

Stevia Genus

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Contributor: Valeria Sülsen

Phytochemistry and biological activities update of *Stevia* genus.

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1. Introduction

The genus *Stevia* represents one of the most diverse and characteristic of the tribe Eupatoriae, subfamily Asteroidae, family Asteraceae. Its distribution area ranges from the southern United States to the Andean region of South America, to northern Chile and northern Patagonia in Argentina ^{[1][2]}. Members of *Stevia* comprise herbs and shrubs that are found mainly 500–3500 m above sea level. They grow in a wide range of environments including grasslands, scrublands, forested mountain slopes, conifer forests, and subalpine vegetation, although they most often inhabit semi-dry mountainous terrains ^[3].

The number of species within the genus is estimated to be 230. Mexico and South America are characterized by highlands where *Stevia* species grow. Most species are found in South America, within Peru, Bolivia, southern Brazil, Paraguay, and northern Argentina, where approximately 120 species are found ^{[3][4]}. There are more than 80 species known to be in North America, and at least 70 are native to Mexico. Records show that the genus is not present in the Bahamas, the Antilles, or Amazonia ^{[2][3]}.

The genus is known worldwide for the species *Stevia rebaudiana* (Bertoni) Bertoni (Asteraceae), popularly named “stevia”, which produces large amounts of stevioside, a powerful non-nutritive natural sweetener. Stevioside is composed of a mixture of several closely related *ent*-kaurene glycosides, among which stevioside, rebaudioside A, and dulcoside A and B are the most important. Stevioside is the most abundant sweetener that, together with the other diterpene glycosides, accumulates in the leaves. The aqueous extracts of *S. rebaudiana* are used commercially to sweeten different products and also for the extraction of sweet principles. *Stevia rebaudiana* has also demonstrated several biological activities in preclinical and clinical studies including antidiabetic, anticariogenic, antioxidant, antihypertensive, antimicrobial, anti-inflammatory, and antitumor activities, among others ^[5].

Revisions on the genus covering ethnobotany and phytochemistry data have been published previously ^{[1][6][7]}. However, in the last years, most of the scientific papers and reviews were dedicated almost exclusively to *S. rebaudiana* and its constituents.

2. Ethnobotany

Ethnobotanical data on *Stevia* species have been described since the 18th century. The latest revision covering ethnobotanical and ethnopharmacological aspects of the *Stevia* species was published in 2002 ^[6]. A literature survey covering the period January 2002–February 2021 was carried out here in order to update the information related to these topics.

The traditional uses of 29 species from Central and South America are available. Some of the most common popular uses of *Stevia* species are related to antidiarrheal, anti-inflammatory, antimalarial uses, as a febrifuge, a diuretic, a diaphoretic, to treat heart diseases, stomachaches, and skin conditions (Table 1).

Table 1. Ethnobotanical uses of *Stevia* species.

Species	Common Name	Ethnobotanical Use	Location	Refs.
<i>S. achalensis</i>	Comadre	Ornamental.	Argentina	[8][9]
<i>S. balansae</i> Hieron.	-	Antidiarrheal.	Paraguay	[10]

Species	Common Name	Ethnobotanical Use	Location	Refs.
<i>S. bogotensis</i> Tr. ex Cortés	Jarilla, Clavito, eupatoria	Febrifuge. Diaphoretic.	Colombia	[6][10]
<i>S. cardiatica</i> Perkins	-	Heart diseases.	Bolivia	[6][10]
<i>S. collina</i> Gardn.	Caá-ehé	Sweetener. As stomachic.	Brazil	[6]
<i>S. connata</i> Lag.	Pericón de monte	Stomachache treatment.	Guatemala	[6][10]
<i>S. elatior</i> HBK.	A-cí	To soothe burns and scratches	Mexico	[6][10]
<i>S. eupatoria</i> (Spreng.) Wild	Hierba del borrego, yerba del borrego, cola del borrego, estevia	Diuretic. Antimalarial. For stomachache. Hypoglycemiatic. Analgesic. Anti-inflammatory. Antihypertensive.	Cuba	[6][10] [11]
<i>S. fiebrigii</i> Hieron. var. <i>vattuonei</i> (Hicken) Cabrera	-	Ornamental.	Argentina	[8]
<i>S. glandulosa</i> Hook. et Arn.	Hierba de la pulga	Antipyretic.	Mexico	[6][10]
<i>S. linoides</i> Sch. Bip.	-	Astringent.	-	[12]
<i>S. lucida</i> Lag.	Yerba del aire, hierba de la araña, ma-li-too, kebuju, mariposa, chirca, chilca, javillo, golondrina de la sabanera	To cure wounds. To soothe pains. Rheumatism treatment. Anti-inflammatory.	Mexico, Guatemala, Colombia, Venezuela	[6][10]
<i>S. macbridei</i> B. L. Robins var. <i>anomala</i> B. L. Robins	Jauja-huancayo	Used as a bath by women.	Peru	[6][10]
<i>S. mercedensis</i> Hieron. var. <i>mercedensis</i>	Comadre	Ornamental.	Bolivia, Argentina	[9][13]
<i>S. nepetifolia</i> HBK	Zazal, anis de ratón, peracón	Dysmenorrhea treatment.	Mexico, Guatemala	[6][10]
<i>S. palmeri</i> Gray	Raniweri, raniwori	Odoriferous.	Mexico	[6]
<i>S. petiolata</i> (Cass) Sch. Bip.	Guarme-guarumi	To give flavor to meat.	Peru	[6][10]
<i>S. pilosa</i> Lag.	Flor de María	Antimalarial. Antipyretic. Cathartic. Diuretic.	Mexico	[6][10]
<i>S. plummerae</i> Gray	Ronino	To make washes and poultices for open wounds.	Mexico	[6]
<i>S. puberula</i> Hook.	Lima-lima	Used as tea substitute and stomach medicine.	Peru	[6][10]
<i>S. rebaudiana</i> Bertoni	Hierba dulce del Paraguay, estevia, stevia	Sweetener. Food additive. Contraceptive. Antidiabetic. Used to regulate arterial pressure.	Paraguay, Brazil	[6][10]
<i>S. rhombifolia</i> HKB var. <i>stephanocoma</i> Sch. Bip.	Manka pak'l, pirq'a	Stomachache treatment. As an emetic. Used for mate.	Peru	[6]
<i>S. salicifolia</i> Cav.	Hierba del aire, hierba de la mula, la envidia, zazale de olor, yerba de la mula. Hierba de la Santa Rita	Rheumatism treatment. Cathartic. For intestinal upset due to parasites. Purgative. For fevers and colds.	Mexico, USA	[6][10]
<i>S. sanguinea</i> Hieron.	Malvisco	Ornamental.	Argentina	[8]
<i>S. satureiifolia</i> (Lam.) Sch. Bip. ex Klotzsch var. <i>satureiifolia</i>	Romerillo	Ornamental.	Argentina, Brazil, Uruguay	[8]
<i>S. serrata</i> Cav.	Ronino, Uriki, Otoninawa, Chapo, yerba picante, hipericón, Q'ang'aj, anis silvestre, hipericon arrie	To make washes and poultices for open wounds. Applied to cuts on feet and on snake bites. As cough remedy. For gastrointestinal disorders.	Guatemala, Mexico	[6][10] [14]

Species	Common Name	Ethnobotanical Use	Location	Refs.
<i>S. subpubescens</i> Lag.	Hierba de la mula, Zazal	As a bath after parturition. Stomachache treatment. To treat joint pains.	Mexico	[6][10]
<i>S. trifida</i> Lag.	Manzanilla de agua	Dysentery treatment.	Mexico	[6][10]
<i>S. yalae</i> Cabrera	-	Ornamental.	Argentina	[8]

Many plants such as *S. connata*, *S. eupatoria*, *S. puberula*, *S. serrata*, and *S. subpubescens* have been used for gastrointestinal disorders. Other species have been used as therapy for infectious diseases. In this sense, *S. bogotensis*, *S. eupatoria*, *S. glandulosa*, *S. pilosa*, and *S. salicifolia* have been employed as antipyretic and antiparasitic. The anti-inflammatory use of *Stevia* plants has also been described in the literature; for instance, *S. eupatoria*, *S. lucida*, and *S. salicifolia* have been described as useful for the treatment of inflammatory processes.

Stevia eupatoria, *S. lucida*, *S. salicifolia*, *S. serrata*, and *S. subpubescens* have been used in the United States, Mexico, and Central America and northern South America. These *Stevia* species have many associated medicinal properties and have been popularly used to treat a wide range of diseases.

Stevia eupatoria, known as “hierba del borrego”, “yerba del borrego”, and “cola del Borrego” has been described as antimalarial and has been used for its diuretic properties. Mexican folk medicine has used this species as an herbal remedy for stomach pain and for its hypoglycemic, analgesic, anti-inflammatory, and antihypertensive properties. This species is known as “estevia” (synonym of *S. purpurea*) [6][10][11].

Stevia lucida is widespread from Mexico to Venezuela. This plant is popularly known in Mexico as “yerba del aire” and “hierba de la araña”. In Guatemala, it is called “kebuj” and in Colombia, it is known as “chilca” and “golondrina de la sabanera”. In Venezuela, it is named “chilca” and “chirca”. *Stevia glutinosa*, a synonym of *S. lucida*, is called “javillo”, “javilla”, and “mariposa”. Several uses have been described for this species, including external use to relieve pain and treat wounds. In Colombia, a decoction of the aerial parts of *S. lucida* has been used to alleviate inflammatory processes. In Guatemala, it has been used to treat rheumatism. With the same purpose, in Maracaibo (Venezuela), a decoction of the leafy stems of *S. lucida* has been used. In Mexican folk medicine, “yerba del aire” has been used to treat chilly cramps [6][10].

S. salicifolia constitutes another species known with different common names and is distributed from southern United States to Mexico. In traditional medicine, it is known as “hierba del aire”, “hierba de la mula”, “zazal”, “zazale de olor”, “yerba de la mula”, and “la envidia” in Mexico. This species, synonym of *S. stenophylla*, is also known as “hierba de la Santa Rita”. In Mercado Juarez (Toluca, Mexico), the dried aerial parts of *S. salicifolia* are marketed to prepare decoctions or alcoholic infusions that can be used “as a rub” to treat rheumatism. In Mexico, the decoction of the dried roots has been used as a cathartic, and the infusion of the roots has been recommended for intestinal upset due to parasites. The roots, mashed and placed in warm water, are used to prepare a drink employed as a purgative. The leaves are used to prepare tea (infusion) for colds and fevers [6][10].

Stevia serrata is known in traditional medicine as “ronino”, “uriki”, “otoninawa”, “chapo”, “yerba picante”, “hipericón”, “Q’ang’aj”, “anis silvestre”, and “hipericon arrie”. The external use of crushed roots of *S. serrata* for washes and poultices applied directly to open wounds has been reported. The whole plant crushed and rubbed has been employed in snake bites. This species has been described as a cough remedy and to treat gastrointestinal disorders [6][10][14].

In Mexico, *S. subpubescens* (synonym of *S. subpubescens* var. *subpubescens*) is commonly known as “zazal” and also as “hierba de la mula”. The aerial parts of this species have been recommended as a decoction to be used as a bath by women after parturition. The leaves are used for stomachaches and the whole dried plant can be rubbed on affected parts to treat joint pain [6][10].

Other species have also been described as medicinal. The decoction of *S. macbridei* has been used externally by women as a bath. The infusion or tea of *S. nepetifolia* has been suggested to alleviate dysmenorrhea symptoms. A drink prepared with the roots of *S. balansae* has been employed in Paraguay to treat diarrhea. The infusion of roots and flowers of *S. trifida* has been orally administered to treat dysentery.

In the last years, several Argentinean *Stevia* species have been employed with an ornamental purpose. In this sense, *S. achalensis*, *S. fiebrigii* var. *vattuonei*, *S. mercedensis* var. *mercedensis*, *S. sanguinea*, *S. satureiifolia* var. *satureiifolia* and *S. yalae* can be mentioned. In particular, the species *S. fiebrigii* var. *vattuonei* and *S. mercedensis* var. *mercedensis* are commonly used in northern Argentina as ornamentation in religious festivities.

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