



Medical Anthropology

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The Ethnobotany of Gastrointestinal Disorders: Mexican Asteraceae

Gastrointestinal disorders are commonly treated with herbal medicines in a wide variety of cultures. The plant family Asteraceae

(Compositae) has contributed among the largest number of plants to the pharmacopoeias of many cultures including those of Mexico. In this review, based on the recent work of Heinrich et al. (1998), we will examine the wide array of species and natural products from this family that are useful in the treatment of gastrointestinal disorders that have afflicted the inhabitants of rural Mexico and continue to afflict people all over the world.

Chemical Compounds

Sesquiterpene Lactones

Sesquiterpene lactones (SQLs) are a large and diverse group of biologically active plant constituents that have been reported from 10 families of flowering plants; however, the greatest number are derived from the Asteraceae, with over 3000 reported structures. SQLs are commonly present in large quantities (>2% dry wt of leaves); these SQLs are usually comparatively nontoxic but have an intensely bitter taste that presumably deters herbivores. Common properties of many of the pharmacologically active SQLs are anti-inflammatory effects and a stimulation of smooth muscle contractions. Both of these properties could explain the popularity of SQL-containing herbal remedies to treat gastrointestinal distress.

Plants containing SQLs have been used as herbal remedies for GI disorders in different cultures. In Argentina, leaves of *Artemisia douglasiana* have been used to prepare an infusion called "matico" that is used to treat peptic ulcers. Antiulcerogenic activity is likely related to the induction of endogenous prostaglandin release.

Polyacetylenes

The polyacetylenes are a large group of compounds that have been reported in numerous species of the Asteraceae, Apiaceae, Campanulaceae and sporadically in other plant families. The polyacetylenes are most often found in the root tissue but are also reported at lower concentrations in the leaf tissue. The polyacetylene compounds most frequently reported from the Asteraceae of Mexico include trideca-ene-pentayne and the epoxides, epoxisulfones, dithiins, and polythiophenes derived from this compound. The dithin compounds are also called thiarubrine compounds because of the intense red color. Laboratory studies have demonstrated that the thiarubrine compounds have extremely potent cytotoxic, nematocidal, and fungicidal properties. Falcarinol, a linear polyacetylenic compound found in *Panax ginseng*, a plant used extensively in East Asia for medicinal purposes, has been investigated and demonstrates antimicrobial, antifungal, and antibacterial

activities at 6-200 ppm. A very similar compound, dehydrofalcarinone, occurs in many of the Asteraceae of Mexico.

Plant Summaries

Achillea

The *Achillea* genus is distributed in temperate regions of the Northern Hemisphere, especially in Europe and Asia. *Achillea millefolium* is a species frequently used in Europe and America alike. Many species of this genus are rich in essential oil, SQLs, and flavonoids.

In the Florentine Codex, *A. millefolium* L. (Anthemidae) or Yarrow (Engl.) is listed as an internal remedy for cough and overeating. Hernandez describes the sap as diuretic and emetic. The plant was used to relieve stomach pain and flatulence. During this century it has been used as bitter tonic for colic of the stomach. Twenty grams of the leaves and flowers are used as an infusion against hemorrhage.

In vitro inhibition of cyclooxygenase and 5-lipoxygenase by alkamides isolated from *Achillea nana* L. and *Achillea ageratifolia* has been reported. These are the key enzymes of the two major pathways of arachidonic acid metabolism and are thus antiinflammatory agents. Cirsiolol, a flavone isolated from *Achillea fragrantissima*, caused a concentration-dependent relaxation of rat isolated ileum. It is thought that cirsiolol interferes with calcium channels and thus inhibits calcium influx from the extracellular compartment.

Artemisia

The genus *Artemisia* contains more than 200 species and has been selected for remedies by cultures throughout the world for its medicinal properties. The reported active constituents of the genus include all the types of common natural products of the Asteraceae: SQLs, polyacetylenes, flavonoids, essential oils (monoterpenes), diterpenes, triterpenes, and coumarins.

Artemisia ludoviciana Nutt. spp. *mexicana* Nutt (Anthemidae)/Wormweed (Engl.) is used for flatulence, colic, or intestinal pain. The Florentine Codex prescribes it to clean urine. Iztauhyatl, together with *Tagetes lucida* (yahuatli), was closely associated with the Aztec rain god, Tlaloc, and had several functions in medicine and ritual because of it.

Mexicans generally use the infusion as a bitter stimulant and the powdered flowers as a vermifuge and stimulant. Because of its spasmolytic properties, the aerial parts are popular for colic. Lack of appetite, stomach ache and parasites, stomach and liver infections are all applications for this plant. In the market of Sonora the plant is sold for the treatment of dysentery and vomiting. The flowers are used as tea for colic, dysentery, diarrhea, indigestion, pain, and stomach aches.

Several aromatic components have been isolated from the essential oil including camphor and borneol. Also monoterpenes and sesquiterpenes (germacranolides, eudesmanolides, guaianolides, and seco-guaianolides) have been isolated. Two

flavonoids (eupatilin and jaceosidin) have been isolated as well. The ethanolic extraction is a potent inhibitor of antiinflammatory transcription factor. Four flavonols isolated from *Artemisia abrotanum* reportedly possess spasmolytic activity.

7-O-methylerythrodioleol, a flavone isolated from the aerial parts of *Artemisia monosperma*, shows relaxant effects on various isolated smooth muscle preparations. The inhibition of contraction induced by known therapeutic agents such as acetylcholine and oxytocin are consistent with the use of this plant in the treatment of certain gastrointestinal disorders.

Artemisia tridentata is frequently used as an antihelmintic, antiseptic, and analgesic. It is also known as *chamiso hediondo* (stinking sagebrush). Many of the compounds identified in this species have notable pharmacological activities, particularly the monoterpenes, SQLs, coumarins, and flavonoids.

Santonin, a potent antihelmintic, is used to treat ascariasis and oxyuriasis. It acts on the ganglion cells of the worm to induce paralysis so that the parasite can be eliminated via the feces. Another SQL with antihelmintic properties is artemisin. Several monoterpenes found in *A. tridentata* have CNS-stimulatory effects (including camphor, cineole, and thujone). Thujone, even when consumed in small doses, can cause convulsions and death as a result of its psychomimetic effects.

Flavones are known to function by at least four physiological mechanisms. They can bind to enzymes and cell membranes and complex heavy metal ions, participate in the electron transfer of enzyme systems, and exhibit free radical scavenging activity. The antiinflammatory activity of *A. tridentata* may result from the flavones present (luteolin, quercetin, and kaempferol).

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Baccharis

Baccharis is a large, strictly American genus with approximately 350 species. In the region of Veracruz, Mexico, *Baccharis conferta* is used to treat stomach aches. It is also recommended for using as a laxative and for stimulating urination. Tea made from the leaves is taken to lose weight. The green leaves/leafy branches of *Baccharis salicifolia* are applied externally as a remedy for inflammation, diarrhea, and dysentery.

Baccharis serraefolia is a popular form of treatment for various gastrointestinal illnesses with the Tzeltal and Tzotzil of Chiapas. An infusion prepared from the leaves of *Baccharis multiflora*, *Baccharis* spp. is said to be effective against catarrhs and was used for urinary problems in 19th century Mexico. Berlin and Berlin list it as one of the most popular Tzeltal and Tzotzil remedies for gastrointestinal disorders. They also mention *Baccharis vaccinioides* as another one of the most popular remedies from Chiapas for gastrointestinal disorders.

B. salicifolia is rich in essential oil-containing monoterpenes (alpha-phellandrene is the main component), sesquiterpenes (with germacrene D, bicyclogermacrene and delta-cadiene as the main products), and numerous monooxygenated sesquiterpenes. Typical for the genus are also germacrene-type sesquiterpenoids, diterpenes, clerodanes, and labdanes. The extract of *B. glutinosa* is active against *Staphylococcus aureus*, *Bacillus subtilis*, and *Streptococcus faecalis*.

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Elephantopus

This tropical genus is particularly well known because one species, *Elephantopus scaber*, is now a widely distributed invasive herb in many countries. There are approximately one dozen species of these herbaceous perennials in North and South America.

A preparation made from the roots is taken as a remedy for colic; the whole plant helps against diarrhea. *E. scaber* has been used to cause diuresis and antipyresis and to eliminate bladder stones.

Helenium

This American genus has yielded several ornamental plants (e.g. *Helenium autumnale*) but is also known for its toxic effects on herbivores. The *Helenium* genus contains about 40 species of annual and perennial herbs. *Helenium mexicanum* (syn.: *Gomphrena decumbens*, *Heliantheae*)/Sneezeweed (EngL)/Ueuei itzontecón (Nahuatl) *Helenium mexicanum* is taken orally if a person is very sick or to treat a stomach ache, faint heart beat, throbbing temples, quivering nerves, or fever.

Packera

This small genus is closely related to the genus *Senecio* (ragworts), from which it was recently separated. The *Packera* genus contains biologically active pyrrolizidine alkaloids.

The whole plant *Packera candidissima* is used as tea for kidney ailments; as a general medicine; and to cure sores, ulcers, and vaginal ailments. Similar uses are reported for *Packera bellidifolia*. The fresh plant is also ground with olive oil and applied as a poultice for boils, tumors, and infections.

The aerial parts of *P. candidissima* yielded four pyrrolizidine alkaloids (PAs): senecionine, integerrimine, retrorsine, and usaramine. The roots yielded senecionine and integerrimine, as well as senkirkine and two unidentified PAs. The aerial parts have 0.06% alkaloids, the roots 0.33%. Additionally, two furanoerimophilane-type sesquiterpenes were isolated. Another species of this genus yielded monoterpene lactones and quinones.

Parthenium

Parthenium is a small genus of approximately 16 species of shrubs, herbaceous perennials and annuals. A well-known species of this genus is guayule (*Parthenium argentatum*), which is considered an alternative source for rubber and which was an emergency rubber during the Second World War.

P. hysterophorus is used medicinally by many indigenous and mestizo groups of Mexico. It is used as a remedy for malaria, for neuralgia, and as a vermifuge. It is employed by the Mixe Indians in the form of baths to cure fever and body pain, and by the Huastec to treat sores, muscular aches, epilepsy, and fever.

The species is rich in SQLs; parthenin is the main compound. Parthenin, the main SQL of *P. hysterophorus*, was shown to possess *in vitro* and *in vivo* (hepatic amoebiasis in hamsters) amoebicidal activity and is as effective as metronidazole.

Tithonia

Tithonia is a small genus of less than 10 species. The Mexican and Central American genus *Tithonia* has yielded some ornamental plants (e.g. *Tithonia rotundifolia*), and at least one species, *Tithonia diversifolia*, is now a pantropically distributed bad weed.

T. diversifolia is one of the most frequently seen plants in gardens of the tropical areas of Mexico and seems to be an important, but ethnobotanically little known, medicinal plant in these regions. With the Lowland Mixe it is used orally to treat

malaria and other forms of fever and topically to treat hematomas and muscular cramps. It is also used as a liniment in Yucatan. These uses may result from the similarity of the flower heads of this species to the ones of European arnica (*Arnica montana* L.). This assumption is corroborated by its popular names: Arnica de la montana and arnica. Berlin & Berlin list it as an important remedy for gastrointestinal complaints and it is cited as an anti-inflammatory and as treatment for wounds and skin eruptions.

The genus is rich in SQLs. A large number of other SQLs have been found, especially for *T. diversifolia*.

Conclusion

Given its long and rich history of use in Mexico, the Asteraceae family is an especially promising one for future ethnobotanical studies. The number of plant species of this family in Mexico and the Southwest is in the thousands, and each species undoubtedly contains hundreds of untested compounds with biological activity. While this review focused on the ethnobotanical applications of this plant for gastrointestinal disorders, many additional studies point to traditional uses for heart disease, cancer, neurological conditions, and skin conditions, among many others. Heinrich, Ortiz, Berlin and the many other ethnobotanists who have contributed to this area are to be applauded for their efforts.

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