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Review article

A Brief Review of *Verbesina crocata* (Cav.) Less., a Scantly Studied Medicinal Plant

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Abstract

Although *Verbesina crocata* (Cav.) Less. is commonly used in Mexico as a medicinal plant to treat numerous disorders (a tradition dating back to pre-Hispanic times), scant scientific evidence exists on its pharmacological activity. The current review compiles information on the botanical characteristics, traditional medicinal use, and scientific evidence of the pharmacological effects of *V. crocata* with the aim of orienting future research. This narrative review searched for information on *V. crocata* with the key words "*Verbesina crocata*" and its local name "Capitaneja" from the following databases: PubMed, Scopus, EBSCO, SciELO, ScienceDirect, and Google Scholar. Few studies were found about the therapeutic effects of *V. crocata* in experimental animal models. Empirical knowledge of the effects of preparations predominated over scientific evidence. Among the diverse medicinal applications of *V. crocata* in Mexico, only its wound healing, antidiabetic, and diuretic activity have been tested scientifically. Little is known about the active constituents of the plant and less about their mechanisms of action or toxicity. Terpenes/steroids, glycosides, alkaloids, coumarins, quinones, saponins, and tannins have been identified as potentially responsible for therapeutic effects. The information available on *V. crocata* is predominantly empirical. The few scientific reports on its biological activity have confirmed the efficacy of the plant as a wound healing agent, antidiabetic, and diuretic. It is necessary to properly characterize the active principles and carry out evaluations of their mechanisms of action and toxicity.

Keywords: diuretics; hypoglycemic agents; Mexico; traditional medicine; wound healing

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Introduction

A great variety of medicinal plants in Mexico are easily obtained in markets, and they are used by a broad section of the population to treat numerous disorders. This custom is expected to continue for a long time [1]. Among the most popular therapeutic treatments with medicinal plants in Mexico are those involving *Verbesina crocata* (Cav.) Less., most often used to treat exantema and kidney disorders, as well as to clean the womb after childbirth [2]. *Verbesina crocata* has been mentioned in the Florentine Codex, which is a written record of pre-Hispanic customs in Mexico [3].

Despite the popularity of *V. crocata* in Mexican traditional medicine, the information about this species is scattered in many articles and there are few scientific reports on its therapeutic effects or the compounds responsible for the activities. The current review aimed to make a compilation, the first to our knowledge, of the botanical characteristics of *V. crocata*, its empirical uses in traditional medicine, and the scientific evidence

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of its pharmacological activity and main active principles of the related effects. The purpose of gathering such data is to orient future research on the subject.

Methods

This narrative review was compiled by means of a bibliographic search of the scientific literature related to the plant *V. crocata*. The search was conducted with the key words "*Verbesina crocata*" and its local name "Capitaneja" (without any filters) in the following databases: PubMed, Scopus, EBSCO, SciELO, ScienceDirect, and Google Scholar. All studies published in English or Spanish up to August of 2022 were taken into account. There was no publication date restriction in order to include all the evidence published to date. Additionally, pertinent references cited in such articles were considered. Finally, information on the plant was sought from the official web pages and documents of the government of Mexico.

Results

Information about botanical characteristics of *V. crocata* was obtained through the website of the National Commission for the Knowledge and Use of Biodiversity (CONABIO, for its acronym in Spanish) [4], a governmental and official commission of Mexico, and a scientific study. Regarding therapeutic effects, a total of 11 articles were identified. Of these, only 4 studies had a scientific methodological approach to demonstrate the therapeutic effects of *V. crocata* in experimental animal models. Most of the studies found (7 articles) were about empirical knowledge of the effects of plant preparations.

Characteristics of *V. crocata*

Taxonomy of *V. crocata*

Verbesina crocata (synonyms: *Bidens crocata* Cav., *Spilanthes crocata* Sims, and *Platypteris crocata* HBK), also widely known by its local names "Capitaneja" and "Arnica capitaneja", is endemic to Mexico. It is frequently confused with other species of the genus because its common name is often indiscriminately applied to them [4]. The confusion occurs in the general population that utilizes this plant and among the scientific community that investigates it. In one report, for example, "Capitaneja" was employed to denote *Verbesina sphaerocephala* [5]. Consequently, it is important to refer to *V. crocata* by its scientific name (or synonyms) and be aware of its complete taxonomical classification (Table 1).

Table 1. Taxonomical classification of *Verbesina crocata* [4]

Taxonomical category	Taxon
Kingdom	Plantae
Clade	Tracheophyta (vascular plants)
Clade	Spermatophyta (seed plants)
Clade	Angiosperms (flowering plants)
Clade	Eudicots
Clade	Asterids
Order	Asterales
Family	Asteraceae
Genus	*Verbesina* L.
Species	*Verbesina crocata*

Description of *V. crocata*

Verbesina crocata is a clambering shrub, 1–8 m tall. Stems are four winged; each wing 1–4 mm broad, branches opposite, with soft and thick hairs. Leaves are mainly opposite, 8–16 cm × 5–13 cm, oval to deltoid in outline, with many erect and rigid hairs, 3-7 lobed, blade acuminate, base truncate, with lateral lobes 1.5–5 cm long, oblong to deltoid. Inflorescence is a capitulescence with 1–5 discoid heads, peduncle up to 20 cm long, with 100–200 orange tubular flowers, each one 9-10 mm long, tubes 1–1.7 mm long, anthers 2.5–2.7 mm long, yellow to orange, style branches 2–2.7 mm long. Fruit is an achene, obovate, 5.5–8 mm × 3.5–4.5 mm, glabrous, dry grey (Figure 1) [4].

Figure 1. Specimen of *Verbesina crocata* growing in the State of Morelos, Mexico (photo taken by authors)

A study on the foliar and stem anatomy of *V. crocata* reported the following observations: epidermis with uniseriate trichomes constituted by 2–5 conical cells, normally with 1(-3) globose-cylindrical basal cells. Vascular bundles more numerous in the midvein and petiole in comparison with other species in the genus *Verbesina*. Small secretory glands are also present in the midvein and petiole, but they are scant on the leaf compared with other *Verbesina* species. They are barely distinguishable on the leaf blade [6].

Distribution and ecology

Verbesina crocata is endemic to Mexico, being reported in the States of Chiapas, Durango, Guerrero, Jalisco, Mexico State, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, Veracruz and Zacatecas. It grows at a wide altitudinal range, from 50 to 2010 m above sea level, frequently in tropical deciduous forests, slopes, shrub lands, riparian forests, and disturbed areas such as deforested lands or on the roadside. It flowers all year long, but the fruits are mainly produced during the rainy season (from May to September). This plant is not considered as an endangered species by the Mexican government [4].

Uses of *V. crocata* in traditional medicine

The diverse applications of *V. crocata* in Mexican traditional medicine vary from one state to another (Figure 2) and include treatments for gynecological [2,7,8], skin [2,8], kidney [2,9], and intestinal [3] disorders. Most preparations are made from the aerial parts of the plant and are generally part of traditional medicine in states where it grows. Regarding gynecological disorders, it has been reported that in the State of Puebla, the aerial parts are boiled in water, which is then used to wash the hips of women during childbirth [8], and that the leaves and roots are utilized to clean the womb after childbirth [2]. In another state, Morelos, the leaves are employed during childbirth [7], although the form of application was unspecified in the article.

For skin disorders, people in Puebla treat rashes with the leaves and stems of *V. crocata* [2] and bathe wounds and burns with a tea made of the aerial parts [8]. Also in Puebla, the leaves and stems of this plant are involved in treating kidney disorders [2]. In Morelos, the aerial parts are prepared in infusions or smoothies to relieve kidney pain and cure infections, urolithiasis, anuria, and oliguria [9]. *Verbesina crocata* is also used in Mexican states where it does not grow. For example, patients in Mexico City attending the Pain and Palliative Care Clinic of General Hospital of Mexico, drink infusions of this plant to seek relief from diabetic neuropathic pain [10]. Additional miscellaneous uses of *V. crocata* have been described such as teas or infusions prepared from the aerial parts of the plant to relieve throat pain and suppress coughing [8,9]. The leaves and stems are employed to relieve colic in Morelos [11], while in Morelos and Guerrero the leaves and flowers are boiled in water with cinnamon and "Piloncillo" (a Mexican preparation similar to brown sugar), and an alcoholic beverage is subsequently added to treat liver and respiratory disorders, reconstitute the respiratory system, eliminate internal tumors, and relieve pain from contusions [12].

Figure 2. Distribution and uses of *Verbesina crocata* in Mexico; the states in which the plant grows and is utilized in traditional medicine are portrayed in red, those where the plant only grows in green, and the ones where it is only applied for treatments in blue.

Scientific evidence on the therapeutic effects of *V. crocata* and its active principles

In the databases, scant scientific evidence was found in relation to *V. crocata*. Only three original studies described the pharmacological activity of this plant [6,9,13], while one review article compiled information on plants with antidiabetic activity and their active principles [14].

Wound healing activity

Only one report, on a pharmacognostic study by García-Bores et al., described a scientific evaluation of the wound healing effect of *V. crocata* [6]. The methanol extract obtained from

the aerial parts of *V. crocata* contained terpenes/steroids, alkaloids, phenols, and glycosides, but these compounds were not characterized. The extract was incorporated into Vaseline® (5% p/p). An incision wound was made on the back of mice (after having been shaven) and the ointment was applied every 24 h for 14 days. The rate of healing was faster and the resistance to tensile strength to open the wound was greater with the extract compared to the positive control treated with Recoveron® and the negative untreated control. The histological results showed that the methanol extract generated a better reconstitution of the cell order in the skin, leaving a small scar with normal epithelialization and no evidence of inflammatory processes. The authors suggested the need for future research to isolate and study the active principles responsible for the healing effect.

Antidiabetic activity

Two scientific reports have been published on the antidiabetic use of *V. crocata* in traditional medicine. One of them detected a slight antidiabetic effect of the extract of *V. crocata* at a dose of 50 g/250 mL of water administered orally or intraperitoneally to mice with alloxan-induced diabetes. However, the active principles responsible for the therapeutic effect were not identified [13].

On the other hand, a review of plants with antidiabetic activity described the results of a preparation based on leaves and flowers of *V. crocata* administered orally and intraperitoneally. Antidiabetic activity was found in a model of alloxan-induced diabetes. This pharmacological activity was attributed to daucosterol, lupeol, lupeol acetate, and galegine as active principles [14]. The antidiabetic effect of all these active principles has been previously documented, but as extracts from plants other than *V. crocata* [15–18]. The toxicity of *V. crocata* is considered probable by the authors of the review article [14], possibly due to the presence of galegine, which has been identified as toxic in other species of the *Verbesina* genus [19].

Diuretic activity

There is only one report with scientific evidence of the diuretic activity of *V. crocata*. Diuretic effects were displayed by aqueous extracts containing fresh plant material prepared in a smoothie, and by decoctions of the aerial parts of the plant. These preparations are commonly employed by the habitants of the community of Tequesquitengo (State of Morelos) for the treatment of kidney disorders. When the preparations were administered to rats, the smoothie mixture with 200 mg/Kg and 400 mg/Kg as well as a decoction of 100 mg/Kg proved to increase potassium clearance to a similar degree as the positive control furosemide. The decoction of 100 mg/Kg enhanced sodium clearance and excretion and the smoothie with 400 mg/Kg produced a greater glomerular filtration rate and excretion of potassium, in both cases comparable to the effect provided by the positive control. Since none of the preparations showed signs of toxicity, the authors suggested that aqueous extracts of *V. crocata* could be utilized safely at the doses tested. The preparations were found to contain alkaloids, coumarins, quinones (anthraquinones), saponins (steroidal saponins) and tannins (phenolic compounds), although these were not characterized [9].

Conclusion

The present review is the first publication, as far as we are aware, with an organized and complete compilation of botanical and ethnopharmacological information on *V. crocata* as well as a summary of results from scientific studies that have tested the pharmacological activity of the extracts of this plant on experimental animal models. Different preparations of *V. crocata*, mainly from the aerial parts of the plant, are widely used in Mexican traditional medicine to treat numerous disorders. However, empirical knowledge of the effects of preparations predominates over scientific evidence.

Scant reports exist on the therapeutic effects of *V. crocata* in experimental animal models. Furthermore, little is known about the active principles responsible for such effects, the mechanisms of action, or toxicity. Despite their limited number, all scientific studies on the plant have confirmed its efficacy, which justifies the use of *V. crocata* in traditional medicine.

Some of the articles on the pharmacological activity and phytochemical analysis were published less than 5 years ago, indicative of the current interest in the plant. Importantly, *V. crocata* is not an endangered species. Hence, there is a good opportunity to investigate the

preparations from the plant in greater detail with the aim of examining the therapeutic impact proposed by traditional medicine. In the event of continuing to find positive results, the relevant pharmaceutical products should be elaborated.

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Author contributions

Ivo Heyerdahl-Viau contributed in bibliographic search, methodology, the writing of the first draft of the manuscript, review and editing of the manuscript and data analysis; Juan Manuel Martínez-Núñez was involved in conceptualization, methodology, and design of the study, review and editing of the manuscript and interpretation of the results; Rebeca Córdova-Moreno contributed in validation of the studies included, visualization of the tables and figures, review and editing of the manuscript; Francisco López-Naranjo contributed in conceptualization of the study, administration of the project, supervision of the study, review and editing of the manuscript; Ariana Urbina-Pastrana was involved in bibliographic search and editing of tables and figures. All the authors read and approved the final version of the manuscript.

Declaration of interests

The authors declare that there is no conflict of interests.

References

[1] García-Alvarado JS, Verde-Star MJ, Heredia NL. Traditional uses and scientific knowledge of medicinal plants from Mexico and Central America. *J Herbs Spices Med Plants*. 2001; 8(2-3): 37–89.

[2] Martínez-Moreno D, Reyes-Matamoros J, Andrés-Hernández AR, Pérez-Espinosa L. Flora útil de la comunidad "Rancho El Salado" en Jolalpan, México [Useful flora of the "Rancho El Salado" community in Jolalpan, Mexico]. *Rev Iberoam Cienc*. 2016; 3(4): 1–15.

[3] Ortega-Cala LL, Monroy-Ortiz C, Monroy-Martínez R, Colín-Bahena H, Flores-Franco G, Luna-Cavazos M, Monroy-Ortiz R. Medicinal plants used for diseases of the digestive system in Tetela del Volcan, State of Morelos, Mexico. *Bol Latinoam Caribe Plantas Med Aromat.* 2019; 18(2): 106–129.

[4] Vibrans H. Malezas de México [Weeds of Mexico], *Verbesina crocata* (Cav.) Less. Comisión Nacional Para El Conocimiento y Uso De La Biodiversidad, México. [National Commission for the Knowledge and Use of Biodiversity, Mexico]. [Accessed 2022 August 15]. Available from: http://www.conabio.gob.mx/malezasdemexico/asteraceae/verbesina-crocata/fichas/ficha.htm.

[5] Velasco-Ramírez AP, Velasco-Ramírez SF, Velasco-Ramírez A. Use in traditional medicine of *Verbesina sphaerocephala* A. Gray (Asteraceae) in the community of San Martin de las Flores, Jalisco, Mexico. *Bol Latinoam Caribe Plantas Med Aromat.* 2019; 18(2): 144–154.

[6] García-Bores AM, Álvarez-Santos N, López-Villafranco ME, Jácquez-Ríos MP, Aguilar-Rodríguez S, Grego-Valencia D, Espinosa-González AM, Estrella-Parra EA, Hernández-Delgado CT, Serrano-Parrales R, González-Valle MR, Benítez-Flores JC. *Verbesina crocata*: a pharmacognostic study for the treatment of wound healing. *Saudi J Biol Sci*. 2020; 27(11): 3113–3124.

[7] Monroy R, Ayala I. Importancia del conocimiento etnobotánico frente al proceso de urbanización. [Importance of ethnobotanical knowledge in the face of the urbanization process]. *Etnobiología*. 2003; 3(1): 79–92.

[8] Canales M, Hernández T, Caballero J, Romo De Vivar A, Avila G, Duran A, Lira R. Informant consensus factor and antibacterial activity of the medicinal plants used by the people of San Rafael Coxcatlán, Puebla, México. *J Ethnopharmacol*. 2005; 97(3): 429–439.

[9] Salazar-Gómez A, Pablo-Pérez SS, Estévez-Carmona MM, Meléndez-Camargo ME. Diuretic activity of aqueous extract and smoothie preparation of *Verbesina crocata* in rat. *Bangladesh J Pharmacol*. 2018; 13(3): 236–240.

[10] Barragán-Solís A. The practice of self-care by phytotherapy in a group of Mexican families. *Arch Med Fam*. 2006; 8(3): 150–162.

[11] Waizel-Bucay J, Waizel-Haiat S. Antitussive plants used in Mexican traditional medicine. *Pharmacogn Rev*. 2009; 3(5): 22–36.
[12] Arenas FS. Etnobotánica y usos potenciales del Cirián (*Crescentia alata*, HBK) en el estado de Morelos. [Ethnobotany and potential uses of Cirián (*Crescentia alata*, HBK) in the state of Morelos]. *Polibotánica*. 2004; 18: 13–31.
[13] Pérez RM, Ocegueda ZA, Muñoz JL, Avila JG, Morrow WW. A study of the hypoglucemic effect of some Mexican plants. *J Ethnopharmacol*. 1984; 12(3): 253–262.
[14] Marles RJ, Farnsworth NR. Antidiabetic plants and their active constituents. *Phytomedicine*. 1995; 2(2): 137–189.
[15] Gu Y, Yang X, Shang C, Thao TTP, Koyama T. Inhibitory properties of saponin from *Eleocharis dulcis* peel against α-glucosidase. *RSC Adv*. 2021; 11(25): 15400–15409.
[16] Gupta R, Sharma AK, Sharma MC, Dobhal MP, Gupta RS. Evaluation of antidiabetic and antioxidant potential of lupeol in experimental hyperglycaemia. *Nat Prod Res*. 2021; 26(12): 1125–1129.
[17] Fred-Jaiyesimi AA, Ibukunoluwa BB. Lupeol acetate from *Macaranga barteri* Müll-Arg leaf lowers blood glucose level in alloxan induced diabetic rats. *Nig Q J Hosp Med*. 2016; 26(1): 368–371.
[18] Neef H, Declercq P, Laekeman G. Hypoglycaemic activity of selected European plants. *Phytother Res*. 1995; 9(1): 45–48.
[19] Oelrichs PB, Vallely PJ, MacLeod JK, Lewis IAS. Isolation of galegine from *Verbesina enceloiodes*. *J Nat Prod*. 1981; 44(6): 754–755.

Abbreviations

There are no abbreviations to declare.