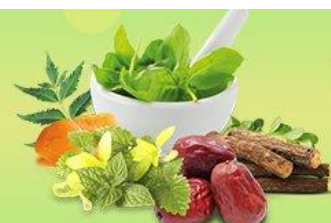


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Abdurrahman
PG Scholar, Department of
Ilmul Advia, Faculty of Unani
Medicine, Aligarh Muslim
University Aligarh, Uttar
Pradesh, India

Samar Zakir
PG Scholar, Department of
Ilmul Advia, Faculty of Unani
Medicine, Aligarh Muslim
University Aligarh, Uttar
Pradesh, India

Ghufran Ahmad
Professor, Department of
Ilmul Advia, Faculty of Unani
Medicine, Aligarh Muslim
University Aligarh, Uttar
Pradesh, India

Mohd Anwar
Professor, Department of Ilaj
Bit Tadbeer, Faculty of Unani
Medicine, Aligarh Muslim
University Aligarh, Uttar
Pradesh, India

Sumbul Rehman
Assistant Professor,
Department of Ilmul Advia,
Faculty of Unani Medicine,
Aligarh Muslim University
Aligarh, Uttar Pradesh, India

Corresponding Author:
Abdurrahman
PG Scholar, Department of
Ilmul Advia, Faculty of Unani
Medicine, Aligarh Muslim
University Aligarh, Uttar
Pradesh, India

Swertia Chirata: A Comprehensive review of its abundant medicinal properties

Abdurrahman, Samar Zakir, Ghufran Ahmad, Mohd Anwar and Sumbul Rehman

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Abstract

Swertia chirata (*S chirata*), (Family Gentianaceae) is a well-known herbaceous plant. It is very popular in traditional systems of medicine like Unani, Ayurveda, and Siddha. It is commonly used in Unani medicine, for several pharmacological effects including *Musaffi-i-Dam* (blood purifier), *Muqawwi-i-Mida* (stomachic), *Muhallil-i-Awram* (anti-inflammatory), *Muqawwi-i-Qalb wa Jigar* (tonic to heart and liver), *Mulattif* (demulcent), *Mudir* (diuretic), *Mulliyin* (laxative) properties. It is used for chronic fever, malaria, anemia, liver disorders, hypertension, dyspepsia, gastritis, ulcers, constipation, and skin diseases, and is included in many pharmacopoeial and non-pharmacopoeial preparations. The entire plant contains ophelic acid, two bitter glycosides chiratin, and amarogentin. It also contains resins, tannin, gum, carbonate, and phosphate of potash, lime, and magnesia. Extensive studies on *S. chirata* have been carried out by various researchers and a wide spectrum of its pharmacological actions have been explored which includes anti-inflammatory, anti-diabetic, antimicrobial, and antioxidant properties. The present review is an effort to provide a detailed survey of the literature, scientific researches of pharmacognostical characteristics, chemical composition, and pharmacological activities of this plant.

Keywords: Swertia chirata, Unani drug, Musaffi-I-Dam (blood purifier), Ophelic acid

Introduction

Swertia chirata, (*Chirayta*) is a very popular Unani medicinal herb that has been extensively used in all the traditional medicines to treat several ailments such as liver disorders, malaria, and diabetes and is reported to have a wide spectrum of pharmacological activities.

It is known by an array of vernaculars such as *Qasabuz-zarirah*, *Qasb-e-Buwa* in Arabic, *Arminoqoon*, *Quoqariyus*, *Falas*, *Qalamas*, *Qalas* in Greek, *Bitter stick* in English, *Kirata-tikta*, *Anarya Tikta*, *Ardhatikta*, *Charatika* in Sanskrit, *Kiryat-Charayatah* in Hindi and *Nhawandi*, *Qasabuz-zarirah*, *Barkunba* in Persian^[1-9].

Among the 135 species of *swertia* found around the world and 40 Indian species, *chirayta* is known to possess the most important medicinal properties^[6, 9, 10]. It is distributed in the temperate Himalaya (4000-10000 feet) from Kashmir, Shimla to Nepal and Bhutan^[6]. It is also found in the Khasi Hills in Meghalaya at an altitude of 1200 – 1500m, Nepal, Bhutan^[9, 11, 12, 13]. The plant of *S. Chirayita* was first described by Roxburgh under the name of *Gentiana Chyrayta* in 1814 which was introduced to Europe 1839^[14, 15].

This drug is known mostly for its bitter taste (thus called as *Chirayta Shherin* and *Chirata talkh*) caused by the presence of different phytochemical constituents such as amarogentin (most bitter compound isolated up till now), swerchirin, Swertiamarin, and other bioactive^[16].

Morphology

Macroscopic features: It is an erect annual/biennial herb attaining up to 1.5 m height, much- branched, and robust^[11, 12]. The Stem is around 2–3 ft long, having a middle cylindrical portion, and upper quadrangular, with a prominent decurrently line at each angle^[17]. Leaves are opposite in pairs, without stalk, pointed at tips up to 10 cm long, the lower often much larger sometimes etiolated; panicles large leafy, pedicels 0-3/4 inches, fascicled, mostly short^[11, 12]. Flowers are greenish-yellow tinged with purple; calyx-lobes 1/6 inch, lanceolate, corolla-lobes 1/4 inch, ovate, acuminate, often sub-marginal, rarely close together

or sub confluent, with a fringe of long white or pink hairs at the summit. Filaments linear free; anther oblong, style cylindrical; stig.as oblong. Fruits are capsule ovoid 8 mm long. Seeds are polyhedral, smooth, test a close, not reticulated [6, 11, 13].

Microscopic features: The inner parenchymal tissue of the leaves contains many chloroplasts, with very little mesophyll tissue differentiation. Single-layer of the epidermis is seen covered outwardly with a thick-lined cuticle and large cells (having straight walls) on the upper surface than the lower one (show sinus outline). Stomata (cruciferous type) are found only on the lower surface. Stem transection shows single-layered epidermis, externally covered with a thick cuticle in its early age, and in the older epidermis, it remains intact but cells become flattened and tangentially elongated endodermis is distinct, showing anticlinal or periclinal walls. Very small needle-shaped crystals are also present in large quantity; cells are cortical, and in some cortical cells resin along with small drops of oil are present as dark brown mass. The transection of roots show 2-4 layers of cork; secondary cortex represented by 4-12 layers of parenchymatous cells which are thick-walled. Few of them showing radial wall formation, tangentially elongated with sinuous walls. The secondary phloem constituted of companion cells, thin-walled strands of sieve tubes and phloem parenchyma; secondary xylem composed of tracheids cells, vessels, and xylem fibres [18].

Unani description (Mahiyat)

It is a commonly available plant that attains a height of up to 1-4 feet and resembles the *kunjad* plant (*Sesamum indicum*) [5, 8]. Around 10-12 varieties have been described among which 2 are more famous; one that is less bitter in taste called "*chiraita shirin*" and two which is bitterer known "*chiraita talkh*" root is approximately 2 inch [3, 8].

Chirata Shirin has a long cylindrical and knotted stem; two branches arise from each node which further divides into various branchlets. The external surface is reddish-yellow; the leaves are ovate similar to mint leaves and the odorless

flowers found in clusters are similar to *banafsha* (*Viola odorata*) [3, 5]. On breaking the lower part of the stem cotton-like fibers are found which appear like a web. Taste on chewing is quite strong acrid and stringent [3, 4, 5]. The above mentioned are the characteristics of the larger variety; the smaller variety has a very thin and delicate stem which is violet in color, acrid in taste, considered better, bears round seeds enclosed in pods, and is known as "*Qasbuzzarira Hindi*" [3, 5]. The Indian variety has a one to three feet tall quadrangular green colored stem; leaves are small linear, opposite, pointed, shiny dark green from above and rough from the underside; the root is triangular and odorless [3, 4]. According to *IBN Sina*, *chiraita* is odorless and hard but during its transportation, it gets affected by the climatic condition and develops a peculiar odor, and becomes light in weight [3].

Parts used (Hasas Mustamila)

Whole plant and root are used [18].

Temperament (Mizaj)

Hot and Dry; (2°) [3, 4, 5, 8].

Phytochemicals

The wide-range pharmacological actions and therapeutic potentials of *S. chirayita* are attributed to the presence of a multiple groups of pharmacologically bioactive compounds belonging to various classes such as xanthenes and their derivatives, lignans, alkaloids, flavonoids, terpenoids, and other compounds like chiratin, ophelic acid, palmitic acid, stearic acid and oleic acid [24, 25, 26]. The entire plant contains ophelic acid (bitter, yellow, amorphous, viscid compound having faint gentian-like odor), two bitter glycosides chiratin (natural, not distinctly crystalline, light yellow powder), and amarogentin. Chiratogenin (brownish, amorphous), gentiopicroin, two yellow crystalline phenols, and a new xanthan are also present in sufficient amounts [1, 2, 7, 9, 8, 12, 16, 17]. It also contains resins, tannin, gum, carbonate and phosphate of potash, lime, and magnesia [7].

Table 1: Pharmacological actions (*Afaal*)

S. No.	Pharmacological actions	References
1.	<i>Musaffi-i-Dam</i> (Blood purifier)	3; 8
2.	<i>Muqawwi-i-Mida</i> (Stomachic)	1; 8; 9; 20
3.	<i>Muqawwi-i-Qalb wa Jigar</i> (Tonic to heart and liver)	3; 5; 8; 20
4.	<i>Muqawwi-i-Basar</i> (Tonic to eyes)	5; 20
5.	<i>Mulattif</i> (Demulcent)	3; 5; 19
6.	<i>Mudir</i> (Diuretic)	3; 4; 8; 19
7.	<i>Mulliyin</i> (Laxative)	3; 5; 6; 20
8.	<i>Qatil-i-kirm-i-Shikm</i> (Anthelmintic)	1; 3; 6; 8; 9; 11; 12
9.	<i>Mushtahi</i> (Appetizer)	9
10.	<i>Muhallil -i-Awram</i> (Anti-inflammatory)	3; 5; 6; 8; 9; 19
11.	<i>Dafti -i-Humma</i> (Antipyretic)	6; 8; 12
12.	<i>Moallid-i- Laban</i> (Galactogogue)	6; 11

Table 2: Therapeutic uses (*Mahal-e-istematat*)

S. No.	Therapeutic uses	References
1.	<i>Ishal</i> (Diarrhea)	8; 11; 12
2.	<i>Humma Ijamia</i> (Malarial fever)	11
3.	<i>Zof-i-Aam</i> (General weakness)	9; 11; 12
4.	<i>Dama</i> (Asthma)	3; 6; 12
5.	<i>Amraz-i-Kabid</i> (Liver disorder)	1; 5; 9; 12
6.	<i>Zofe Ishtiha</i> (Dyspepsia)	3; 8; 12

7.	<i>Nafkh-i-Shikam</i> (Flatulence)	8
8.	<i>Amraz-i-Jild</i> (Skin diseases)	3
9.	<i>Bahaq</i> (Leucoderma)	6
10.	<i>Kirm-i-Shikam</i> (Intestinal worms)	3; 8
11.	<i>Malankhuliya</i> (Melancholia)	20
12.	<i>Istisqa</i> (Acitis)	3; 4; 5
13.	<i>Usr al- Bawl</i> (Dysuria)	3; 5; 6
14.	<i>Taqteer al-Bawl</i> (Urinary incontinence)	3; 4; 5; 8
15.	<i>Irq al-Nasa</i> (sciatica).	3; 5

Dose (*Miqdar-e-khuraq*)

3.5-7 g [3, 4, 5, 8].

Adverse effect (*Mazarrat*)

It is harmful for the lungs [3, 5, 7, 8].

Correctives (*Musleha*)

Asl-us-soos (*Glycyrrhiza glabra*) for the lungs and Anisoon (*Pimpinella anisum*) for back are considered corrective [3, 5, 8].

Substitute (*Badal*)

Gul-e-surkh (*Rosa damascena*), Sumbul-ut-tib (*Nardostachys jatamansi*), Zafran (*Crocussativas*), Sandal (*Santalum album*), and Sana-e- makki (*Swertia angustifolia*) [2, 3, 5, 8].

Compound formulations (*Murakkabat*)

Joshanda-e-Chiraita, Dawa-e-muqawwi, Habb-e-chiraita, Noquw-e-shahatra wa chiraita [8].

Pharmacological studies**Anti-inflammatory effect**

Banerji (2000) evaluated the anti-inflammatory activity of *Swertia chirata* in acute, sub-acute, and chronic experimental models in male albino rats. Inflammation was induced by carrageenan and formalin. The result showed that *Swertia chirata* had strong anti-inflammatory action [26].

A study conducted by Kacker *et al.* (2013) showed that the *Swertia chirata* and *Ocimum sanctum* had strong anti-inflammatory and anti-pyretic effects in rats when compared with Aspirin, and Phenylbutazone [27].

The ethanolic root extract of *Swertia chirata* showed analgesic and anti-inflammatory activities (Das *et al.*, 2012) [28].

Hepatoprotective effect

The ethanolic extract of *Swertia chirata* had a hepatoprotective effect (Verma *et al.*, 2013) [29].

Anti-diabetic effect

The anti-diabetic effect of 96% of Ethanolic extract of *S. chirata* on neonatal-streptozotocin induced type 2 diabetic model rats has been studied and found that its stem bark possesses significant antihyperglycemic activity in T2DM rats. It improved glucose tolerance, decreased insulin resistance, increased glycogenesis, and total cholesterol (Bhowmik *et al.* 2018) [30].

Ali *et al.* (2017) evaluated the hypoglycemic and hypolipidemic properties of *Swertia chirata*. The results showed that *Swertia chirata* decreased the amount of glucose (14.5%), triglycerides (10.5%), cholesterol (8.6%), and LDL cholesterol level by 14.4% in diabetic patients [31].

The root extract of *Swertia chirata* had an anti-

hyperglycemic effect on Indinavir treated rats and decreased glucose and insulin levels and also increased lipid levels that were found nearly close to the effect of regular metformin and pioglitazone (Rajesh *et al.* 2017) [32].

Antimicrobial and Antioxidant effect

Methanolic extract of the aerial part of *Swertia chirata* had antioxidants, antimicrobials Activity (Khan *et al.* 2018) [33].

Chen *et al.* (2011) investigated the 70% ethanolic extract of *S. chirayita* for antioxidant activities by using antioxidant tests including reducing power and beta-carotene assay. The results showed that 70% ethanolic extracts exhibited high DPPH scavenging activity ($IC_{50} = 267.80 \mu\text{g/mL}$) [34].

The ethanolic extract of *S. chirayita* had significant antimicrobial activity against *Staphylococcus aureus* which reflects its potentiality to be used in skin infections (Alam *et al.*, 2009) [35].

Methanolic and aqueous extracts of *S. chirata* evaluated for their antimicrobial activity against 10 bacteria and 3 fungi showed concentration-dependent activity (Laxmi *et al.*, 2011) [36].

A study was conducted by Sumbul Rehman in 2011 and it was found that ethanolic and aqueous extract of *Chirayita* had a good antibacterial effect against some gram-negative bacterial strains like *E. coli*, *K. pneumoniae*, and *P. vulgaris*. It was also absorbed that ethanolic extract is having more efficacy as compared to the aqueous extract [37].

Conclusion

S. chirayita had been a very popular drug of Unani medicine and still, it offers many promising prospects for both traditional and modern medicine. It is a potential herbal drug for diverse ailments. This review paper summarized the identifying features based on its pharmacognostical features, ethnobotanical uses, phytochemistry, various pharmacological activities, and Unani literature survey. More efforts are required to investigate the mode of action of this plant in various types of diseases. Further, more clinical studies should be conducted on larger samples to establish the efficacy of using *S. chirayita* in medicine.

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