BOLETIN LATINOAMERICANO Y DEL CARIBE DE PLANTAS MEDICINALES Y AROMÁTICAS
© / ISSN 0717 7917 / www.blacpma.ms-editions.cl

Revisión / Review

From miracle medicine to fuel: Uses of the multifaceted genus *Randia* (Rubiaceae) in Mexico

[De medicina milagro a combustible: usos del multifacético género *Randia* (Rubiaceae) en México]

Alejandro Torres-Montúfar[1] & Mayte Stefany Jiménez-Noriega[2]

[1]Herbario FES-Cuautitlán, Departamento de Ciencias Biológicas. Facultad de Estudios Superiores Cuautitlán, Universidad Nacional Autónoma de México, Cuautitlán Izcalli, México

[2]Jardín Botánico FES-Cuautitlán, Departamento de Ciencias Biológicas. Facultad de Estudios Superiores Cuautitlán, Universidad Nacional Autónoma de México, Cuautitlán Izcalli, México.

Reviewed by:
Jordan de la Cruz Castillo
Universidad Nacional de Trujillo
Perú

Leticia Cano
Universidad Veracruzana
México

Correspondence:
Alejandro TORRES-MONTÚFAR
montufar@comunidad.unam.mx

Section Ethnobotany

Received: 9 August 2024
Accepted: 20 October 2024
Accepted corrected: 20 November 2024
Published: 30 March 2025

Citation:
Torres-Montúfar A, Jiménez-Noriega MS
From miracle medicine to fuel: uses of the multifaceted genus *Randia* (Rubiaceae) in Mexico
Bol Latinoam Caribe Plant Med Aromat
23 (2): 186 - 198 (2025)
https://doi.org/10.37360/blacpma.25.24.2.13

Abstract: Mexico harbors a rich floristic and cultural diversity that makes it a key area for ethnobotanical research. Among its plant families, Rubiaceae stands out, including 111 genera and 711 species, with the genus *Randia* comprising 64 species. This review examines the ethnobotanical uses of *Randia* in Mexico, identifying 19 species of interest. Medicinal uses dominate, involving 14 species, followed by food (nine species) and fuel (five species), highlighting Randia's role in daily life. Medicinal applications include treatments for gastrointestinal and urinary ailments, antidotes for venom, and remedies for cultural conditions like “mal de ojo” (evil eye), with some validated by chemical and pharmacological studies. Documenting these practices is essential to preserve cultural heritage and promote sustainable development. Further chemical and pharmacological research on *Randia* species are recommended to substantiate traditional uses and explore pharmaceutical applications, offering benefits for both local and global communities.

Keywords: Ethnobotany; Ethnomedicine; Traditional uses; Sustainability; Wild foods.

Resumen: México alberga una rica diversidad florística y cultural que lo convierte en un área clave para la investigación etnobotánica. Entre sus familias de plantas, destaca Rubiaceae, que incluye 111 géneros y 711 especies, siendo el género Randia uno de los mejor representados con 64 especies. Esta revisión analiza los usos etnobotánicos de Randia en México, identificando 19 especies. Los usos medicinales predominan, con 14 especies, seguidos por los usos alimenticios (nueve especies) y como combustible (cinco especies), destacando así el papel de Randia en la vida cotidiana. Las aplicaciones medicinales incluyen tratamientos para afecciones gastrointestinales, urinarias, antídotos para venenos y remedios para condiciones culturales como el "mal de ojo", algunos de los cuales han sido validados mediante estudios químico-farmacológicos. Documentar estas prácticas es esencial para preservar el patrimonio cultural y el desarrollo sostenible. Se recomienda realizar más investigaciones químicas y farmacológicas sobre las especies de Randia para respaldar los usos tradicionales y explorar aplicaciones farmacéuticas, ofreciendo beneficios tanto a las comunidades locales como a nivel global.

Palabras clave: Etnobotánica; Etnomedicina; Frutos silvestres comestibles; Sustentabilidad; Usos tradicionales

INTRODUCTION

Mexico boasts a high diversity of flora with over 22,000 plant species (Villaseñor, 2016), attributed to its varied climates which give rise to different ecosystems ranging from deserts to tropical rainforests (Villaseñor & Meave, 2022). This natural richness is closely intertwined with the cultural diversity of its people, further emphasizing Mexico's importance as a center for ethnobotanical research (Vidal & Brusca, 2020). The ethnobotanical practices observed in Mexico have been meticulously developed over thousands of years, often passed down through generations, reflecting a profound heritage of knowledge and tradition.

The traditional knowledge held by Mexican indigenous communities is invaluable for the identification, classification, and utilization of plant species (Linares & Bye, 2016; Vidal & Brusca, 2020; Sclavo, 2023). Ethnobotanical studies have documented that over 4,000 plant species are used in Mexico, showcasing the extensive botanical knowledge embedded within these communities (Vibrans & Casas, 2022).

Ethnobotanical knowledge not only helps preserve traditional practices but also fosters innovations that can lead to the development of new pharmaceuticals and sustainable agricultural methods, demonstrating the contemporary relevance and future potential of these ancient practices. The ongoing documentation and study of ethnobotanical practices in Mexico are crucial for preserving this rich heritage and promoting sustainable development.

One of the most relevant elements in the Mexican flora, in terms of the number of species, is the Rubiaceae family, better known as Coffee family, which is the fourth most diverse among angiosperms with around 700 genera and 13,800 species (Davis *et al*., 2009). It is a cosmopolitan lineage characterized by a unique combination of traits: opposite or verticillate leaves with entire margins, presence of inter- or intra-petiolar stipules, gamosepalous and gamopetalous flowers, and inferior ovary (Torres-Montúfar & Torres-Díaz, 2022).

The Rubiaceae family is globally known mainly for coffee plants (*Coffea* spp.), although there are other species of importance such as Quina (*Cinchona officinalis* L.), which until 70 years ago was the only known antimalarial remedy due to its quinine content (Egan, 2001). Gardenia (*Gardenia* spp.) is very important in the perfume industry for its fragrant flowers, which are used to produce essential oils and perfumes (Zhang *et al*., 2020). The "*Chancrona*" (*Psychotria viridis* Ruiz & Pav.) is one of the ingredients in the Amazonian hallucinogen called ayahuasca, used traditionally in spiritual and healing ceremonies by indigenous peoples (Frecska *et al*., 2016). The Cat's Claw (*Uncaria tomentosa* (Willd.) DC.) is used in traditional medicine in South America for its anti-inflammatory and immunostimulant properties (Pilarski *et al*., 2006). The Noni (*Morinda citrifolia* L.) has been promoted for its potential health benefits, including anti-cancer properties, although scientific evidence is still being evaluated (Assi *et al*., 2017). The diversity and widespread distribution of the Rubiaceae family underscore its importance not only in economic and medicinal contexts but also in ecological and cultural landscapes worldwide.

In Mexico, the Rubiaceae family includes 111 genera and 711 species (Torres-Montúfar & Torres-Díaz, 2022). This high diversity obviously translates into a high number of species with some use, whether medicinal, alimentary, ritual, or for construction. To date, there is no work compiling the number of useful species of Mexican Rubiaceae, which is an enormous task.

The genus *Randia* L. is the second most diverse genus of Rubiaceae in Mexico, with 64 species, of which 47 are endemic to the country (Torres-Montúfar & Torres-Díaz, 2022). It has a Neotropical distribution and consists of woody plants, shrubs, or lianas, rarely small trees, functionally dioecious, with leaves distributed in brachyblasts, usually with spines at the nodes, pollen dispersed in permanent tetrads, a 1-locular ovary with parietal placentation, and fruits in berries with pulp turning black upon oxidation (Figure No. 1) (Judkevich *et al*., 2015). In the literature, multiple reports have described various ethnobotanical uses of *Randia*, remarking it as an invaluable plant widely used (Ojeda-Ayala *et al*., 2022). However, this information is very region-specific, and there is no study that compiles all the uses of the genus in Mexico. Our review aims to integrate the findings concerning the ethnobotanical aspects of *Randia* and its chemistry and pharmacology when available.

MATERIAL AND METHODS

This review was prepared based on an extensive survey of major scientific databases as Google Scholar, Scopus, PubMed, Medline, and Science Direct, and English and non-English references books, thesis, research articles dealing with useful properties of *Randia* species. We reviewed more than 150 publications related to Mexican ethnobotany to report beneficial information about various aspects of

the genus. The selection of texts was based primarily on mentions of the genus *Randia* and its uses, whether in ethnobotanical studies or pharmacological studies aimed at confirming traditional uses. Traditional uses were arranged according to the classification by Bernal-Ramírez *et al*. (2019), which considers nine categories that are applicable: food, crafts, ceremonial, construction, fuel, medicinal, ornamental, and veterinary. The Plant List (**www.theplantlist.org**) and International Plant Name Index (**www.ipni.org**) databases were used to the correct nomenclature for scientific names.

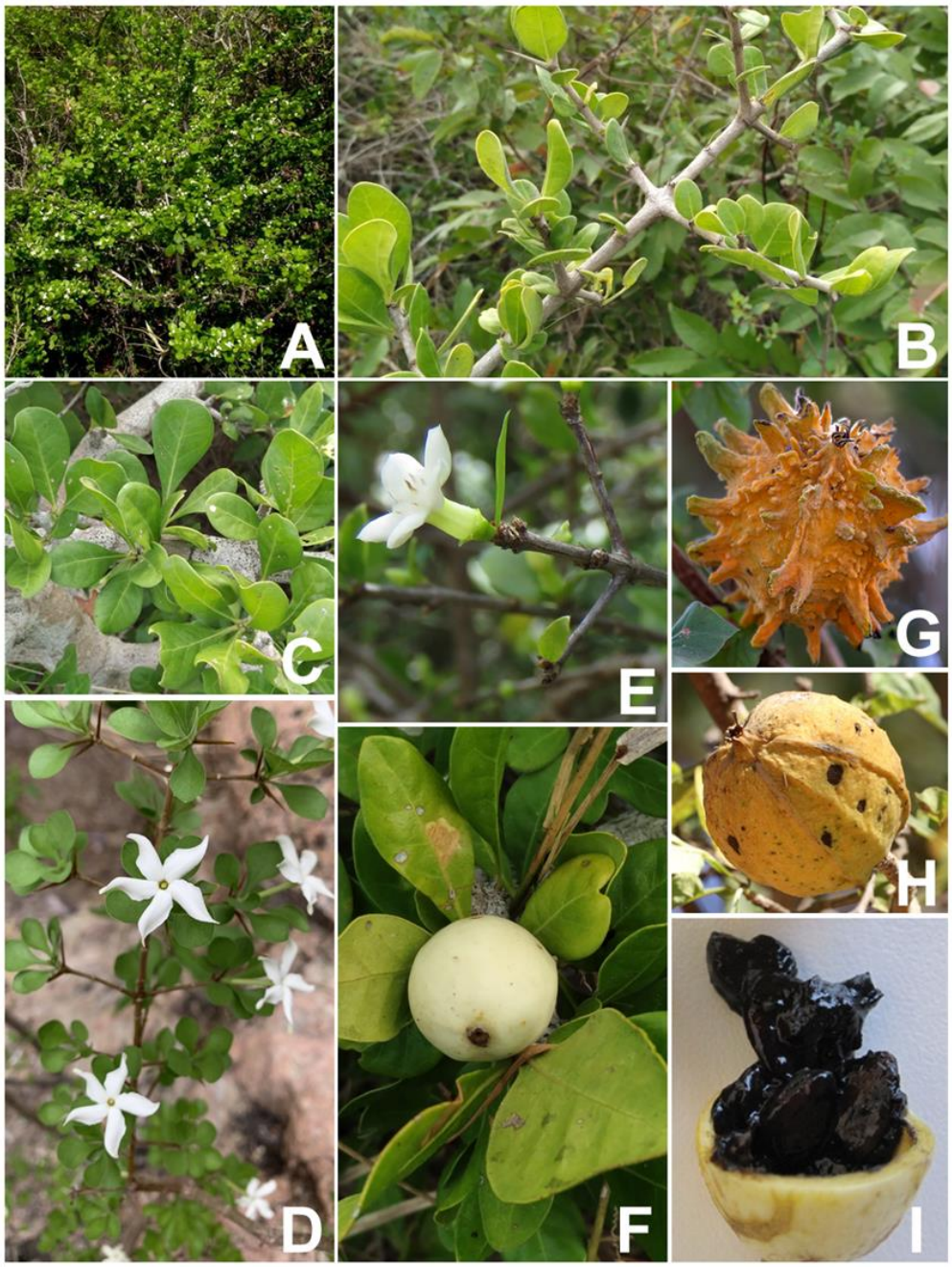

Figure No. 1
Main morphological characters in Randia. A. Lifeform (*Randia aculeata*). B. Cross-like stems (*R. aculeata*). C. Leaves disposed on brachyblasts (*R. aculeata*). D. Flowering branch (*Randia thurberi*). E. Flower (*R. aculeata*). F-H. Mature fruits. F. *R. aculeata*. G. *Randia echinocarpa*. H. *Randia tetracantha*. I. Black pulp of the fruits (*R. aculeata*). Photographs A-C and E-F by F. Farriols Sarabia; D, by M. Magaña; G by M. P. Amarillas; H by E. Barraza; I by A. Torres.

RESULTS AND DISCUSSION

From the 700 species of Rubiaceae in Mexico, the genus *Randia* is one of the most diverse with 64 species of which 19 are useful (Table No. 1), making it the genus with the greatest number of uses in the Rubiaceae family followed by *Psychotria* (12 species) (Torres-Montúfar and Lazcano-Flores *ined.*).

The category of use with the most species is medicinal (14 species), followed by food (nine species), and finally fuel (five species), the other categories have less than four representative species (Figure No. 2).

Table No. 1
Ethnobotanical uses of documented *Randia* species

	Taxon	Common names	Useful category	Part used
1	*Randia aculeata* L.[3, 5, 8, 9, 10, 22]	Guayacan, Crucetillo; Crucero, Cruceto, Crucetilla blanca, Torillo, Torito, Xilimayatl;	Craft, Food, Fuel, Medicinal	Fruits, Stems
2	*Randia armata* (Sw.) DC.[5, 13, 17]	Limón cruceto	Construction, Fuel, Medicinal	Twigs Leaves, Fruits
3	*Randia capitata* DC.[5, 7, 9]	Crucetillo	Medicinal	Non-Specified
4	*Randia cinerea* (Fernald) Standl.[5]	Crucillo	Construction, Medicinal	Leaves, Fruits
5	*Randia echinocarpa* DC.[1, 2, 4, 5, 7, 11, 14, 15, 16, 17]	Membrillo de zorro, Humo, Huitsumo, Tecolotillo, Bola de granjel; Shauca, cirián Chino; Garanjel, Ahuizcolotl, Aguizcolotle, Papache	Food, Fuel, Medicinal	Leaves, Fruits, Stems
6	*Randia laetevirens* Standl.[5, 6, 18, 19]	Jicaquillo, Crucito, Capulín de corona	Food, Medicinal	Fruits
7	*Randia laevigata* Standl.[5,9]	Crucetillo	Construction, Fodder, Food, Medicinal	Fruits
8	*Randia longiloba* Hemsl.[5]	Non-specified	Food, Medicinal	Bark, Fruits
9	*Randia micrantha* (Lillo) Bacigalupo[5, 21]	Rompezapato	Construction, Fuel	Stems
10	*Randia monantha* Benth.[5, 9, 11, 19]	Crucetillo	Medicinal	Fruits
11	*Randia oaxacana* Standl.	Non-Specified	Food	Fruits
12	*Randia obcordata* S. Watson[5]	Non-Specified	Food, Utensils	
13	*Randia ovalifolia* Borhidi[13]	Non-Specified	Fodder, Fuel	Stems, Leaves
14	*Randia petenensis* Lundell[5,18]	Crucetillo, Limón cruceto	Medicinal	Fruits
15	*Randia rhagocarpa* Standl.[5,12]	Brasil	Fodder, Medicinal, Veterinary	Leaves, Stems
16	*Randia sonorensis* Wiggins[5]	Non-specified	Food	Fruits
17	*Randia tetracantha* (Cav.) DC.[5]	Non-specified	Medicinal	Fruits
18	*Randia thurberi* S. Watson[5, 9, 13, 17, 23]	Tecuchi	Food, Medicinal	Fruits
19	*Randia xalapensis* M. Martens & Galeotti[3,5]	Non-Specified	Medicinal	Non-Specified

References: ([1]Alonso-Castro *et al.*, 2011; [2]Argueta *et al.*, 1994; [3]Avendaño & Acosta, 2000; [4]Bye *et al.*, 1991; [5]Caballero & Cortés, 1982-2024; [6]Castillo-Gómez, 2015; [7]Cruz-Pérez *et al.*, 2021; [8]Farrera, 2019; [9]Flores-Camargo & Sánchez-Dirzo, 2022; [10]Gallardo-Casas *et al.*, 2012; [11]García, 2016; [12]Jasso, 2015; [13]Luna-José & Rendón-Aguilar, 2008; [14]Maldonado *et al.*, 2019; [15]Martínez-de la Cruz *et al.*, 2015; [16]Martínez-Moreno *et al.*, 2016; [17]Martínez, 2015; [18]Martínez *et al.*, 2007; [19]Moreno-Casasola & Paradowska, 2009; [20]Rendón-Aguilar *et al.*, 2023; [21]Rodríguez *et al.*, 2018; [22]Zamora *et al.*, 2009; [23]Zepeda *et al.*, 2017).

Table No. 2
Specific medicinal uses for *Randia* in Mexico

	Taxon	General system	Particular disease	Pharmacology & phytochemistry
1	*Randia aculeata*	Circulatory	Venom antidote (snake)	Gallardo-Casas *et al*., 2012 Torres-Schwartz *et al*., 2018
2	*Randia armata*	Circulatory Sleep	Venom antidote (snake) Insomnia	Non-studied
3	*Randia capitata*	Respiratory	Cough	Non-studied
4	*Randia cinerea*	Urinary	To clear the urinary tract	Non-studied
5	*Randia echinocarpa*	Kidney Respiratory Gastrointestinal Circulatory Dermatology Parasites	Bad urine Kidney diuretic Gastritis Feet problems Wash wounds Cancer Malaria Peptic ulcers Abortive	Bye *et al*., 1991 Alarcón-Aguilera *et al*., 1998 Cuevas-Juárez *et al*., 2014 Santos-Cervantes *et al*., 2007 Cano-Campos *et al*., 2011 Montes-Avila *et al*., 2018 Pérez *et al*., 1993 Vargas-Solís & Pérez-Gutiérrez, 2002
6	*Randia laetevirens*	Non-specified	Non-specified	Non-studied
7	*Randia laevigata*	Parasites Gastrointestinal	Gastric discomforts Malaria	Non-studied
8	*Randia longiloba*	Parasites	Dengue	Gamboa-Angulo *et al*., 2008 Cristóbal-Alejo *et al*., 2006
9	*Randia monantha*	Circulatory	Venom antidote (snake and other poisonous animals)	Non-studied
10	*Randia petenensis*	Non-specified	Non-specified	Non-studied
11	*Randia rhagocarpa*	Pancreatic	Diabetes	Non-studied
12	*Randia tetracantha*	Gastrointestinal	Dysentery	Non-studied
13	*Randia thurberi*	Non-specified	Non-specified	Non-studied
14	*Randia xalapensis*	Non-specified	Non-specified	Non-studied

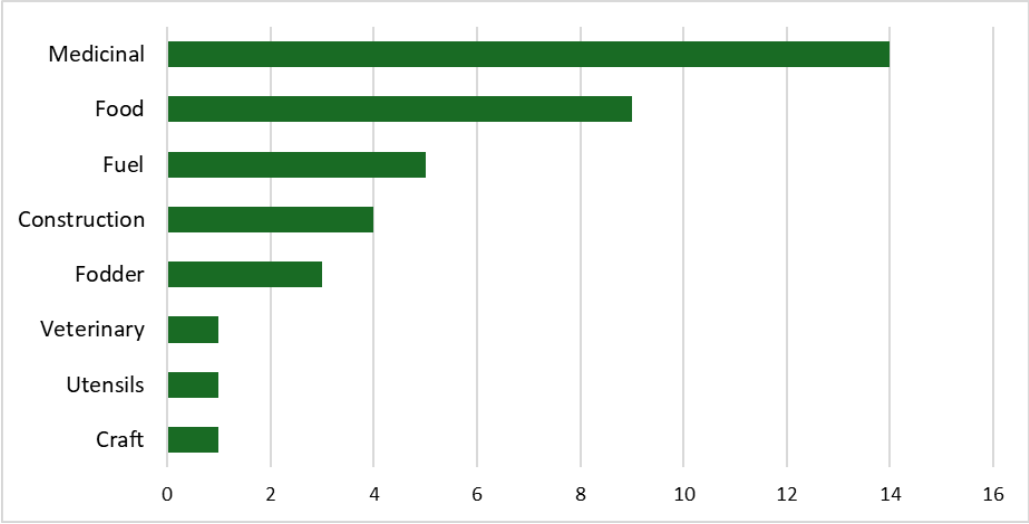

Figure No. 2
Number of *Randia* species by useful category

Medicinal uses of Randia

The species with the most medicinal applications is undoubtedly *R. echinocarpa* (Figure No. 3, Table No. 2), distributed in the country along almost the entire Pacific coast, and due to its extensive use as a medicinal plant, it is also marketed in central Mexico. This species is used for respiratory ailments, gastrointestinal issues (gastritis and peptic ulcers), as an antiparasitic (malaria), for dermatological conditions (burning feet and wound washing), and for kidney issues (urinary problems, kidney stones, diuretics). For example, the *Mayos*, an ethnic group in northern Mexico, boil the bark for urinary problems, and the fresh leaves are rubbed locally on ant bites. In Guerrero, the fruit is used as an abortifacient (Bye *et al*., 1991).

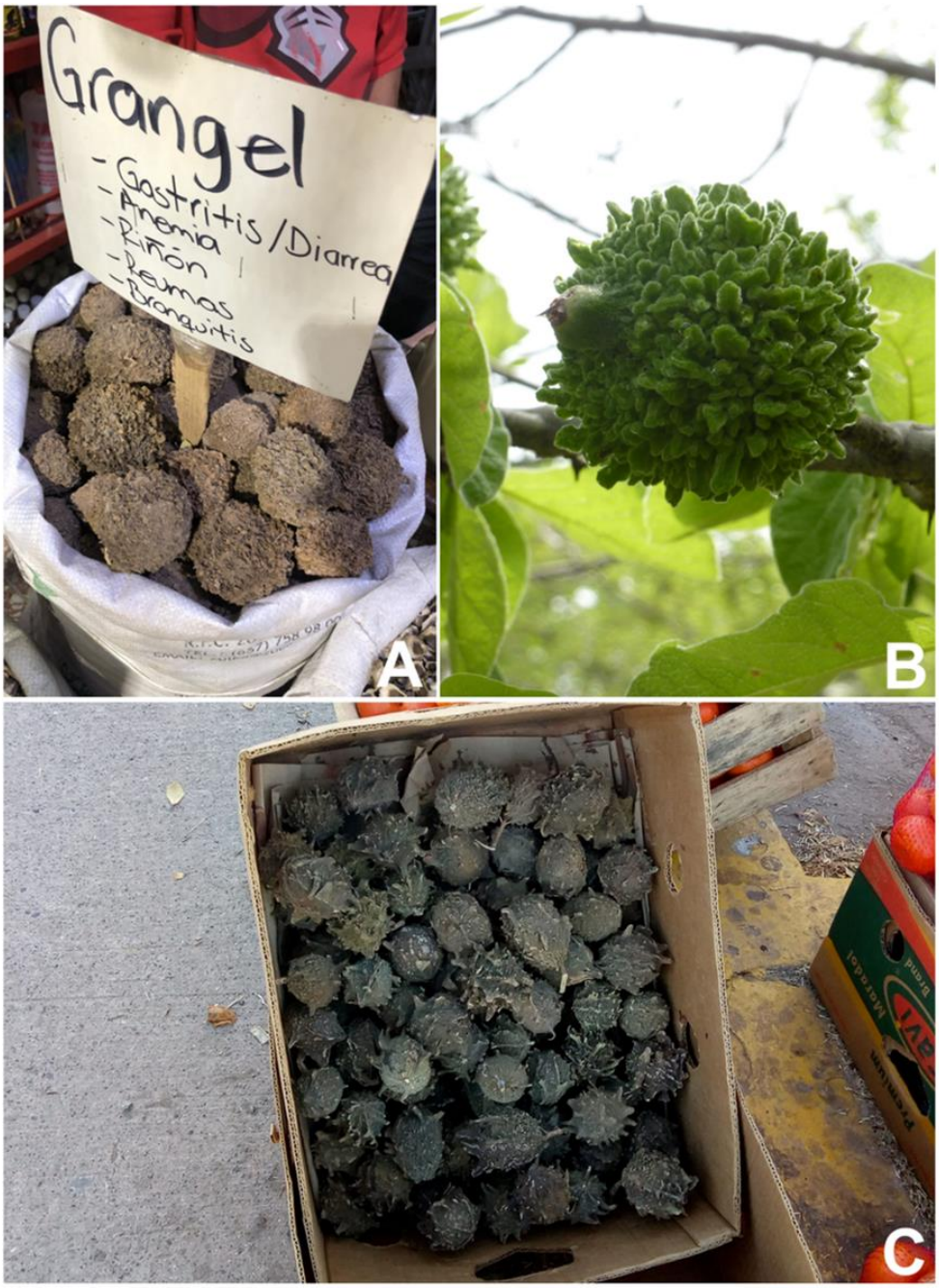

Figure No. 3
***Randia echinocarpa*. A. Fruits for sale in Sonora Market at Mexico City. B. Immature fruit. C. Fruits for Sale in Sinaloa, Mexico. Photographs A by A. Torres, B by D. Valenzuela; C by U. Baez**

Chemical studies of plant extracts have shown antimutagenic (Santos-Cervantes *et al*., 2007) and antioxidant (Cano-Campos *et al*., 2011) activity, while other studies support its immunoprotective effect in mice (Serrano-Silvas, 2013) and its diuretic activity (Vargas-Solis & Pérez-Gutierrez, 2002).

Other important species or species group is the plants named "*Crucetillo*" which is a common name assigned to several species (*R. capitata*, *R. laevigata*, *R. monantha* and *R. petenensis*) widely distributed in Mexico (Table No. 1). From the fruit of these species, a liquor called "*Licor de Crucetillo*" is made. The pulp of the fruits and the leaves are macerated in cane liquor/cane spirit, and it is mainly used for treating snake bites or poisonous insect stings. The method of consumption is by drinking it and applying it to the affected area (Figure No. 4).

Figure No. 4

Crucetillo (*Randia capitata*). A. Fruits for sale at market in Xalapa, Veracruz. B. Fruit for sale at Sonora market in Mexico City. C. Liquor commercialized. D. Announcement of the benefits of Crucetillo in Xalapa market, Veracruz ("What for many years was considered a homemade remake, is now sold to thousands of people in the Mexican Republic. 100% Mexican fruit to cure: Diabetes, rheumatism, arthritis, chronic colitis, kidney stone, gout, liver, gallbladder, cancer, prostate, circulation, sexual impotence, triglycerides, cramps, cholesterol, migraine, depression, sores and many more. Dose: a glass on an empty stomach or a tablespoon"). Photographs A, C and D by C. Arzaba; B by A. Torres

It became so famous that some producers market it as a liquor that promises to cure everything from colds to heartache, including diabetes, migraines, depression, arthritis, cancer, kidney diseases, cramps, and even the recent COVID-19, making it seem like a "miracle product" (Figure No. 3). Most of these uses are not reported in the literature and are only information obtained from popular markets and do not have scientific endorsements, which is why their properties are also considered to be magnified by Mexican folklore. Of all the species of *Crucetillo*, only *R. monantha* has demonstrated antioxidant biological activity which were attributed to its high phenolic and flavonoid content (Juárez-Trujillo *et al*., 2018).

One of the scientifically supported properties of several *Randia* species is their effect against venoms, particularly snake venom. Scientific studies that support some properties of *Randia aculeata* mention it as particularly useful for cellular-level protection against Nauyaca venom (*Bothrops asper*), one of the most venomous snakes in Mexico, using in vivo models in rats. Fruit extracts protect against thrombocytopenia and partially inhibit necrosis in skeletal muscle and myocardium (Gallardo-Casas *et al*., 2012). Other studies support its antioxidant functions (Cuevas-Juárez *et al*., 2014), which could hypothetically suggest some type of protective effect or mitigation of cardiovascular diseases also associated with poisoning. The species of *Randia* used against snake venom and other poisonous animals are *R. aculeata, R. armata*, and *R. monantha*, which should undoubtedly be the subject of pharmacological study to also confirm their effects.

Another of the most important medicinal uses of *Randia* is against malaria or dengue, for which three species are reported (*R. echinocarpa*, *R. laevigata*, and *R. longiloba*). It is not specified whether the plant is used as a palliative for the fever or general discomfort caused by these diseases or if, in some cases, it is mentioned that they help combat the parasites that cause these diseases. For the latter, there are pharmacological properties described such as antiparasitic and nematicidal activities of *R. echinocarpa* and *R. longiloba* (Cristobal-Alejo *et al*., 2006; López-Aroche *et al*., 2008). It is important to note that in Mexico, a very important traditional remedy against malaria is also a Rubiaceae: *Hintonia latiflora* Bullock, whose bark is used as an antimalarial remedy (Rivera *et al*., 2014), and also that the traditional remedy against malaria worldwide is *Quina*, also from the Rubiaceae family (*Cinchona officinalis* L.), so studies on the effects of *Randia* on this condition make sense and should be studied from a chemical perspective.

Additional medicinal use of *Randia* that stands out is its use against "*Mal de orin*" literally translated as "Bad urine" as mentioned in Bye *et al*. (1991), a condition considered a cultural disease often referred to as a folk illness, which encompasses a diverse array of conditions deeply embedded within the cultural fabric of societies worldwide. These illnesses are characterized by their unique etiologies, symptomatology, and treatment approaches, which are often distinct from those recognized by modern medicine, as "*Mal de ojo*" (evil eye) or "*Aire*" (bad air) (García-González *et al*., 2024). While traditional illnesses may lack empirical validation from a biomedical perspective, they hold significant cultural significance and shape the beliefs, behaviors, and experiences of individuals within their respective cultural contexts. We reported two species (*R. cinerea* and *R. echinocarpa*) used against, a condition is characterized by symptoms such as dysuria, urinary urgency, and discomfort in the lower abdomen, mirroring the physiological manifestations of urinary tract infections. Then, "*Mal de orin*" is a colloquial expression used in some spanish-speaking countries, especially in Latin America, to refer to infections that can affect any part of the urinary system, including the kidneys, ureters, bladder, and urethra. The effects that plants can have on the urinary system include bactericidal, fungicidal, anti-inflammatory, or diuretic properties, many of which are already reported in various *Randia* species (Vargas-Solís & Pérez-Gutiérrez, 2002; Nazari *et al*., 2006; Salinas-Sánchez *et al*., 2009; Perez-Espinosa *et al*., 2015; Cruz-Silva *et al*., 2016; Martínez-Ceja *et al*., 2022).

Edible wild foods

After medicinal use, the most employed category is food. The fruits of a total of five *Randia* species are consumed: *R. aculeata*, *R. echinocarpa*, *R. laetevirens*, *R. laevigata*, and *R. thurberi*). The fruits, which contain a juicy pulp typically sweet, although in some species (*R. echinocarpa*) it is reported as bitter (Bye *et al*., 1991). Their nutritional values have not been studied, but without a doubt, the consumption of fruits of wild plants is a complement to the diet of indigenous groups living in dry areas where agriculture is minimal. Therefore, the genus *Randia* is significant as a dietary supplement. Recognizing the wild native plant species is an essential practice for fostering sustainable development and honoring the rich cultural and ecological knowledge of Indigenous peoples in

Mexico which often possess a rich understanding of local ecosystems, accumulated over generations through direct interaction with their natural surroundings.

The only species that, besides consuming the fruit used as food, is *R. echinocarpa*, from which the bark and seeds are used as an additive to "*tesgüino*" a fermented maize beverage widely consumed in Mexico (Bye *et al*., 1991). The *Tesgüino* is more than just a drink; it is a social and ceremonial cornerstone. During important events, such as religious ceremonies and community gatherings, the consumption of *tesgüino* is central. It is often prepared by women, who hold the knowledge and skills necessary for its production. The communal consumption of *tesgüino* reinforces social bonds and collective identity among the Tarahumara people (Ojeda-Linares *et al*., 2021).

Wild foods serve as a critical resource during periods of food scarcity, acting as a buffer against hunger. They provide an accessible and affordable source of nutrition for vulnerable populations, particularly in developing countries where food insecurity is prevalent, also beyond their nutritional benefits, wild foods hold substantial cultural importance. They are integral to traditional diets and cuisines, and their gathering and consumption are often linked to cultural practices and knowledge systems (Aberoumand, 2009).

Other uses of Randia

Other less widespread uses include stems for construction (*R. laevigata* and *R. micrantha*), fuel (firewood) (*R. echinocarpa*, *R. laevigata*, and *R. micrantha*), or utensils/crafts (*R. aculeata*), leaves for forage (*R. laevigata*), and unspecified veterinary use, either as forage or for treating livestock diseases (*R. rhagocarpa*). This also reflects that in many human communities developed in dry areas, they must make use of the few available resources and use the adjacent plants for many purposes, including food and medicine.

Common names as cultural appropriation of Randia

Common plant names hold significant cultural importance as they reflect the relationship between humans and the natural world. Unlike scientific names, which are standardized and universally recognized, common names are deeply rooted in the language, traditions, and experiences of different communities.

Undoubtedly, the most widespread name for *Randia* in Mexico is "*Crucetillo*" and its derivatives ("*Cruceto*", "*Crucito*", and "*Limón cruceto*") assigned to six species (*R. armata*, *R. capitata*, *R. laetevirens*, *R. laevigata*, *R. monantha*, *R. petenensis*), which undoubtedly refers to the growth pattern of the shrubs, where the branching forms 90° angles, giving the appearance of a "cross" (Figure No. 1B).

Other names given to these plants denote a resemblance to another plant, such as "Guayacan" (*R. aculeata*) likely due to its similarity to the shrub of the Zygophyllaceae family commonly known as Guayacan (*Guaiacum* spp.) or "*Capulín de corona*" (*R. laetevirens*) due to the resemblance of its fruits to those of "*Capulín*" (*Prunus serotina* Ehrh., Rosaceae) and the addition of the term "corona" (crown) likely referring to the persistent calyx in the mature fruit. The name "*Membrillo de zorro*" (*R. echinocarpa*) may refer to "*Membrillo*" a term associated with various edible Rosaceae (e.g. *Malacomeles* spp.) and possibly to some association with the fox, which may use it as a den. The term "*Cirián chino*" (*R. echinocarpa*) is probably given for its resemblance to "*Guaje cirian*" (*Crescentia alata* Kunth., Bignoniaceae), whose spherical dried fruits are used as containers, maybe because the hard exocarp resembles that of *R. echinocarpa*, the term "*chino*" probably referring to the curly surface of the fruit, in Spanish, someone with curly hair is called "*chino*".

The name "*Rompezapato*" traduced as "Shoe-breaker" (*R. micrantha*) likely refers to the hardness of its wood, which is used for construction or fuel. Other names derive from indigenous languages, such as "*Ahuizcolotl*" (*R. echinocarpa*) or "*Teuchi*" (*Randia thurberi*). Other common names do not provide elements to presume their etymology or origin, such as *Tecolotillo*, *Humo*, *Huitsumo*, *Granjel*, *Jicaquillo*, or *Brasil*.

The use and preservation of common plant names are important for conservation efforts, as they can foster local engagement and awareness. When people feel a cultural connection to a plant through its name, they are more likely to value and protect it. This connection can be a powerful tool for promoting biodiversity conservation and environmental stewardship.

CONCLUSIONS

Our study highlights the main uses of the genus *Randia* in Mexico and constitutes a first approach to its study. Given the diversity of this genus and the high cultural diversity in Mexico, there are surely other uses not yet reported in the literature and other useful *Randia* species, emphasizing the importance of

basic ethnobotanical studies in Mexico directly with indigenous communities and market studies to approach a more complete knowledge of these plants and their relationship with humans. Additionally, the few studies evaluating the chemical and pharmacological effects of *Randia* species support the uses for which they are employed, thus more studies focused on this aspect are needed with a view to potential drug development.

ACKNOWLEDGEMENTS

This research was totally supported by the Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica (PAPIIT, research project IA205224). We are grateful to the anonymous reviewers and to the editorial staff of the Journal.

REFERENCES

Aberoumand A. 2009. Nutritional evaluation of edible *Portulaca oleracea* as plant food. **Food Anal Meth** 2: 204 - 207. **https://doi.org/10.1007/s12161-008-9049-9**

Alarcón-Aguilera FJ, Roman-Ramos R, Pérez-Gutiérrez S, Aguilar-Contreras A, Contreras-Weber CC, Flores-Sáenz JL. 1998. Study of the anti-hyperglycemic effect of plants used as antidiabetics. **J Ethnopharmacol** 61: 101 - 110. **https://doi.org/10.1016/s0378-8741(98)00020-8**

Alonso-Castro AJ, Villarreal ML, Salazar-Olivo LA, Gomez-Sanchez M, Dominguez F, Garcia-Carranca A. 2011. Mexican medicinal plants used for cancer treatment: pharmacological, phytochemical and ethnobotanical studies. **J Ethnopharmacol** 133: 945 - 972. **https://doi.org/10.1016/j.jep.2010.11.055**

Argueta V, Cano AL, Rodarte ME. 1994. **Atlas de las plantas de la medicina tradicional Mexicana**. Instituto Nacional Indigenista. **http://www.medicinatradicionalmexicana.unam.mx/apmtm/index.html**

Assi RA, Darwis Y, Abdulbaqi IM, Khan AA, Vuanghao L, Laghari MH. 2017. *Morinda citrifolia* (Noni): A comprehensive review on its industrial uses, pharmacological activities, and clinical trials. **Arab J Chem** 10: 691 - 707. **https://doi.org/10.1016/j.arabjc.2015.06.018**

Avendaño S, Acosta I. 2000. Plantas utilizadas como cercas vivas en el estado de Veracruz. **Madera y Bosques** 6: 55 - 71.

Bernal-Ramírez LA, Bravo-Avilez D, Fonseca-Juárez RM, Yáñez-Espinosa L, Gernandt DS, Rendón-Aguilar B. 2019. Usos y conocimiento tradicional de las gimnospermas en el noreste de Oaxaca, México. **Acta Bot Mex** 126: 1 - 24. **https://doi.org/10.21829/abm126.2019.1471**

Bye R, Linares E, Mata R, Albor C, Casteñeda PC, Delgado G. 1991. Ethnobotanical and phytochemical investigation of *Randia echinocarpa* (Rubiaceae). **Anal Inst Biol Univ Nac Auton Mex-Bot** 62: 87 - 106.

Caballero J, Cortés L. 1982-2024. **Base de datos etnobotánicos de plantas de México (BADEPLAM)**.: Jardín Botánico, Instituto de Biología, Universidad Nacional Autónoma de México, Ciudad de México, México. **http://unibio.unam.mx/badeplam**

Castillo-Gómez HA. 2015. **Flora Vascular, vegetación y plantas útiles del Cañón del Espinazo del Diablo, San Luis Potosí, México**. Thesis, Universidad Autónoma de San Luis Potosí, Mexico.

Cano-Campos MC, Díaz-Camacho SP, Uribe-Beltrán J, López-Angulo G, Montes-Avila J, Paredes-López O, Delgado-Vargas F. 2011. Bio-guided fractionation of the antimutagenic activity of methanolic extract from the fruit of *Randia echinocarpa* (Sessé et Mociño) against 1-nitropyrene. **Int Food Res** 44: 3087 - 3093. **https://doi.org/10.1016/j.foodres.2011.08.006**

Cristóbal-Alejo J, Tun-Suárez JM, Moguel-Catzín S, Marbán-Mendoza M, Medina-Baizabal L, Simá-Polanco P, Peraza-Sánchez SR, Gamboa-Angulo MM. 2006. *In vitro* sensitivity of *Meloidogyne incognita* to extracts from native Yucatecan plants. **Nematropica** 36: 89 - 97. **https://doi.org/10.18781/R.MEX.FIT.1507-3**

Cruz-Pérez AL, Barrera-Ramos J, Bernal-Ramírez LA, Bravo-Avilez D, Rendón-Aguilar B. 2021. Actualized inventory of medicinal plants used in traditional medicine in Oaxaca, Mexico. **J Ethnobiol Ethnomed** 17: 1 - 15. **https://doi.org/10.1186/s13002-020-00431-y**

Cruz-Silva SCBD, Matias R, Bono JAM, Santos KS, Ludwig J. 2016. Antifungal potential of extracts and fractions of *Randia nitida* leaves on soybean pathogens and their phytochemistry. **Rev Caatinga** 29: 594 - 602. **https://doi.org/10.1590/1983-21252016v29n309rc**

Cuevas-Juárez E, Yuriar-Arrredondo YK, Pío León FJ, Montes-Ávila J, López-Angulo G, Díaz- Camacho PS, Delgado-Vargas F. 2014. Antioxidant and aglucosidase inhibitory properties of soluble melanins from the fruits of *Vitex mollis* Kunth, *Randia echinocarpa* Sessé et Mociño and *Crescentia alata* Kunth. **J Funct Foods** 9: 78 - 88. **https://doi.org/10.1016/j.jff.2014.04.016**

Davis AP, Govaerts R, Bridson DM, Ruhsam M, Moat J, Brummitt NA. 2009. A Global assessment of distribution,

diversity, endemism, and taxonomic effort in the Rubiaceae. **Ann Missouri Bot Gard** 96: 68 - 78. **https://doi.org/10.3417/2006205**

Egan TJ. 2001. Quinoline antimalarials. **Exp Opin Ther Patent** 11: 185 - 209. **https://doi.org/10.1517/13543776.11.2.185**

Farrera, O. 2019. **Conservación y manejo sustentable de las plantas útiles en comunidades zoques del occidente de Chiapas, México**. Thesis, Universidad de Ciencias y Artes de Chiapas, Mexico.

Flores-Camargo FG, Sánchez-Dirzo MG. 2022. **Maximino: Base de datos de plantas útiles de México**. **www.maximinom.org**

Frecska E, Bokor P, Winkelman M. 2016. The therapeutic potentials of Ayahuasca: Possible effects against various diseases of civilization. **Front Pharmacol** 7: 35. **https://doi.org/10.3389/fphar.2016.00035**

Gallardo-Casas CA, Guevara-Balcázar G, Morales-Ramos E, Tadeo-Jiménez Y, Gutiérrez-Flores O, Jiménez-Sánchez N, Valadez-Omaña MT, Valenzuela-Vargas MT, Castillo-Hernández MC. 2012. Ethnobotanic study of *Randia aculeata* (Rubiaceae) in Jamapa, Veracruz, Mexico, and its anti-snake venom effects on mouse tissue**. J Venom Anim Toxins incl Trop Dis** 18: 287 - 394. **https://doi.org/10.1590/S1678-91992012000300006**

Gamboa-Angulo MM, Cristóbal-Alejo J, Medina-Baizabal IL, Chí-Romero F, Méndez-González R, Simá-Polanco P, May-Pat F. 2008. Antifungal properties of selected plants from the Yucatan peninsula, Mexico. **World J Microbiol Biotechnol** 24: 1955 - 1959. **https://doi.org/10.1007/s11274-008-9658-x**

García V. 2016. **Uso y manejo tradicional de los recursos vegetales en comunidades de la mixteca poblana**. Thesis, Benemérita Universidad Autónoma de Puebla, Mexico.

García-González G, Muñoz-Tejada N, Torres-Montúfar A. 2024. Flowers vs. devils: plants used against witchcraft in the urbanized Sonora market, Mexico City. **Bol Latinoam Caribe Plant Med Aromat** 23: 371 - 381. **https://doi.org/10.37360/blacpma.24.23.3.25**

Jasso SN. 2015. **Etnobotánica de plantas medicinales del municipio de Güémez, Tamaulipas, México**. Thesis, Universidad Autónoma de Nuevo León, México.

Juárez-Trujillo N, Monribot-Villanueva JL, Alvarado-Olivarez M, Luna-Solano G, Guerrero-Analco JA, Jiménez-Fernández M. 2018. Phenolic profile and antioxidative properties of pulp and seeds of *Randia monantha* Benth. **Ind Crops Prod** 124: 53 - 58. **https://doi.org/10.1016/j.indcrop.2018.07.052**

Judkevich MD, Salas RM, Gonzalez AM. 2015. Revisión de *Randia* (Rubiaceae) en Argentina, taxonomía y morfoanatomía. **Bol Soc Bot Arg** 50: 607 - 625.

Linares E, Bye R. 2016. **Traditional markets in Mesoamerica: a mosaic of history and traditions**. In: Lira R, Casas A, Blancas J, Ed. Ethnobotany of Mexico, Springer, New York, USA. https://doi.org/10.1007/978-1-4614-6669-7.

López-Aroche U, Salinas-Sánchez DO, Mendoza de Gives P, López-Arellano ME, Liébano-Hernández E, Valladares-Cisneros G, Arias-Ataide DM, Hernández-Velázquez V. 2008. *In vitro* nematicidal effects of medicinal plants from the Sierra de Huautla, Biosphere Reserve, Morelos, Mexico against *Haemonchus contortus* infective larvae. **J Helminthol** 82: 25 - 31. **https://doi.org/10.1017/S0022149X07873627**

Luna-José ADL, Rendón-Aguilar B. 2008. Recursos vegetales útiles en diez comunidades de la Sierra Madre del Sur, Oaxaca, México. **Polibotánica** 26: 193 - 242.

Maldonado Almanza B, Alemán Octaviano AM, Gadea Noguerón R, Rangel Altamirano MG. 2019. **Plantas útiles de la Mixteca baja poblana**. Universidad Autónoma del Estado de Morelos, Cuernavaca, Morelos, México.

Martínez-Ceja A, Romero-Estrada A, Columba-Palomares MC, Hurtado-Díaz I, Álvarez L, Teta-Talixtacta R, Sánchez-Ramos M, Cruz-Sosa Francisco, Bernabé-Antonio A. 2022. Anti-inflammatory, antibacterial and antioxidant activity of leaf and cell cultures extracts of *Randia aculeata* L. and its chemical components by GC-MS. **South Afr J Bot** 144: 206 - 218. **https://doi.org/10.1016/j.sajb.2021.08.036**

Martínez-de la Cruz I, Rubí-Arriaga M, González-Huerta A, Pérez-López D, Franco-Mora O, Castañeda-Vildózola A. 2015. Frutos y semillas comestibles en el Estado de México. **Rev Mex Cienc Agric** 6: 331 - 346.

Martínez-Moreno D, Reyes-Matamoros J, Andrés-Hernández AR, Pérez-Espinosa L. 2016. Flora útil de la comunidad" Rancho El Salado" en Jolalpan, México. **Rev Iberoam Cienc** 3: 1 - 15.

Martínez C. 2015. **Listado etnofloristico de dos localidades del municipio de Tepexi de Rodriguez, Puebla**. Thesis, Benemérita Universidad Autónoma de Puebla, Puebla, Mexico.

Martínez MA, Evangelista V, Basurto F, Mendoza M, Cruz-Rivas A. 2007. Flora útil de los cafetales en la Sierra

Norte de Puebla, México. **Rev Mex Biodiv** 78: 15 - 40. **https://doi.org/10.22201/ib.20078706e.2007.001**

Montes-Avila J, Ojeda-Ayala M, López-Angulo G, Pío-León JF, Díaz-Camacho SP, Ochoa-Terán A, Delgado-Vargas F. 2018. Physicochemical properties and biological activities of melanins from the black-edible fruits *Vitex mollis* and *Randia echinocarpa*. **J Food Meas Charact** 12: 1972 - 1980. **https://doi.org/10.1007/s11694-018-9812-6**

Moreno-Casasola P, Paradowska K. 2009. Especies útiles de la selva baja caducifolia en las dunas costeras del centro de Veracruz. **Maderas y Bosques** 15: 21 - 44.

Nazari AS, Dias SA, da Costa WF, Bersani-Amado CA, Vidotti GJ, de Souza MC, Sarragiotto MH. 2006. Anti-inflammatory and antioxidant activities of *Randia hebecarpa* and major constituents. **Pharm Biol** 44: 7 - 9. **https://doi.org/10.1080/13880200500496504**

Ojeda-Ayala M, Gaxiola-Camacho S, Delgado-Vargas F. 2022. Phytochemical composition and biological activities of the plants of the genus *Randia*. **Bot Sci** 100: 779 - 796. **https://doi.org/10.17129/botsci.3004**

Ojeda-Linares C, Álvarez-Ríos GD, Figueredo-Urbina CJ, Islas LA, Lappe-Oliveras P, Nabhan GP, Torres-García I, Vallejo M, Casas A. 2021. Traditional fermented beverages of Mexico: a biocultural unseen foodscape. **Foods** 10: 2390. **https://doi.org/10.3390/foods10102390**

Pérez GS, Pérez GRM, Pérez-González C, Zavala SMA, Vargas SR. 1993. Cicatrizing activity of *Randia echinocarpa* in gastric ulcers. **Phyton** 54: 157 - 162.

Pérez-Espinosa TP, Castillo-Hernández MC, Valadez-Omaña MT, Gallardo-Casas CA. 2015. Evaluación toxicológica y efecto antinociceptivo en un modelo de dolor visceral del extracto etanólico de *Randia aculeata* (Crucetillo). **Rev Toxicol** 44: 50 - 57.

Pilarski R, Zieliński H, Ciesiołka D, Gulewicz K. 2006. Antioxidant activity of ethanolic and aqueous extracts of *Uncaria tomentosa* (Willd.) DC. **J Ethnopharmacol** 104: 18 - 23. **https://doi.org/10.1016/j.jep.2005.08.046**

Rendon-Aguilar B, Bravo-Avilez D, Bernal-Ramírez LA, García-Mendoza A, Espejo-Serna A, Lopez-Ferrari AR. 2023. **Ethnobotanical science in the clouds: Useful plants of northeastern Oaxaca, Mexico.** In: Casas A, Blancas Vázquez JJ. Ed. Ethnobotany of the Mountain Regions of Mexico. Springer, Cham, New York, USA. **https://doi.org/10.1007/978-3-030-99357-3_16**

Rivera N, Lopez PY, Rojas M, Fortoul TI, Reynada D, Reyes AJ, Rivera E, Beltran HI, Malagon F. 2014. Antimalarial efficacy, cytotoxicity, and genotoxicity of methanolic stem bark extract from *Hintonia latiflora* in a *Plasmodium yoelii* lethal murine malaria model. **Parasitol Res** 113: 1529. **https://doi.org/10.1007/s00436-014-3797-9**

Rodríguez LA, Sánchez Cortés MS, Gordillo Ruiz MC. 2018. Árboles útiles del bosque tropical caducifolio secundario en la Reserva Forestal Villa Allende, Chiapas, México. **Acta Bot Mex** 125: 189 - 214. **https://doi.org/10.21829/abm125.2018.1359**

Salinas-Sánchez D, Arteaga-Najera GL, León-Rivera I, Dorado-Ramírez O, Valladares-Ceniceros Ma. G, Navarro-García VM. 2009. Antimicrobial activity of medicinal plants from the Huautla sierra biosphere reserve in Morelos (México). **Polibotánica** 28: 213 - 225.

Santos-Cervantes ME, Ibarra-Zazueta ME, Loarca-Pina G, Paredes-López O, Delgado-Vargas F. 2007. Antioxidant and antimutagenic activities of *Randia echinocarpa* fruit. **Plant Foods Hum Nutr** 62: 71 - 77. **https://doi.org/10.1007/s11130-007-0044-x**

Sclavo D. 2023. Framing the traditional: counterrevolution and gender in Mexican ethnobotanical research through the 1970s and 1980s. **J Ethnobiol** 43: 262 - 273. **https://doi.org/10.1177/027807712311947**

Serrano-Silvas R. 2013. **Extracción, purificación, caracterización químico-biológica y evaluación in vitro del efecto inmunomodulador del pigmento de la pulpa de Papache (*Randia echinocarpa*)**. Thesis, Universidad Autónoma de Sinaloa, México.

Torres-Schwartz JL, Valadez-Omaña MT, Gallardo-Casas CA. 2018. Efecto de la combinación de un antisuero y el extracto etanólico de *Randia aculeata* (Crucetillo) contra el daño pulmonar que provoca el veneno de *Bothrops asper*. **Rev Toxicol** 56: 22 - 31.

Torres-Montúfar A, Torres-Díaz AN. 2022. Las Rubiáceas de México: ¿Ya está hecho el trabajo? **Bot Sci** 100: 446 - 468. **https://doi.org/10.17129/botsci.2847**

Vargas-Solís R, Pérez-Gutiérrez R. 2002. Diuretic and urolithiatic activities of the aqueous extract of the fruit of *Randia echinocarpa* on rats. **J Ethnopharmacol** 1: 145 - 147. **https://doi.org/10.1016/s0378-8741(02)00091-0**

Vibrans H, Casas A. 2022. Roads traveled and roads ahead: the consolidation of Mexican ethnobotany in the new millennium. An essay. **Bot Sci** 100: 263 - 289. **https://doi.org/10.17129/botsci.3190**

Vidal O, Brusca RC. 2020. Mexico's biocultural diversity in peril. **Rev Biol Trop** 68: 669 - 691. **https://doi.org/10.15517/rbt.v68i2.40115**

Villaseñor JL. 2016. Checklist of the native vascular plants of Mexico. **Rev Mex Biodivers** 87: 559 - 902. **https://doi.org/10.1016/j.rmb.2016.06.017**

Villaseñor JL, Meave JA. 2022. Floristics in Mexico today: insights into a better understanding of biodiversity in a megadiverse country. **Bot Sci** 100: 14 - 33. **https://doi.org/10.17129/botsci.3050**

Zamora CP, Flores Guido JS, Ruenes Morales R. 2009. Flora útil y su manejo en el cono sur del estado de Yucatán, México. **Polibotánica** 28: 227 - 250.

Zepeda Gómez C, Burrola Aguilar C, White Olascoaga L, Rodríguez Soto C. 2017. Especies leñosas útiles de la selva baja caducifolia en la Sierra de Nanchititla, México. **Madera y Bosques** 23: 101 - 119.

Zhang N, Luo M, He L, Yao L. 2020. Chemical composition of essential oil from flower of 'Shanzhizi' (*Gardenia jasminoides* Ellis) and involvement of serotonergic system in its anxiolytic effect. **Molecules** 25: 4702. **https://doi.org/10.3390/molecules25204702**