Chapter 10

Some Mexican Plants Used in Traditional Medicine

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Abstract

In Mexico, there is an area known as semiarid region that is located in northern Mexico, and this region is rich in biodiversity (endemic flora and fauna). In the semiarid region of Mexico are more than 3500 species of plants that have been identified and used as natural alternatives to treat different ailments (digestive ailments, kidney problems, skin conditions, etc.). The use of plants for medicinal purposes was a common practice in Mexico before the arrival of the Spanish in the sixteenth century; although this knowledge was underestimated for a long time, now interest has reemerged in the use of plants as alternative remedies or traditional medicine. It is now known that the medicinal plant capacity is due to its biological properties, which are due to chemical compounds that are synthesized by the plant metabolisms, called phytochemicals. Phytochemicals are bioactive compounds that have important biological properties such as anticancer property, antimicrobial, antiparasitic, antioxidant, and interest in the recovery of these compounds has grown in recent years, in order to find natural alternatives to synthetic drugs, which they are used for different chronic conditions such as cancer.

Keywords: phytochemical, bioactive compounds, medicinal plant, antioxidant

1. Introduction

Mexico has diverse natural ecosystems that allow the development of a wide variety of flora and fauna; one of them is the semiarid ecosystem. Also, in Mexico, herbal medicine goes back beyond pre-Columbian times, representing a natural and inexpensive alternative for health care, having an important role in the system of traditional medicine. In this context, the plants that grow in Mexican semidesert have been used through the years as traditional medicinal agents and that practice and knowledge have been passed down from generation to generation. In

according to data from the World Health Organization (WHO), about 75% of people use herbal medicinal plant extracts for primary health care worldwide.

Therefore, the interest in natural products has increased as a source of new medicines at the industrial and research level, where about 40% of modern drugs in use have been developed from natural products. Since these natural products have a wide structural diversity, mainly small molecules (<2000 Da), which are able to be absorbed and metabolized quickly in the body, called secondary metabolites, its interaction gives biological effects resulting in benefit to health [1]. About 39% of drugs approved between 1983 and 1994 were natural products or their derivatives, including a 60–80% antibacterial and anticancer agents from a natural source. For that reason scientific studies about chemical composition of plants from the Mexican semidesert have been developed, in order to understand and explain the medicinal effects of these plants. Now it is well known that the medicinal effects are due to the presence of phytochemicals with bioactive potential. This chapter provides an overview of the Mexican semidesert endemic plants that have been used in traditional medicine in order to project the opportunities for study and use of natural resources in Mexico.

2. *Jatropha dioica* Sessé (dragon's blood)

One of the plants used in Mexican traditional medicine is a plant called *Jatropha dioica* Sessé [1]. It is a plant native to the Mexican semidesert [2], is a small shrub (50–150 cm), and is commonly known by different names, such as batácora, coatli, dexthi, drago, felondilla, sangregado, and sangregada. In the Mexican semidesert, its most common name is dragon's blood [3] due to the fact that the plant contains a colorless liquid that turns red on contact with air (red-like blood) [2].

This plant grows in dry climates and rocky soils over the mountains; therefore, it is a unique specie of the Mexican semidesert [4, 5].

Dragon's blood has been used in Mexican traditional medicine to treat different diseases or to prevent hair loss. Actually, the stems of the plant are cooked in hot water, and the liquid is applied to the hair after washing [1, 6]. The liquid recovered from the cooking of dragon's blood stems is also used for the treatment of strokes, small wounds, acne, and also for other skin conditions [6, 7].

Also, it has been reported that this plant is useful for strengthening the gums, to keep the teeth in their sockets, acting on the fibers that sustains them [8]. Extracts from this plant have been used as antimicrobial agents. The plant is mainly used as medicinal infusions for the treatment of vaginitis, urethritis, gonorrhea, nephritis, gastroenteritis, conjunctivitis, renal congestion, and local antiseptic. The plant has also been used to treat ulcers and asthma [1].

In addition, there are few reports about the phytochemistry of *J. dioica*. It has been reported that from the root of the plant are extracted and identified terpenes, such as citlalitrione, jatrophone, riolosatrione, and sterols like R-sitosterol [2]. In addition, essential oils, resins, saponins, and alkaloids have been recovered [9].

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The phytochemicals of *J. dioica* have been associated with important biological properties for traditional medicine. It has been reported that *J. dioica* contains secondary metabolites such as polyphenols or tannins, flavonoids, and terpenes, which help the defense mechanisms of the plant [10, 11]. Aguilera-Carbo *et al*. [12] reported the presence of important compounds such as ellagitannins and ellagic acid in the plant. These compounds are relevant because they posses biological activities such as antimicrobial and antioxidant.

Besides, this plant has antitumoral, antimicrobial, and antioxidant properties [13]. However, it has also been reported that the plant seeds produce toxic effects if they are consumed as infusions. The main toxic effects are related to the damage at DNA level in cells; however, it has been demonstrated that such effects can be eliminated if the concentrations used are appropriate to take care of the toxicological aspects in order to preserve the biological effects [1]. Furthermore, Lioglier [14] reported that the use of the seeds of the plant in traditional medicine is not recommended due to toxicity. One of the main medicinal effects is the effect against skin conditions, it has been demonstrated that *J. dioica* control wounds, skin infections, and inflammation.

Another important medicinal effect is the antiviral effect, mainly against influenza type A virus and simplex herpes virus [15]; this is important due to the fact that these two viral diseases are the most common throughout the world. There is no doubt that the anticancer effect is also the most important because it is a common and difficult condition to treat. *J. dioica* extracts have shown anticancer activity against melanoma cells, human hepatocellular carcinoma, and human pharynx carcinoma [16].

All these medicinal effects abovementioned are relevant, and this plant represents an option for treatment for different conditions on human health.

3. *Turnera diffusa* Willd (damiana)

The semiarid region of México has a great diversity of plant species that have been used in traditional medicine; this is the case of *Turnera diffusa* [17]. *T. diffusa* is commonly known as damiana, although it is also known by other names, such as "hierba de la postora," "hierba del venado," and "oreganillo." This plant is widely distributed in the semiarid region of México, mainly in the states of Baja California, Chihuahua, and Coahuila [18]. It is a small wild shrub that measures 60 cm–1 m and grows in rocky soil with dry climate and characteristics of the semiarid México [19]. This plant has been used in traditional Mexican medicine, such as infusions, teas, antiseptic solutions, for the treatment of various disorders. Damiana extracts have medicinal effects against digestive disorders (diarrhea), urinary (infections), and respiratory (expectorant). Damiana also has therapeutic effects against me nstrual and circulatory disorders because the plant has vasodilatory properties [9].

The compounds present in damiana extracts have other beneficial properties for human health; it has been shown that this plant has anxiolytic effects that reduce and prevent depression and its physiological effects [19]. The consumption of damiana infusions prevent diabetes because its hypoglycemic activity [20] and cutaneous application of damiana infusions control the

process of inflammation in wounds [21] and prevent infections caused by microorganisms and parasites [22].

It has been demonstrated that damiana extracts have important medicinal properties. There are studies about the antiulcerogenic effects of this plant, it was demonstrated that due to the presence of damiana bioactive compounds, arbutina, it has an anti-inflammatory activity in tissue samples of cells from the stomach [23]. Other authors have reported that consumption of damiana infusions control and prevent diabetes mellitus and avoid dependence on insulin [24], and damiana infusions control polyuria, polydipsia, and glucosuria.

However, there is scarce information about the content of phytochemicals in this specie; however, it was reported that the specie has some important compounds in it. One of the groups that have been reported to damiana is terpenes; Alcaráz-Meléndez *et al*. [24] determined the proportion of compounds as cineole, alpha-pinene, beta-pinene, thymol, and p-Cymene (0.5–1%). Damiana also contains hydrolysable tannins (4%) [25], flavonoids (0.7%) [26], alkaloids, etc. Some reference compounds in damiana are ar arbutin (flavone) and apigenin (hydroquinone), and they have been reported to be the main bioactive compounds of this plant.

Zhao *et al*. [25] described the presence of uncharacterized compounds in damiana. These compounds were luteolin glycoside, apigenin glucopyranoside, apigenin coumaroylglucoside, syringetin glucopyranoside, and laricitin glucopyranoside. These compounds belong to the group of flavones and flavonoids that have biological activities such as anti-inflammatory, antibacterial, and antioxidant [27, 28].

The compounds identified in damiana possess biological activities that can improve the medicinal effects. Damiana has compounds such as flavonoids, polyphenols, and terpenes [25], and these compounds have antioxidant activity, which inhibits the activity of free radicals that cause damage to health by increasing the risk of cancer [29].

On the other hand, compounds of damiana have other activities that promote human health. These compounds have antimutagenic, antitumor, and anticancer activity [30, 31] against carcinogenic compounds such as pyrene-7,8-dio-9,10-epoxide (BPDE); therefore, damiana represents an option for prevention and treatment of cellular disorders.

The antiviral property of damiana compounds has been studied *in vitro*. Polyphenols and flavonoids inhibit the replication of human influenza type A virus [32], and these compounds inhibit the replication of human immunodeficiency virus (HIV) also, blocking the action of some specific enzymes.

The compounds that are present in damiana can also prevent infections caused by pathogenic microorganisms because these compounds have antimicrobial activity. Polyphenols and flavonoids have been evaluated against pathogens such as *Salmonella tiphy, Salmonella pyogenes, and Pseudomonas aeruginosa* [33, 34].

There is scarce information about the compounds present in damiana and its medicinal and pharmacological effects, this represents an opportunity to generate knowledge and expand the application field of the plant for the treatment of relevant conditions for human health.

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4. *Larrea tridentata* (Creosote bush)

Larrea tridentata (Creosote bush) is known as "gobernadora," "hediondilla," or "guamis" in Mexico. It is abundant in the desert areas of the North Mexican states such as San Luis Potosi, Coahuila, Chihuahua, Durango, Sonora, and Zacatecas [35]. Creosote bush is a widespread perennial flowering bush thriving in the deserts of Mexico and is an important plant with a long history of medicinal use for different pathologies [36].

Creosote bush is widely distributed in nature, and it is a notable source of natural products with biological activities. The plant resin has been reported to contain a total of 19 flavonoid aglycones, some flavonoid glycosides, halogenic alkaloids, several lignans, and a large quantity of essential oils [35]. The leaves are shiny with a thick resinous coating and discharge a strong odor and have a sour flavor. Along with these compounds, Creosote bush extracts contain saponins, monoterpenes, sterols, tannins such as gallic acid (GA) and the antioxidant nordihydroguaiaretic acid (NDGA). All these compounds, especially NDGA and other phenols of the leaf surface, function as antimicrobial agents and as protection against herbivores, UV radiation, and water loss [37].

The medicinal use of Creosote bush is through extracts and preparations from this plant to treat a wide variety of disorders including skin sores, fungal and microbial infections, diabetes, kidney and gallbladder stones, arthritis, venereal diseases, cold virus infections, sinusitis, rheumatism, and cancer [38].

Particularly, NDGA and tannins has been identified to have a significant role in cancer therapy including different models of carcinogenesis such as lung, breast, skin, prostate, and esophageal cancers, demonstrated the capacity of these compounds to inhibit the growth and proliferation of several human cancer types [39]. In addition, NDGA has been found to be a potent antiviral and inhibitor of viruses such as herpes simplex virus (HSV), human papilloma virus (HPV), human immunodeficiency virus (HIV-1), and influenza virus [40]. NDGA suppresses regulated transcription DNA-binding site that plays an active role in the virus gene expression, leading to inhibition of gene expression from the early promoters and thus interferes with proteins function and transcription [41].

5. Cancer and bioactive compounds

Currently, some authors mention that the incidence of cancer is significantly lower in the people whose diet consists mainly of fruits, vegetables, and herbal teas, than people whose food consumption is mainly animal products. This has led researchers to search for natural anticancer compounds obtained from semidesert plants or foods with high phytochemicals and polyphenols [42].

Hopeful polyphenols are ellagic acid and gallic acid, among other polyphenols, that could be considered as alternative treatments against cancer. Some studies with GA obtained from various foods and plants have shown that this compound has anticancer activity against several types of cancer interfering in some stages of tumor growth, suppressing angiogenesis

and metastasis in some tumor lines of lung, prostate, bladder, brain, kidney, and leukemia [43, 44]. Moreover, GA inhibits metastasis of P815 liver cells, induced apoptosis in DU145 and 22Rv1 cell prostate cancer in athymic mice, and reduced viability of U251n and U87 human cells glioma after 24 h of treatment [45, 46]. In contrast, for PWR-1E prostate epithelial cells that are not cancerous have no significant change, indicating that GA has a selective toxicity to cancer cells of prostate cancer. Besides, gallic acid treatment was found to diminish the cellular oxidative stress by decreasing ROS (Reactive Oxygen Species) production and hepatocarcinoma cell proliferation and also decrease hepatitis C virus (HCV) replication in Huh7 replicon cells decreasing the expression of nonstructural HCV proteins of the virus [47].

Moreover, the molecular mechanisms underlying the anticancer activities of Creosote bush lignans and antioxidants have been shown to involve wide cancer pathways. The specific inhibition of the Sp1 oncogenic factor (Sp1-dependent gene coding for cyclin-dependent kinase) promotes apoptosis by inhibiting expression of the surviving gene with these plant lignans and methylated NDGA derivatives and have been shown to induce a decrease in the proliferation of breast cancer cells [48, 49].

The mechanisms that Creosote bush compounds are antitumorigenic and antiproliferative are still being elucidated. Other authors carrying out *in vivo* studies revealed that NDGA suppresses tumor growth by inhibiting metabolic enzymes as well as RTK phosphorylation, which is overexpressed in certain cancer cells [50]. Also, several studies demonstrated that NDGA and some tannins have the property of inhibiting cancer cell growth *in vitro* in human tumor cell xenografts in mice [51].

Furthermore, the demonstration of the hypothesis that antioxidants from foods and plants can execute beneficial health effects, including acting as inducers of mechanisms relating to antioxidant defense [52], longevity [53], cell maintenance, and DNA repair [54].

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