmex.net/portal/index.php. Accesed: February 2023.

RODRÍGUEZ Torres, Juan R. (2008). El sitio arqueológico Cerro Las ventanas y sus terrazas prehispánicas (Tesis de licenciatura). Universidad Autónoma de Zacatecas. Zacatecas, México.

RODRÍGUEZ, María F and Rúgolo de Agrasar, Zulma E. (1999). Deyeuxia eminens (Poaceae, Agrostideae) en un sitio arqueológico de la Puna Meridional Argentina (Provincia de Catamarca). Darwiniana 37: 229-242. ISSN0011-6793

RODRÍGUEZ-GUZMÁN, Eduardo; Vargas-Canela, Diego; Sánchez-González, José J; Lépiz-Ildefonso, Rogelio; Rodríguez-Contreras, Aarón; Ruiz-Corral, José A; Puente-Ovalle, Pedro; Miranda-Medrano, Roberto. (2009). Etnobotánica de Solanum lycopersicum var. cerasiforme en el Occidente de México. Naturaleza y Desarrollo 7 (2): 45-57.

RODRÍGUEZ, María F; Rúgolo de Agrasar, Zulma E; Aschero, Carlos A. (2006). El uso de las plantas en unidades domésticas del sitio arqueológico Punta de la Peña 4, Puna Meridional Argentina. Chungara, Revista de Antropología Chilena 38: 257-271.

ROQUE, José; Cano, Asunción; Cook, Anita. (2003). Restos vegetales del sitio arqueológico Casa Vieja, Callango (Ica). Revista Peruana de Biología. 10 (1): 33-43. ISSN1727-9933

RZEDOWSKI, Jerzy. (1978). Vegetación de México. México, DF: Limusa. ISBN: 968-18-0002-8

RZEDOWSKI, Jerzy and Calderón de Rzedowski, Graciela. (1998). Flora del Bajío y de Regiones Adyacentes. Fascículo 70: Familia Apocynaceae. Instituto de Ecología, A.C. Centro Regional del Bajío, Pátzcuaro, México.

RZEDOWSKI, Jerzy and Calderón de Rzedowski, Graciela. (2002). Flora del Bajío y de Regiones Adyacentes. Fascículo 100: Familia Verbenaceae. Instituto de Ecología, A.C. Centro Regional del Bajío, Pátzcuaro, México.

RZEDOWSKI, Jerzy and Calderón de Rzedowski, Graciela. (2013). Datos para la apreciación de la flora fanerogámica del bosque tropical caducifolio de México. Acta Botánica Mexicana 102: 1-23.

SAHAGÚN-GODÍNEZ, Eduardo; Macías-Rodríguez, Miguel A; Carrillo-Reyes, Pablo; Larrañaga-González, Nerea; Vázquez-García, José A. (2014). Guía de campo de los árboles tropicales de la Barranca del Río Santiago en Jalisco, México. Guadalajara, México: UAG-UdG-COECyT Jal. ISBN: 978-607-8336-24-1

SÁNCHEZ-KEN, J. Gabriel. (2019). Riqueza de especies, clasificación y listado de las gramíneas (POACEAE) de México. Acta Botánica Mexicana 126. DOI: https://doi.org/10.21829/abm126.2019.1379

SÁNCHEZ-VELÁSQUEZ, Lázaro R; Hernández-Vargas, Guadalupe; Carranza-M, Mario A; Pineda-López, María R; Cuevas, Ramón; Aragón, Fernando. (2002). Estructura arbórea del bosque tropical caducifolio usado para la ganadería extensiva en el norte de la Sierra de Manantlán, México. Antagonismo de usos. Polibotánica 13: 25-46. ISSN1405-2768

SANTOS, Ronize S; Coelho-Ferreira, Márlia; Lima, Pedro G. C; Magalhães, Marcos P. (2019). Useful plants and their relation to archaeological sites in the Serra de Carajás, Brazil. Anais da Academia Brasileira de Ciências 91 (1): 1-18. ISSN1678-2690

SEMARNAT [Secretaría del Medio Ambiente y Recursos Naturales].

(2010). Norma Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental – Especies nativas de México de flora y fauna silvestres – Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio – Lista de especies en riesgo. Diario Oficial de la Federación. 2da Sección, 30 de diciembre de 2010.

THIERS, B. (2023). Index Herbariorum. A global directory of public herbaria and associated staff. Botanical Garden´s Virtual Herbariorum. New York. http://sweetgum.nybg.org/science/ih/. Accesed: February 2023.

TORRES Soria, Pablo. (2001). Flora fanerogámica de la zona arqueológica de Teotihuacán, Estado de México. Polibotánica 12: 57-83. ISSN1405-2678

TROPICOS. (2023). Missouri Botanical Garden. Saint Louis, Missouri. http://www.tropicos.org. Accesed: December 2023.

VILLASEÑOR, José Luis. (2004). Los géneros de plantas vasculares de la flora de México. Boletín de la Sociedad Botánica de México 75: 105-135. DOI: https://doi.org/10.17129/botsci.1694

VILLASEÑOR, José Luis. (2015). ¿La crisis de la biodiversidad es la crisis de la taxonomía? Botanical Sciences 93 (1): 3-14. DOI: https://doi.org/10.17129/botsci.456

VILLASEÑOR, José Luis. (2016). Checklist of the native vascular plants of Mexico. Revista Mexicana de Biodiversidad 87: 559-902. DOI: https://doi.org/10.1016/j.rmb.2016.06.017

ZIZUMBO Villarreal, Daniel and García-Marín, Patricia Colunga. (2008). El origen de la agricultura, la domesticación de plantas y el establecimiento de corredores biológico-culturales en Mesoamérica. Revista de Geografía Agrícola 41: 85-113. ISSN0186-4394