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Unani Perspective and Recent Studies on Phytopharmacological Activities of *Operculina turpethum* Linn.: A Review

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Abstract
Turbud (*Operculina turpethum* Linn. syn. *Ipomoea turpethum*) belonging to family Convolvulaceae is commonly used since centuries in Unani system of medicine for the treatment of various disorders like paralysis, chronic cough, sciatica, melancholia, epilepsy, bronchitis, helminthiasis, constipation, haemorrhoids, anemia and hepatitis. Roots or stem bark of the plant is used in Unani system of medicine to treat a variety of diseases. A number of scientific studies have shown that *Operculina turpethum* possesses promising anti-ulcer, antibacterial, anti-inflammatory, anti-diabetic, cytotoxic, laxative, antioxidant and anti-diarrhoeal activities. This article discusses and summarizes the important medicinal actions, uses, phytochemistry and pharmacological activities of *Operculina turpethum* in the perspective of Unani literature as well as modern scientific research.

Keywords
Turbud, *Operculina turpethum*, Unani, laxative.

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INTRODUCTION
Operculina turpethum known as *Turbud* in Unani system of medicine is a large perennial twinner with milky juice and fleshy branched roots of the family Convolvulaceae. Leaves are variable in shape, flowers tubular-campanulate, white, in few flowered cymes, capsules globose with 4 or less, dull black, glabrous seeds [1]. The leaves are sharp and similar to the leaves of Lablab Kabeer. The colour of flowers is sky blue. Its fruit is like *Inderjoo* fruit. The drug occurs in two forms: white and black. White turpeth is preferred, as Black Turpeth produces drastic purgation which may be followed by vomiting, giddiness and even fainting [2].

Taxonomical Classification [3]**:**

Kingdom	Plantae
Division	Angiosperma
Class	Dicotyledons
Order	Solanales
Family	Convolvulaceae
Genus	Operculina
Species	O.turpethum
Botanical name	*Operculina turpethum/ Ipomoea turpethum*

Vernaculars [1,2,4,5]**:**

English	Turpeth, Indian Jalap
Arabic	Turbud
Hindi	Nisoth, Nisotar, Pithori
Unani	Fotroo, Shajratuz zarareeh
French	Turbith, Vegetal
Sanskrit	Trivrit, Kalaparni
Tamil	Shivadai, Kumbam
Telugu	Tellategada
Gujarati	Nashotar, Nahotara
Kannada	Bili tigade. Bangada balli

Habitat & Distribution:

Operculina turpethum is a convolvulaceous plant which is found throughout India, China, Ceylon, Australia. It is found throughout India up to 1000m, occasionally grown in gardens for ornament. This plant appears to be rarely cultivated in non-Indian regions of Asia [1,6].

Botanical description

Macroscopic characteristics:

It is a large perennial twinner with milky juice and fleshly branched root, stems very long, twining and much twisted together, angled and winged. Leaves 5-10 by 1.3-7cm, ovate or oblong, minutely reticulated veined; petioles 2-5cm long, pubescent. Cymes few flowered, peduncles stout, 2.5-5cm; pedicels 0.6-2.5cm. Outer sepal up to 2.2cm, long in flower, much enlarged in fruit, broadly ovate, concave, pubescent; the inner sepals smaller, scarcely 2cm, long very thinly membranous. Corolla white, 3.8-5cm. Anthers nearly 8mm, long, narrowly oblong [7]. The central woody portion is removed by splitting the bark on one side before the use, external surface longitudinally furrowed giving the drug a rope-like appearance; fracture short in bark and fibrous in wood; odour distinct but unpleasant; taste somewhat nauseating at first, then slightly acrid [1].

Microscopic Characteristics:

The epidermis consists of tubular brown cells; the parenchyma is starchy, in it are thick, scattered, very large resin cells and various rosettes like raphides. Many large vascular bundles are composed of large dotted vessels surrounded by wood fibres, each of prominent external ridges of the bark contains one of these bundles.

The central cane-like woody column of the root or stem ehen present, is seen to be divided into four parts by four bands of parenchyma (medullary rays); it consists of large dotted vessels connected together by narrow portion of woody fibre. In structures, the black nisoth is similar to the white [8].

Part Used: Different parts of plant of *Operculina turpethum* are used for medicinal purpose like roots or stem bark [8].

Temperament: It is Hot in 3rd degree and dry in 2nd degree [9]. But *Ibn e Baitar* considered it Hot and dry in 3rd degree [4]. Some Unani scholars considered it Hot and dry in 2nd degree [5].

Dosage: Therapeutic dose of *Turbud* varies in different Unani classical texts as follows:

3-5gm [9]

4-7gm [4]

6-12 gm [10]

Toxicity: *Turbud* (*Operculina turpethum*) is harmful for intestine, causes nausea and vomiting [1,5].

Correctives: It is fried (charb) with *Raughan Badam* (almond oil) after peeling its black covering [5].

Substitute:

Ghariqoon (*Agaricus alba* Linn.)

Jalap (*Ipomoea purga*) [1,5]

Compound Formulations: There are various formulations used in Unani system of medicine which contain *turbud*. Commonly used formulations and their main indications are as follows:

- **Itrifal Ustukhuddus**: It is used mainly for the treatment of *Fālij* (Paralysis), *Nazla Muzmin* (Chronic rhinosinusitis), *Ṣar'*(Epilepsy), *Ṣudā'* (Headache) [9]
- **Majoon Najah**: It is used in Unani system of medicine mainly for the treatment of *Mālankhūliyā* (Melancholia), *Ikhtināq al-Raḥim* (Hysteria), *Qolanj* (colitis) [11].

Pharmacological Actions: Turbud is described to possess several pharmacological actions in unani classical text which are as follows:

- *Mushil-e-Balgham wa Ṣafrā* (Purgative of phlegm and yellow bile) [4,5,10]
- *Musaffi Dam* (Blood purifier) [11]
- *Muqawwi Asaab* (Nervine tonic) [11]
- *Munaqqi Dimagh wa Meda wa Raham* (Purifier for brain, stomach and uterus) [5]
- *Mufatteh Sudad* (Deobstruent) [5]
- *Qatil Kirme Shikam* (Anthelmintic) [7]
- *Mushil* (Purgative) [7]
- *Dafe Ḥummā* (Antipyretic) [7]
- *Munaffis* (Expectorant) [7]
- *Mulaiyan* (Laxative) [7]

Therapeutic Uses: Various therapeutic uses of Turbud i.e. *Operculina turpethum* are as follows:

- *Fālij* (Paralysis) [5]
- *Surfa Muzmin* (Chronic cough) [5]
- *'Irq al-Nasā* (Sciatica) [5]
- *Mālankhūliyā* (Melancholia) [5]
- *Ṣar'*(Epilepsy) [5]
- *Junoon* (Schizophrenia) [5]
- *Iltihāb al-Shu'ab* (Bronchitis) [12]
- *Deedan-e-Ama* (Helminthiasis) [12]
- *Istisqā* (Ascites) [12]
- *Baraṣ* (Leucoderma) [12]
- *Qarḥa* (Ulcers) [12]
- *Māshrā* (Erysipelas) [12]
- *Bawāsīr* (Haemorrhoids) [12]
- *Yaraqān* (Jaundice) [12]
- *Qabḍ* (Constipation) [12]
- *Waja'al-Mafāṣil* (Arthritis) [12]
- *Faqr al-Dam* (Anemia) [13]
- *Waram al-Kabid* (Hepatitis) [13]
- *Amraz-e-Jild* (Skin disorders) [13]
- *Ḥudār* (Rheumatism) [13]
- *Niqris* (Gout) [13]
- *Bayāḍ al- 'Ayn* (Corneal opacity) [14]
- *Āshob-i-Chashm* (Conjunctivitis) [14]

Phytochemical Constituents:

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 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 insoluble in ether, but soluble in alcohol. Alcoholic extract of *O. turpethum* showed the presence of glycosides, saponins, flavanoids, steroids and carbohydrates. Turpethin is mainly responsible for its purgative action. The plant contains b-sitosterol, alpha and beta turpethin, lupeol and botulin [1,2].

Pharmacological Studies:

The extracts and phytochemical compounds or components of *Operculina turpethum* revealed various pharmacological properties which include antiulcer, CNS depressant, antibacterial, anti-inflammatory and laxative activities etc. Following are the reported pharmacological activities of *Operculina turpethum*:

- **Anti-ulcer activity:** The study showed that mehanolic and hydroalcoholic extract of *Operculina turpethum* possess enhanced ulcer preventive and protective activities when compared with the standard drug ranitidine. Further the result of the histopathological and biochemical studies also confirmed potent ulcer preventive and protective nature of extracts in a similar manner [15].
- **Analgesic and CNS depressant activity:** The study showed CNS depressant activity of *Operculina turpethum* on experimental animal models. *Operculina turpethum* was extracted with ethanol and investigated for its CNS activity in experimental model of mice. The extract produced a dose dependent reduction in the onset and duration of pentobarbitone induced hypnosis, reduction of locomotor and exploratory activities in the open field at the dose level of 250 mg/kg and 500 mg/kg body weight. At the same dose labels, the extract dose dependently inhibited acetic acid induced writhing in mice [16].
- **Anti-inflammatory activity:** In present study the effect of oral root powder of *O. turpethum* was evaluated on rat paw edema in albino rats. The study validated that pre-treatment with the root powder of *O. turpethum* reduced the formalin induced edema volume to the extent of 36.45% hence proving its anti-inflammatory activity [17].
- **Antibacterial and cytotoxic activities:** Three compounds H-1 (β-Sitosteryl-β-D glucoside), H-2 (22, 23-dihydro-α-spinosteryl glucoside) and CH-2 (salicylic acid) isolated from the chloroform extract of stem of Ipomea turpethum and the crude petroleum ether, chloroform and ethyl acetate extracts were screened against thirteen

pathogenic bacteria for their antibacterial activities. The crude petroleum ether, chloroform and ethyl acetate extracts and compound CH-2 showed moderate activities and H-1 and H-2 showed little activities against some gram-positive bacteria (Bacillus subtilis, Bacillus megaterium, Staphylococococcus aureus, Sarcina lutea, Streptococcus β-hemolyticus, Pseudomonas aureginosae, Sarcina sarcinaceae) and some gram negative bacteria (E.coli, Shigella dysenteriae). Results of antibacterial activity results showed that the crude extracts and the compound CH-2 showed significant antibacterial activity. The results of cytotoxicity test reported that the ethyl acetate extract is much more cytotoxic than chloroform extract [18].

- **Hepatoprotective activity:** The study reported that ethanolic extract of *Operculina turpethum* possess hepatoprotective activity. The ethanolic extract obtained from roots of *O. turpethum* was evaluated for hepatoprotective activity in rats by inducing liver damage by paracetamol. The ethanol extract at an oral dose of 200 mg/kg exhibited a significant protective effect by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase and total bilirubin. These biochemical observations were supplemented by histopathological examination of liver sections [19].
- **Antimicrobial activity:** The antibacterial properties of leaf and callus extracts of Ipomea turpethum were screened against human pathogenic bacteria by well diffusion method. The results showed that among the extract tested, significant inhibitory activity was observed in ethanol extract of leaf callus, the aqueous extract did not show any significant activity [20].
- **Anticancer and antioxidant activities:** The study investigated antioxidant activity of methanolic extract of O. turpethum stems (100 mg/kg for 45 days) on 7, 12 dimethylbenz(a)anthracene (DMBA) induced breast cancer in female Sprague-Dawley rats. A significant increase in lipid peroxidation levels were observed in tested samples of cancer induced rats while the activities of enzymatic antioxidants such as Superoxide dysmutase, catalase, glutathione peroxidase and nonenzymatic antioxidants like glutathione, ascorbic acid and alpha tocopherol were decreased in cancer bearing animals when compared to controlled animals. A significant (P-0.05) increase in breast tumor weight was observed in DMBA group while breast tumor weight decreased significantly in combination of DMBA and *O. turpethum* extract group. Investigators of this experiment recommended the use of the bioactive compounds from *O. turpethum* as supplementary to anticancer medicines [21].
- **Antidiarrhoeal, antispasmodic and bronchodilator activities**: The study reported that the crude extract of *O. turpethum* possesses antidiarrhoeal, antispasmodic and bronchodilator activities, mediated possibly through the presence of Ca^{++} antagonist like constituent(s). In the castor oil-induced diarrhoea in mice, the crude extract of *O. turpethum* caused a dose-dependent (300–1000 mg/kg) protection from diarrhoea, similar to that of loperamide. In isolated rabbit jejunum preparations, *O. turpethum* produced a dose-dependent inhibition of spontaneous and high K+ (80 mM)-induced contractions with resultant median effective concentrations (EC50 with 95% confidence interval) of 1.04 mg/ml (0.59-1.54) and 0.12 mg/ml (0.10-0.15; n = 4) respectively, thus showing more potency against K+. Pretreatment of the tissue with OTB (0.01 and 0.03 mg/ml) caused a rightward shift in the concentration response curves of Ca++, similar to that of verapamil. Activity-directed fractionation showed that the ethyl acetate fraction was more potent than the parent crude extract and hexane fraction [22].
- **Antidiabetic activity:** The study revealed that the methanolic extract of *O. turpethum* stem (MEOTS) and methanolic extract of *O. turpethum* root (MEOTR) are capable of exhibiting significant anti-hyperglycemic activity in STZ - induced diabetic rats and hypoglycemic activity in healthy, glucose loaded rats. The antidiabetic potential of MEOTS and MEOTR was evaluated in the Streptozotocin (STZ) - induced type 2 diabetic models. When compared MEOTS produced more significant effect on blood glucose level [23].
- **Laxative activity:** The present study showed a potent laxative activity of the extract of *Operculina turpethum*. The laxative activity of *O. turpethum* leaves was investigated using in vivo models; faecal consistency, intestinal motility and enteropooling in mice. The chloroform and methanol extract of *O. turpethum* produced a significant ($P < 0.05$) dose- and time-dependent increase in the percentage of wet faeces in the treated groups when compared to the negative

control group. The extract caused a 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 [24].

CONCLUSION

Turbud (*Operculina turpethum*) is an important curative plant which is efficiently used for the treatment of diverse disorders in Unani system of medicine since centuries. The plant is traditionally claimed to possess various pharmacological actions like *Mushil-e-Balgham wa Safra* (Purgative of phlegm and yellow bile), *Musaffi Dam* (Blood purifier), *Muqawwi Asaab* (Nervine tonic), *Mufatteh Sudad* (Deobstruent), *Qatil Kirme Shikam* (Anthelmintic), *Mushil* (Purgative), *Dafe Humma* (Antipyretic), *Munaffis* (Expectorant) and *Mulaiyan* (Laxative) [5,7,11]. The above review reveals that the plant has various potent pharmacological activities. *O. turpethum* plant was found to have promising anti-ulcer, antibacterial, anti-inflammatory, anti-diabetic, cytotoxic, laxative, antioxidant and anti-diarrhoeal activity. The plant possess various pharmacological actions may be due to the presence of turpethin, turpethinic acid and other constituents. The presence of glycosidic resin and other phytoconstituents may open new routes for exploring various potential of the plant. Further research is required to isolate different phytoconstituents present to get an apparent idea of the mechanism of action of the plant. The present literature review concludes that the plant *Operculina turpethum* possess high medicinal value.

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