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Medicinal importance of *Operculina turpethum* (Linn.): A Review

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Abstract

Traditional medicine is a major part of the cultural heritage of a society and it has developed in accordance with the lifestyle and cultural practices of the society. Natural products are part and parcel of human society to combat a wide range of disorders from the dawn of civilization. *Operculina turpethum* (L.) Silva Manso (Convolvulaceae) is a well-known medicinal herb traditionally used in Unani and Ayurvedic systems of medicine to treat various diseases. *Operculina turpethum* (L.) contains various secondary metabolites including saponins, flavonoids, glycosides like turpethien and phenolics and it also contains some amount of essential oil, glucose and fructose. Various studies on *Operculina turpethum* Linn. Validated its different pharmacological action like laxative action, hypoglycemic action, anti-dyslipidemic effect, anti-inflammatory effect, ulcer protective effect, anti-microbial effect, etc. The present review comprehensively incorporates the phytochemical, pharmacological and therapeutic importance of *Operculina turpethum* (L.).

Keywords: Medicinal plant, *Operculina turpethum*, turpethien, laxative

Introduction

Synonyms

Basionym

Convolvulus turpethum (L.)

Homotypic

Ipomoea turpethum (L.)

Merremia turpethum (L.)

Spiranthera turpethum (L.)^[1]

Heterotypic

Argyreiaalu lata (L.)

Convolvulus anceps (L.)

Convolvulus triqueter (L.)

Ipomoea anceps (L.)

Ipomoea diplocalyx (L.)

Ipomoea Silvana (L.)

Ipomoea turpethum Var. *Anceps*. (L.)

Operculina triquetra (L.)

Operculina turpethum var. *Heterophylla* Hallier F (L.)^[2-4]

Taxonomical Classification

| | | |
|---------------|---|---|
| Kingdom | : | Plantae |
| Subkingdom | : | Tracheobionata, vascular plants |
| Superdivision | : | Spermatophyta, seed plants |
| Division | : | Angiosperma |
| Class | : | Dicotyledons |
| Order | : | Solanales |
| Family | : | Convolvulaceae |
| Genus | : | Operculina |
| Species | : | <i>Operculina turpethum</i> (L.) Silva Manso |
| Binomial name | : | <i>Operculina turpethum</i> (L.) Silva Manso ^[5] |

Vernacular names

1. Scientific name: *Operculina turpethum* (Linn.) Silva Manso
2. Sanskrit: Ardhachandra, Aruna, Kalameshi, Kalaparni, Kali, Kalingika, Kumbhadhatri, Laghurochani, Malavika, Masuravidala, Masuri, Nandi, Paripakini, Rechani, Rochani, Saha, Sara, Sarana, Sarasa, Sarata, Sarvanubhuti, Shyama, Susheni, Suvaha, Tribhandi, Triputa, Trivela, Trivrit, Trivrittika, Vidala
3. Hindi: Nishothra, Nisotar, Nisoth, Nukpatar, Pitohri, Trivrut, Tarbal, Tarbud, Trabal
4. Bengali: Teudi, Tvuri, Dhdha kalami
5. Gujarati: Kala Nasottara
6. Kannada: ViliTigade
7. Malayalam: Trikolpo kanna
8. Marathi: Nisottar
9. Oriya: Dudholomo
10. Punjabi: Nisoth
11. Tamil: Karum Sivadai, Adimbu, Kumbam, Kumbanjan, Kunagandi, Paganrai, Samaran, Saralam, Sivadai
12. Telugu: Tella, Tegada
13. Urdu: Turbud, Nishoth
14. English: Indian Jalap, Turpeth, Terpeth Root, False Jalap

Introduction

Operculina turpethum (L.) Silva Manso of family Convolvulaceae, is a potent medicinal plant, used in both Unani and Ayurvedic systems of medicine. The plant is native to Asia; India, Nepal, Bangladesh, Pakistan, Sri Lanka, China, Taiwan and Myanmar. Generally, it is reported throughout the warmer parts of India; whereas, in Karnataka and Tamil Nadu the plant is recorded from the dry zones. The plant is a large climber and perennial twinner. The leaves are simple, pubescent on both sides and variable in shape. The leaf base is either cordate or truncate at base, nearly 5-12.5 cm long and 1.3-7 cm wide. The flowers are white, campanulate, sepals long, borne in cymes of few flowers, giving way to globose capsules enclosed within overlapping brittle sepals. The capsule is rounded, being 1 to 1.5 centimeters and contains normally 4 black smooth seeds (Fig.1B) The stems are very long twisting, pubescent, angled and winged which become very tough and brown when become old. The roots are long, slender, fleshy and much branched. The thin root is about 4 mm in diameter and is circular with irregular wavy outline [6].



Fig 1: Flower of *Operculina turpethum*



Fig 2: Root of *Operculina turpethum*

During the flowering season, plants are uprooted and detached roots from the plants are shed dried to be used as a drug. It is called Turbud Safaid in Urdu, Nisoth in Hindi, Dudh Kalmi in Bangali, Tellate gada in Telugu, Shivadai in Tamil, Billiti gate in Kannada and Chivaka in Malyalam. The plant contains resin, jalapine and convolvulin which are insoluble in ether, benzene and carbon sulphide. It is used as purgative and mild cathartic. Turbud in combination of ginger and bitartrate of potash is very effective for the removal of dropsical effusion [7].

Botanical Description

Macroscopic description

It is a perennial aromatic creeper with a simple stem, triangular or rectangular stems. Leaves are many and are oval in shape, 2 to 5 inch in length. It consists of cylindrical pieces of root and stem, 1.5-15 cm. long x 1-5 cm. diameter, often with central woody portion removed by splitting the bark on one side, external surface longitudinally furrowed giving the drug a rope-like appearance, fracture short in bark and fibrous in wood, odor distinct but unpleasant or musty, taste somewhat like bland at first, then slightly acrid. The pieces of root are cylindrical, somewhat twisted and externally of a dull gray color. The flower presentation is 1 to 4 inch long and has 3 to 4 branches that bear white flowers. Fruit is round 1/2 or 3/4 inch in diameter, it bears 4 shiny 2 inch long seeds. The plant bears fruits and flowers from March to December [8].

Microscopic description

Mature root shows thin cork, consisting of 3-5 rows of brown cells, secondary cortex 4-6 layered, composed of tangential elongated, thin-walled cells, some of the cortical cells become thick-walled appearing as isolated, oval to sub-rectangular sclerenchymatous cells having wide lumen, secretory cavities surrounded by subsidiary cells and resin canals found scattered in secondary cortex, secondary phloem, a wide zone, consisting of sieve elements and phloem parenchyma, vascular bundles arranged in a continuous and a discontinuous ring, traversed by uni and biseriate medullary rays, numerous resin cells also seen in phloem in longitudinal rows. Xylem shows 3-5 radiating arms, small patches of intraxillary phloem often formed, xylem vessels in singles or 2-3 in groups, having simple pits on their walls, calcium oxalate crystals as prisms and

rosettes found scattered in cortex, phloem parenchyma, xylem parenchyma and medullary ray cells starch grains, both simple and compound, simple ones elliptical to spherical with central cleft hilum, compound grains consisting of 2-4 components, size vary from 5-44 μ in diameter, found scattered in cortex, phloem parenchyma, xylem parenchyma and medullary ray cells ^[9].

Powder

The root powder is greyish to light brown in colour consisting of parenchymatous cells. The cellulosic fibers have pointed tips. The vessels consist of simple pits. The starch grains are simple and compound, elliptical to spherical with central cleft, measuring 5-44 μ in diameter having 2-4 component, rosette and prismatic crystals of calcium oxalate ^[10].

Distributional Range

Native

Africa: East Tropical Africa: Kenya; Tanzania
 South Tropical Africa: Mozambique; Zimbabwe Western
 Indian Ocean: Madagascar; Mauritius; Reunion
 Asia-Temperate: China: China - Guangdong, Guangxi [w.],
 Yunnan [s.] Eastern Asia: Taiwan
 Asia-Tropical: Indian Subcontinent: India; Nepal; Pakistan
 [possibly]; Sri Lanka Indo-China: Indochina; Myanmar;
 Thailand Malaysia: Indonesia; Malaysia; Papua New
 Guinea; Philippines
 Australasia: Australia: Australia - Northern Territory,
 Queensland
 Pacific: Northwestern Pacific: Micronesia
 Naturalized: Southern America
 Caribbean: West Indies ^[11-13]

Operculina turpethum in Unani System of Medicine

Unani name of *Operculina turpethum* is Turbud. According to Unani system, it is of Hot³ and Dry² temperament and is slightly bitter in taste. There are two types of Turbud i.e. white and black; white Turbud is used for medicinal purposes; while black one, is not considered therapeutically safe due to its emetic effect. It exerts Mus'hil (Purgative), Mula'iyyin (Laxative) and Da'fa-e-Amraz-e-Balgham-wa-Sauda (removes morbid matters of phlegmatic and biliary diseases) actions; it is also used in neurological disorders.

It has Mus'hil-e-Balgham, Qata-e-Balgham-e-Ghaleez (Expectorant), Munaqqi-e-Dimag (Brain evacuant), Muqawwi-e-Dimagh (Brain tonic), Munaqqi-e-Meda (Gastric depurative), Mujaffi-e-Badan (desiccative), Istifiragh-e-Rutubat (Excretory), Mus'hil (Laxative) activities. The major indications of Turbud are Waja-ul-Mafasil (Arthritis), Istisqa (Ascites), Niqris (Gout), Irq-un-Nasa (Sciatica), Falij (Hemiplegia), Laqwa (Facial palsy), Sua'l (Cough), Zeeq-un-Nafas (Bronchial Asthma), Junoon (Insanity), and Sara (Epilepsy) ^[14].

Recommended Dosage

The recommended therapeutic dosage of Turbud is 3-5 gm in form of Safuf (powder), and 5-7 gm in form of Joshanda (decoction).

Important Unani Formulations

It has some important Unani formulations such as –
 Itrifal Ustu-khud'dus;
 Itrifal Zamani;

Itrifal Muqil;
 Itrifal Mula'iyyin;
 Jawarish Kamooni;
 Sharbat Mus'hil;
 Habb-e-Mafasil;
 Habb-e-Ayarij;
 Habb-e-Suranjan;
 Majoon-e-Suranjan;
 Majoon-e-Najah ^[15].

Chemical Constituents

Upon literature survey, it was found that the active principle of the plant is glycosidic resin. The scopoletin, a coumarin derivative, turpethinic acid and its derivatives were isolated from the plant. Boutron-Chalard found in turpeth root a volatile oil, albumen, starch, a yellow coloring matter, lignin, salts, and ferric oxide. The root contains 10 percent of resin. According to Spirgatis this resin is a glycoside, *turpethin* like that of other Convolvulaceae, insoluble in ether, but soluble in alcohol. Alcoholic extract of *O. turpethum* showed the presence of glycosides, saponins flavonoids, steroids and carbohydrates. Turpethin is mainly responsible for purgative action of *O. turpethum*. The plant contains b-sitosterol, α - and β -turpethin, lupeol and botulin. ^[16, 17]

Parts use

Apart from the whole plant, seeds, root bark, root, stem, and leaves are also used.

Toxicity studies

Kumar *et al.* in 2006 carried out an experiment for toxicity studies of ethanolic extract of OT. When the extract was given in different groups of rat animals in a dose-dependent manner, after a particular time, the animals were observed for mortality, and it was found that there were no alterations in liver function markers such as serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase, serum bilirubin, and serum alkaline phosphatase ^[18].

Another acute toxicity study was also done by Bhande *et al.* in 2006 in healthy albino mice for toxicity studies. In this study, healthy male/female albino rats were divided into eight different groups containing six mice in each group. Acacia suspension was administered orally at a dose of 0.5 ml in one group while root suspension of OT was administered at the dose of 10, 30, 100, 200, 400, 600, and 800 mg/kg, respectively. After then, the animals were observed at different time intervals for 1 week. Findings showed that root suspension of OT did not cause any toxic action in each group ^[19].

An experiment on toxicity study was carried out by Sharma and Singh in 2012a to evaluate the acute oral toxicity using the methanolic extract of OT in mice and its LD₅₀ value was found to 1917.66 mg/kg ^[20].

Pharmacological Profile

Antimicrobial activity (antibacterial activity)

The antimicrobial agents derived from plant extracts cause leakage from the interior of cells by tampering with the function of the membranes or hindering with intermediary metabolisms or DNA/RNA synthesis/function and thus prevent the bacterial cell wall or protein synthesis.

Alam *et al.* in 2010 determined the antimicrobial efficacy of

the petroleum ether and ethanolic extracts of leaves of OT for their antimicrobial activity. The antimicrobial activity was evaluated by standard disc diffusion method against Gram-positive bacteria such as *Streptococcus haemolytica* and *Bacillus subtilis* and Gram-negative bacteria such as *Pseudomonas aeruginosa*, *Shigellasonnei*, and *Shigella dysenteriae*. The ethanolic extract revealed a significant zone of inhibition in various human pathogenic organisms, and thus, the minimum inhibitory concentration (MIC) was found which ranged from 0.13–0.75 mg/mL while petroleum ether extract did not reveal any significant zone of inhibition [21].

In another study, Srivastava in 1984 and Bauer *et al.* in 1951 observed the antibacterial potential in *I. turpethum* using the standard disc diffusion method. The crude extracts of this plant prepared in petroleum ether, chloroform, and ethyl acetate, and three compounds H-1, H-2, and CH-2, viz., β -sitosterol- β -D-glucoside; 22,23-dihydro- α -spinosterol- β -D-glucoside, and salicylic acid (2-hydroxy benzoic acid), respectively, isolated from chloroform stem extract of this plant were employed against 13 human pathogenic bacteria, out of which six bacteria were Gram negative and seven Gram positive. These were assembled from the Institute of Nutrition and Food, University of Dhaka, and International Centre for Diarrhoeal Disease Research, Bangladesh. All extracts and isolated compounds were solubilized in methanol at a concentration of 200 and 100 μ g/10 μ L, respectively. Nutrient broth and nutrient agar were employed as bacteriological media. Kanamycin was used as standard drug. The bacterio toxic action of these samples was examined against all the pathogenic bacteria, and by comparing with the approved kanamycin disc (K-30 μ g/disc), it was recommended that the bioactive compounds of this plant could be employed as antibacterial agents [22].

Antihepatotoxic activity

Most of the hepatotoxic chemicals damage liver cells mainly by inducing lipid peroxidation and other oxidative damages in the liver or by forming the reactive free oxygen radicals which directly causes hepatotoxicity or increasing the apoptosis or reducing glutathione stores an oxidant of the human body.

Kumar *et al.* in 2006 estimated the hepatoprotective activity of OT in paracetamol-induced hepatopathy (liver toxicity) in rats that causing acute centrilobular necrosis. The ethanolic extract of OT administered intraperitoneally at the dose of 100–2000 mg/kg body weight which revealed significant hepatoprotective activity in a dose-dependent manner. Here, silymarin was employed as a standard drug and thus showed a significant increment in hepatoprotective efficacy [23].

Vaidya *et al.* in 2010 carried out three experimental analysis and assessed the hepatoprotective action of oral administration of the herbomineral formulation of OT root powder in carbon tetrachloride-induced hepatotoxicity in rats [24].

Antinephrotoxic activity

Sharma and Singh in 2012a assessed the therapeutic Antinephrotoxic potential of a steroidal glycoside, stigma-5, 22dien-3-O- β -D-glucopyranoside in N-nitrosodimethylamine-induced renal carcinogenesis in male mice and hepatotoxicity in the liver of mice. The steroidal glycoside was isolated from the ethanolic fraction of root bark extracts of OT. When the ethanolic extract of the roots

and also the isolated compound was administered to mice at 400 and 50 mg/kg doses, respectively, it revealed a significant reduction of nephrotoxicity and hepatopathy [25].

Antiulcer activity

In an experimental study, the antiulcer activity of methanolic extracts of the stem of OT (MEOTS) and hydroalcoholic extracts of the stem of OT was assessed in aspirin and pyloric ligation-induced ulcer in male albino rats. It was studied by Ignatius *et al.* The MEOTS and hydroalcoholic stem extracts of OT administered at a dose of 100 mg/kg of body weight which showed a significant antiulcer activity. Ranitidine was used as a standard drug. Finally, it was observed that the hydroalcoholic stem extracts revealed better results than the methanolic extracts [26].

Analgesic activity

The analgesic agents block prostaglandin biosynthesis by inhibiting cyclooxygenase enzyme. Inhibition of this enzyme centrally produces the analgesic antipyretic effect, while inhibition of this enzyme peripherally produces its anti-inflammatory effect.

Prabhavathi *et al.* in 2012 carried out an experiment using tail flick method and acetic acid induced the writhing response. Diclofenac sodium was employed as a standard analgesic drug. When extract was administered orally in a dose-dependent manner, it was observed that the chloroform extract of OT exhibited better dose-dependent response than the petroleum ether extract [27].

Anti-arthritis activity

Sharma and Singh in 2013d carried out a study through the *in vitro* models of inhibition of protein denaturation to find the anti-arthritis activity of the ethanolic root extracts of OT. The ethanolic root extracts in various concentrations with bovine serum albumin were measured for the potency. Acetylsalicylic acid was used as a standard, and finally, a significant inhibition, i.e. 70%, was observed in the case of acetylsalicylic acid while 67.22% with the ethanolic extract [28].

Anti-venom

The root purgative and prescribed in scorpion sting and snake bite. Other Diseases healed by turbud. Turbud is also efficacious for other diseases like melancholia, leprosy, enlargement of spleen and paralysis. Its effectiveness magnifies threefold when mixed with *chebulic myroblan* [29].

Laxative effect

Samuel *et al* investigated the laxative effect of *Operculina turpethum* Linn. Leaf extract in mice weighing 28-34 gm. The dried leaves of turbud were successively extracted with hexane, chloroform and 70% methanol using cold maceration. 200 mg/kg and 400 mg/kg of each extract were administered and castor oil was used as positive control. The treatment of the mice with the extracts and castor oil produced various degrees of wet feces. The chloroform and methanol extract produced a significant ($P < 0.05$) dose and time dependent increase in the percentage of wet feces in the treated groups when compared to the negative control group. It is also observed that there is significant ($P < 0.05$) dose dependent increase in the intestinal motility in the treated mice when compared to the negative control. The

treatment of the mice with the extracts did not produce any significant ($P > 0.05$) change in the intestinal content volume when compared to the negative control. Therefore, validate the potent laxative activity of turbud^[30].

Safety Profile in Pregnancy

Unsafe, it should not be used in pregnancy. It is hot in potency, laxative and purgative. It can cause Abortion due to abortifacient activity^[31].

Precautions

Its use in children or in physically or mentally weaker persons or overdose of *Operculina turpethum* may lead to complications like excessive purgative activity, bleeding per rectum, vomiting, abdominal pain, chest pain, dehydration, hypotension, vertigo, confusion, shock, & unconsciousness^[32]. It should not be used in pregnancy, in children below 12 years of age, in elderly, in physically or mentally weaker persons, and in persons suffering from diarrhoea, bleeding per rectum, rectal prolapse, or fecal incontinence^[33]. Turbud may act as an abortifacient when used in pregnant ladies.

Future prospects

These studies may help in standardization, identification, and providing out further research in OT plant-based medicines which are applied in unani and modern pharmacopeia. More research is needed to isolate the various phyto-constituents present to get a clear idea of the mechanism of action of the plant. The presence of carbohydrates and reducing sugars in the plant shows the high energy content that could be utilized as a source of crude materials for pharmaceutical trades. Literature review observed that there is no clinical trials have been performed so far. Although few clinical trials have been reported safety and potency of turbud in some patients with rheumatoid arthritis and ascariasis, yet there is a lack of randomized, controlled clinical trial to confirm its effectiveness and safety. Such data are required to present scientific confidence to the customs use of traditional unani drugs such as turbud and even be helpful for the improvement of future drugs or therapy for diseases-related rheumatoid arthritis and cancer.

Conflicts of Interest

The author declares no conflict of interests.

Conclusion

The extensive literature survey clearly infers that *Operculina turpethum* is a very potent Unani medicinal plant which has diverse pharmacological actions and therapeutic indications. Preclinical and clinical studies with ample size may be done for further evaluation and validation of turbud with the help of modern scientific techniques.

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