

PHYTOCHEMICAL AND ETHNOPHARMACOLOGICAL REVIEW OF TUDRI SURKH (*CHEIRANTHUS CHEIRI*)

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ABSTRACT

Background and Aims: The traditional system of medicine continues to play an essential role in health care management. A number of plant origin drugs are utilized in Unani system of medicine for the treatment of various diseases. Tudri surkh (*Cheiranthus cheiri*) is one among them and is used either individually or in combination with other drugs in compound pharmacopeial formulations. Tudri surkh is a perennial plant of family *Brassicaceae* originally a native of Europe. This review article aims to describe morphological characteristics, phytochemistry, ethno botanical uses and therapeutic properties of Tudri Surkh. **Methods:** We systematically searched classical Unani literature, online data sources (PubMed, Google scholar, Elsevier, Science Direct and

Research Gate) and offline encyclopaedia and books on medicinal plants for the relevant data on Tudri Surkh. **Results:** Tudri surkh contains alkaloids, glucosides, flavonoids and phenols. Plant contains cardenolides used for congestive heart failure. Glucosinalates (mustard oil glucosides) are secondary metabolites which are present in Tudri surkh possess biocidal and health benefits. Seeds are considered as tonic, diuretic, aphrodisiac, and expectorant. It is beneficial in tumours, jaundice and drug toxicity.

KEYWORDS: Glucosides, flavonoids, glucosinalates, drug toxicity.

INTRODUCTION

Medicinal plants have been used by mankind for their therapeutic value since the beginning of human civilization. The medicinal plant-based, traditional medicine system continues to play an essential role in health care, with about 80% of the world's inhabitants relying mainly on these medicines for their primary health care.^[1] Medicinal plants are plants containing inherent active ingredients used to cure disease or relieve pain.^[2] Unani system has described a large number of such medicines based on plants or plant products and the determination of their morphological and pharmacological or pharmacognostical characters can provide a better understanding of their active principles and mode of action. Observations of scientific studies on medicinal plants are used to cure various diseases that include infectious disease, non-communicable and lifestyle disorders. Tudri surkh is one such plant species used for treatment of various ailments.

Tudri Surkh (*Cheiranthus cheiri*) also known as “Wallflower” is a perennial plant species that belong to family *Brassicaceae* (*Cruciferae*). Originally a native of European countries it has been introduced in other geographical regions of the world where it is grown primarily as an ornamental garden plant. *Cheiranthus cheiri* is the synonym of *Erysimum cheiri*. *Erysimum cheiri* is assigned to the genus *Erysimum* L., section *Cheiranthus* L.^[3]

Vernacular names.^[4-7]

Bengali	<i>Khueri</i>
English	<i>Bee flower, Bleeding heart, Geraflour, Wallflower, Jilliver, Jacks</i>
French	<i>Giroflee, Murer, Jaune, Coquardeau, violette giro flee</i>
German	<i>Goldlock, Handblume, Lackviole</i>
Hindi	<i>Lahurishubu</i>
Punjabi	<i>Tudri siyah</i>
Urdu	<i>Todri surkha</i>

Taxonomical classification^[8]

Kingdom	<i>Plantae</i>
Sub kingdom	<i>Cormobionta (Tracheobionta)</i>
Superdivision	<i>Spermatophyta</i>
Division	<i>Magnoliophyta (Angiospermatophyta)</i>
Class	<i>Magnoliatae (Magnoliopsida)</i>
Subclass	<i>Dilleniidae</i>
Order	<i>Capparales</i>
Family	<i>Brassicaceae (Cruciferae)</i>
Genus	<i>Cheiranthus</i>
Species	<i>Erysimum cheiri (L) crantz</i>

Botanical description

Tudri surkh (*Cheiranthus cheiri*) is an erect or ascending perennial herb with an average height of 25-80 cm which requires a fertile and well-drained soil. It grows well in sunny or partially shaded conditions. Roots of Tudri surkh are adventitious in nature. Leaves are lanceolate 5-10 cm in length entirely or slightly pointed. Flowers exhibit club shaped inflorescence arranged in clusters with purplish green sepals and rounded petals which are 2-3 cm in length. Flowers have four sepals and six stamens typical of members of *Brassicaceae*. Petals of Tudri surkh are highly pigmented with a wide range of colours from orange, brown, bronze, cream, yellow, pink, ruby and primrose purple. Seeds are sub orbicular, pale brown in colour about 3mm long with flat borders and accumbent cotyledons.^[7, 5]

Weston et al. carried out a study to analyse the ultrastructure of coloured Wallflower (*Cheiranthus cheiri*) petals and examined their cellular structure and plastid development. The plants of *Cheiranthus cheiri* were harvested at different developmental stages including fully open flowers and were processed for light and electron microscopy. Transverse sections (TS) of young petals that were still within the wallflower bud displayed that cells at both the adaxial and abaxial surfaces show intense staining. Quantitative analysis of transverse sections of mature petal tissue of Wallflower gives a volume proportion ratio of 25: 43: 1:31 for epidermis, mesophyll, vascular tissue and airspace respectively.^[9]

The pigmentation of Wallflower petals appear to be derived from two cellular components namely chromoplasts and distinct pigment containing vesicles. The type of chromoplasts present in these petals are globular type of chromoplasts.^[10]

Leaves of Tudri Surkh vary in appearance possibly in relation to the average dampness of the wall among other factors. Leaves are usually more upright compared to plants grown in soil and are often small and distinctly succulent. Lesage experimented with the Wallflower by watering them with sea water solution or sodium chloride solution to determine the succulence, increased development of palisade, reduction of intercellular spaces and diminution of chlorophyll. He found growth of strongly succulent leaves in plants treated with sodium chloride solution within a short span of time while the control plants produced none. He further observed that palisade cells became very much elongated, mesophyll largely converted into palisade tissue, and the intercellular spaces and chlorophyll grains significantly reduced in size. Salt or its component elements were found to be present in

considerable quantity in all the succulent leaves of the Wallflower. The permeability of the epidermis in treated plants was also found to be higher compared to untreated control plants. The study concluded that under halophytic conditions wallflower tend to be more succulent.
[11]

Phytochemical constituents

A number of constituents have been isolated from different parts of Tudri Surkh (*Cheiranthus cheiri*) and these include alkaloids, glucosides, flavonoids and phenols. The important phytochemical constituents among others include Cheirinine, Cheirolin, Quercetin, Strophanthidin, Cheirotoxin, Erysimoside, Glucoerysimoside and Cheiroside A^[12,4,6,7] and cyanidin have been obtained from *Cheiranthus cheiri*.^[13] Isorhamnetol or Isorhamnetin was isolated for first time from *Cheiranthus cheiri* in 1896.^[14] Its fresh leaves contain 3-methyl thiopropyl isothiocyanate. For many years Sinigrin and Sinalbin represented the only crystalline mustard oil glucosides, however, in 1913 Schneider and his coworker succeeded in crystallizing glucocheirolin from the seeds of Tudri Surkh. The enzymic hydrolysis of glucocheirolin liberates the isothiocyanate cheiroin. Cheirolin is an optically inactive, neutral compound which crystallizes from ether in a colourless prisms of melting point 47-48°C. It is soluble in alcohol or chloroform, slightly soluble in water and almost insoluble in petroleum ether.^[15]

Plant produced cardenolides are a group of remarkable chemical compounds responsible for the poisoning of livestock and also the treatment of countless people with congestive heart failure.^[16] James R et al. in 1982 analysed 24 leaf samples of *Erysimum*, collected from different parts of North America, spectrophotometrically at 626 nm in reaction with 2,2',4,4'-tetranitrodiphenyl (TNDP) in presence of NaOH. All samples of *Erysimum* investigated in the study gave positive results for cardenolides. Variation in total cardenolide concentration in different parts of the plant was found, in leaves it ranged from 0.009% to 1.288% while in seeds higher concentration of 1.744% to 2.906% were obtained. Cardenolides can be significant constituent of plant metabolism in *Erysimum* especially seeds.^[17]

In *Cruciferae* various members contain unusual flavonol glycosides. Isorhamnetin is present in *Mathiola incana* whereas Robinin (kaempferol 3-galactosyl rhamnoside 7-rhamnoside) has been found in seeds of *Cheiranthus cheiri*.^[18]

Tudri Surkh contains cardioactive steroid glycosides including cheirotoxin, erysimoside, glucoerysimoside and cheiroside A.^[19] Makarevich and Belokon (1975) reported 30 compounds (cardiac glycoside) by qualitative paper chromatographic analysis from the seeds of Wallflower (*Cheiranthus cheiri*).^[20]

Recently, the flowers of ornamental plants in the family *Brassicaceae* have been found to be a source of complicated acylated anthocyanins.^[21] Seeds of Tudri Surkh contain protein (28%) and fatty oil (30%). The seed oil of Tudri Surkh has an Iodine value of 129 while the Saponin value is 178. The fatty acid composition of the oil includes 3% palmitic acid, 0.8% arachidic acid, 10% oleic acid, 17% linoleic acid, 23% linolenic acid.^[5] *Cheiranthus cheiri* seed oil contains 65% of cheiranthic acid (C₁₈H₃₄O₂) which is an isomer of oleic acid. Van Loon extracted the seeds of wallflower with petroleum ether and on saponification found fatty acid consisted of 4.9% of oleic acid, 24.7% of linoleic acid, 19.4% of linolenic acid.^[22]

Tudri Surkh contains glucosinolates. Glucosinolates (mustard oil glucosides) and their glucosinolate products are responsible for the typical flavor and odors of *Cheiranthus cheiri*.^[23] Glucosinolates are glucose and sulfur containing organic anions. When plant cells are ruptured glucosinolates present in vacuoles are hydrolyzed by myrosinase enzyme. The hydrolysis products contain isothiocyanates, nitriles, thiocyanates, epithionitriles. Several hydrolysis products show biocidal activity against plants, fungi and bacteria and are also having health benefits.^[24]

Pharmacological activity

Tudri Surkh (*Cheiranthus cheiri*) possess remarkable activity against various physiological disorders. It was formerly used as diuretic. Smaller dose of *Cheiranthus cheiri* is cardiogenic supporting a failing heart in a manner similar to foxglove but in more than small dose it is toxic.^[25] Flowers possess cardiac stimulant and emmenagogue properties. Seeds of *Cheiranthus cheiri* are tonic, diuretic, aphrodisiac and expectorant being useful in dry bronchitis. They are good remedy for fevers and eye injuries. Flowers are used in paralysis and impotence.^[7]

The expressed juice of the seeds of Wallflower shows anti-bacterial activity against gram positive and gram negative bacteria. Cheirolin possesses goitrogenic activity. Cheirinine, an alkaloid isolated from its seeds has quinine like action.^[5]

According to classical Unani literature leaves and oil may be used in the treatment of cancer.^[5, 6] Saleem et al., (2001) conducted a study on mouse skin tumorigenesis model depicting chemo preventive potential of seed extracts of Tudri Surkh. Result of the study suggested that topical application of Tudri Surkh prior to tissue plasminogen activator (TPA) and croton oil treatment, inhibited TPA induced cutaneous ornithine decarboxylase (ODC) activity, [³H] thymidine incorporation and croton oil promoted skin tumorigenesis respectively in a dose dependent manner.^[26]

Laoq containing Tudri Surkh (*Cheiranthus cheiri*) seeds helps to expel phlegm out of lungs. It is used in chronic inflammation of breasts, tonsils and testes. *Discorides* has described its potential role in cancer, jaundice, sciatica, and drug toxicity.^[27, 28, 29] Tudri surkh is a constituent of many compound pharmacopeial Unani formulations having *Zoaf-e-Gurda* as their major therapeutic indication e.g *Jawarish Atai*^[30], *Laboob-e-Sagheer* and *Majoon Alkula*.^[31] It has also been mentioned as one of the drug for the management of *Zoaf-e-Gurda*.^[32] Seeds of Tudri surkh (*Cheiranthus cheiri*) are aphrodisiac and also helps to expel black bile (*Sauda*) from the body.^[28, 29]

CONCLUSION

Tudri Surkh (*Cheiranthus cheiri*) is considered as an important medicinal herb in Unani system of medicine. This plant contains flavonoids, phenols which scavenge free radicals, thereby protecting cellular macromolecules from oxidative damage. Due to antioxidant property of Tudri Surkh, it is used in various degenerative disease including cancer.

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