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Review Article

Prophylactic aspects and therapeutic potential of Turbud (*Operculina turpethum* L.) in Unani medicine: An evidence-based appraisal

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Abstract

Turbud (*Operculina turpethum* L.) belongs to the family Convolvulaceae, a potent and well-known medicinal herb, used in Unani system of medicine to treat several diseases. It is a large perennial twinner with milky juice. Roots are long, slender, fleshy, and much branched. In classical text, it is mentioned that *Turbud* which is white in colour, light weighted and having resin on both ends is of good quality. In Unani system of medicine, its main actions are expectorant and laxative and used in several diseases like arthritis, ascites, gout, hemiplegia etc. According to *Ibn Sina* use of *Turbud* along with *zanjabeel* is more effective. It has been used as an important component in many compound formulations such as *Itrifal Ustu-khud'dus*, *Itrifal Zamani*, *Itrifal Muqil*, *Itrifal Mulaiyyin*. The major chemical constituents present are turpethin, glucoside, jalapine, convolvulin etc. *Operculina turpethum* L. is validated for its different pharmacological actions like anti-inflammatory effect, and ulcer protective etc. The present review comprehensively embodied its phytochemical, pharmacological and pharmacognostic description.

Keywords: Turbud, convolvulin, turpethin, traditional medicine, Unani

1. Introduction

Operculina turpethum (L) belongs to the family Convolvulaceae. The family comprises 55 genera and 1650 species, which are found in the tropical region of the world. In India, the family is represented by 177 species belonging to 20 genera[1]. It is native to India, Pakistan, Nepal, Bangladesh, Sri Lanka, China, South Asian countries as well as in African and Australian continents [2]. It is a large perennial twinner with milky juice [3-6]. Roots are long, slender, fleshy, and much branched. Stems are very long, twining, and much twisted together, angled and winged pubescent, tough and brown when old. Leaves are 5-10 x 1.37 cms, ovate or oblong, rarely slightly lobulate, subacute, pubescent on both sides especially when young, minutely reticulately veined, base cordate or truncate; petioles 2-5cm long, pubescent [4,5,6]. Cymes few-flowered; peduncles stout, 2.5-5cm long; bracts large, lanceolate, pubescent reaching 2.5cm long, caduceus, often pinkish; pedicels 0.6-2.5 cm, long, pubescent, slightly thickened upwards. Outer sepalsupto 2.2cm, long in flower, much enlarged in fruit, broadly ovate or suborbicular, obtuse, 2cm long, very thinly membranous, glabrous, apiculate. Corolla is white 3.8-5cm long, and subcampanulate. Anthers are 8mm long, narrowly oblong, cordate, capsules 13-8mm diameter, globose, enclosed in the enlarged brittle, very imbricate sepals, glabrous or faintly pubescent [2].

2. Taxonomical Classification

Kingdom	:	Plantae
Subkingdom	:	Tracheobionata
Super division	:	Spermatophyta
Division	:	Angiosperma
Class	:	Dicotyledons
Order	:	Solanales
Family	:	Convolvulaceae
Genus	:	Operculina
Species	:	*O. turpethum* (L.) Silva Manso [2]

3. Vernaculars

Arabic	:	Turbud
Persian	:	Turbud
English	:	Turpeth root, Indian jalap [3]
Bengali	:	Teudi, tvuri, Dhdhakalami
Gujarati	:	Kala Nashotar [3]
Hindi	:	Nishothra [3]
Oriya	:	Dudholomo
Punjabi	:	Nisot[9], chitabansa [3]
Sanskrit	:	Shyama, Tribhandi [3]
Tamil	:	Kumbam, sivadai [3]
Telugu	:	Tella, Tegada
Urdu	:	Turbud [3, 4]

4. Description

4.1 Macroscopic

Roots occur in pieces, 1.5-15 cm long, 1-5 cm diameter usually unbranched, cylindrical elongated, bearing thin rootlets; thicker pieces, occasionally split and show central wood portion; surface dull grey, reddish-grey to light brown, showing deep furrows or longitudinal wrinkles giving a rope-like or columnar appearance; transversely cut surface shows thick, whitish bark and light yellow centre; fracture in bark short; in wood fibrous, odour indistinct; taste slightly acrid and nauseating when kept in the mouth for some time.

a. Fruit of *Operculina turpethum*

b. Leaves of *Operculina turpethum*

c. Root of *Operculina turpethum*

4.2 Microscopic

The epidermis consists of tubular brown cells; parenchyma is starchy and thick, scattered very large resin cells and various rosettes like raphides. 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 cortica1 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 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 intra-axillary 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 food 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].

5. Unani Description

5.1 *Mahiyat*

Operculina turpethum is called *Turbud* in Arabic. The word *Turbud* is considered to be coined from its Sanskrit name Tripatak meaning triangulated as its stems are triangulated[8]. Upper surface of its root is whitish brown and after peeling the inner side appears white in colour. It has a central woody portion like carrot which is removed by splitting on one side. The outer brownish surface is peeled and then the middle portion is used as medicine[10]. The taste of fresh root is sweet followed by sour, old root has no specific taste [8]. It is branched with pointed leaves, flowers are sky blue in colour some physicians stated that the colour of flower is white, blue, and blackish red in the morning, evening and night respectively. It is most found over the banks of river in India and Khorasan[10]. Unani writers have mentioned it has two variants white and black, the black variant is advised not to be used, as it produces harmful effects and poisonous in nature. *Ibn Sina* described the name of *Turbud* and according to him, the first among the Arabs who prescribed it was Rhazes[11,12]. *Turbud* which is white in colour, light weighted and having resin on both ends is of good quality. The worst quality of Turbud is one which grows alongside of river as it causes pain in the stomach and is not purgative. According to *Ibn e Sina*, use of *Turbud* along with *zanjabeel* is more efficacious [8].

5.2 *Mizaj* (Temperament)

Haar 3° [8] Yaabis 2° [8, 10]

5.3 *Hissa e mustamila* (part used)

Apart from the whole plant, seeds, root bark, root, stem, and leaves are also used [3].

5.4 *Af'al* (Action)

- *Mushil-wa- Mukhrij Balgham*
- *Daaf-e-Hummiyat-e-Harah*
- *Munaffis-e Balgham*
- *Mudir-e-bol*
- *Daf-e-Waja ul Mafasil* [10]
- *Munaqqi-e-Dimagh* [8]

- *Mushil*
- *Mulayyin*[13, 3]

5.5 *Istemal* (Therapeutic Uses) [14,15]

- *Istisqa*
- *Waja ul Mafasil*
- *Irq un Nisa*
- *Laqwa*
- *Falij*
- *Zeeq-un-Nafas*
- *Junoon*
- *Sara*
- *Bawaseer*
- *Niqras*
- *Melancholia*

5.6 *Mazarrat* (Toxicity)

For intestines [16]

5.7 *Musleh* (Corrective)

Roasted in Roghan e badam [10, 17]

5.8 *Badal* (Substitute)

Beekh e Toot [10]

Ghareqoon[10, 17]

Kaala dana [17]

5.9 *Miqdar e khurak* (Dosage)

3-5gm in the form of Safoof (powder)[10]

5-7 gm in form of Joshanda (decoction)

5.10 *Murakkabat* (Formulations)

Itrifal Ustu-khud'dus, Itrifal Zamani, Itrifal Muqil, Itrifal Mulaiyyin, Jawarish Ood-e Mulaiyyin, Jawarish Kamooni, Habb-e-Mafasil, Habb-e- Aftimoon, Habb-e-Istisqa, Habb-e-Ayarij, Habb-e-Suranjan, Sharbat Mus'hil, Majoon-e-Anjeer, Majoon-e-Sana, Majoon-e-Suranjan, and Majoon-e-Najah [14]

6. Pharmacological Actions

Anthelmintic, Purgative, Antipyretic [4, 18], Expectorant, Carminative [18], Cathartic [6]

7. Chemical constituents

It contains resin known as turpethin present in root bark, glucoside, jalapine, convolvuli insoluble in ether, benzene, and carbon sulphide. It also contains some ether soluble resin, volatile oil, yellow colouring matter, albumin, starch, lignin, salts, ferric oxide[3]. Turpethinicacids A, B, C, D and E [2,4] glycosides, saponins, flavanoids, steroids and carbohydrates, starch, glucoside, scopoleptin, triterpenes (etulinic acid, betulin, and lupeol), sitosterol glucose and rhamnose[14].

8. Evidence-based research

8.1 Anti-inflammatory

Anti-inflammatory potential of different extracts (*ethanolic, aqueous and ethereal*) of *O. turpethum* has been reported in carrageenan-induced paw oedema, cotton pellet-induced granuloma and formalin induced arthritis animal model of rats. The *aqueous* extract was reported more potent fraction in all three animal models[19]. In another study, pre-treatment of roots of *O. turpethum* and its polyherbal formulation; Avipattikar Churna (100 mg/kg body weight) showed anti-inflammatory activity in rat paw oedema induced by formalin in experimental animal model[20].

8.2 Analgesic

Chloroform and petroleum ether extract of *O. turpethum* at different doses (125, 250, 500, 1000 mg/kg) showed potent analgesic activity against various types of pain stimuli in mice [21].

8.3 Anti-ulcer Activity

Oral administration of hydro-alcoholic and methanolic extract of *O. turpethum* at the dose of 100 mg/kg body weight exhibited potent anti-ulcer activity in aspirin and pylorus ligation (APL) rat animal model. This study further substantiated anti-ulcer activity as per the biochemical and histopathological parameters when compared with standard drug Ranitidine. Hydroalcoholic extract showed better effect than the methanolic extract[22]. In another study, *O. turpethum* exhibited potential anti-ulcer activity at the dose of 100 mg/kg body weight given orally in pylorous ligated albino rat model [23].

8.4 Anti-diabetic Activity

Methanolic extract of *O. turpethum* roots and stems revealed anti-diabetic activity in Streptozotocin induced type-2 diabetic animal modelat the dose of 100 mg/kg of body weight[24]. In another study, the antidiabetic activity of *O. turpethum* was found in alloxan-induced diabetes in rats at dose of 500mg/kg body weight orally [25].

8.5 Anti-diarrhoeal Activity

The crude extract of *O. turpethum* exhibited anti-diarrhoeal effect in the castor oil induced diarrhoea animal model, similar to that of Loperamide (10 mg/kg) at a dose dependent manner (300-1000 mg/kg body weight) [26].

8.6 Hepato-protective Activity

Ethanolic extract of *O. turpethum* showed hepatoprotective effect in Paracetamol induced hepatotoxicity in rat in a dose dependent manner (100-200 mg/kg body weight). Results showed significant reduction in the serum levels of SGOT, SGPT, Alkaline Phosphatase and Bilirubin[27]. It also has hepatoprotective and anticlastogenic effects against N-nitrosodimethylomine induced hepatic fibrosis[28]. It manifested therapeutic effects by significantly restoring the enzymatic levels and reducing the hepatic damage in mice[29]. *Methanolic* extract of *O. turpethum* rhizomes at the dose of 200, 400mg/kg body weight per oral showed significant ($p<0.05$) hepatoprotective activity against Carbon tetrachloride induced liver damage in Wister albino ratsby lowering the serum levels of various biochemical parameters such as serum glutamic oxaloacetate transaminase (SGOT), serum glutamic pyruvates transaminase (SGPT), alkaline phosphatase (ALP), total bilirubin (TBL), total cholesterol (CHL) and by increasing the levels of total protein (TPTN) and albumin (ALB) [30].

8.7 Anti-microbial Activity

O. turpethum has manifested antimicrobial activity against gram-positive and gram-negative bacterial strains such as Staphylococcus aureus, Bacillus subtilis, Streptococcus haemolytica, Micrococcus luteus, Micrococcus pyogenes, Enterococcus faecalis, Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi, Shigelladysenteriae and Shigellasonnei [31].

In another study, antibacterial activity has been investigated against Shigellaboydii, Shigelladysenteriae, Escherichia coli, Proteus vulgaris, Salmonella typhi, Staphylococcus epidermidis, Streptococcus pyogenes, Staphylococcus aureus, Enterococcus faecalis by disc diffusion and broth macro-dilution assay [32].

8.8 Anti-cancer Activity

Methanolic extract of *O. turpethum* stems at the dose of 100 mg/kg body weight retrieved the level of antioxidant enzymes such as Superoxide Dismutase (SOD), Catalase (CAT), Glutathione Peroxidase (GPx) and non-enzymic antioxidants like Glutathione (GSH), Ascorbic acid (Vitamin C), Alpha-tocopherol (Vitamin E) and inhibited the levels of lipid peroxidation on 7, 12 dimethylbenzanthracene (DMBA) induced breast cancer in female Sprague-Dawley rats [33]. Another study showed ameliorating effects of *O. turpethum* and its isolated Stigma-5, 22 dien-3-o-β-Dglucopyranoside on haematological parameters in male mice exposed to a potent carcinogen N-nitrosodimethylamine. The ethanolic and chloroform extract of *O. turpethum* showed dose-dependent inhibition of cell growth. Extract of chloroform showed highest inhibition in comparison to ethanolic extracts [34].

8.9 CNS Depressent activity

Ethanoic extract of *O turpethum* in a dose of 500 mg/kg/bw showed depressant activity in rats [35].

8.10 Laxative effect

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. There was a dose dependent increase in the intestinal motility in the treated mice [36].

8.11 Anti-obesity activity

The roots of *O. turpethum* are beneficial in treating fatty liver and improving fat metabolism in the liver. It works effectively against obesity by decreasing excessive body fat [37].

8.12 Anti-arthritic activity

A study was carried out through the in vitro models of inhibition of protein denaturation to find the anti-arthritic activity of the *ethanolic* root extracts of *O. turpethum*. The 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 [38].

8.13 Anti -tumor activity

A study was conducted in which antitumor activities of *Operculina turpethum extract* (OTE) was investigated by MTT and clonogenic assay, effect on cell cycle and apoptosis induction by Annexin-V/propidium iodide (PI) staining and flow cytometry and invasive potential of the tumor was determined by matrigel assay. It was concluded that OTE specifically inhibited the growth and colony formation of oral squamous cell carcinoma cells (OSCC) in a dose-dependent manner via inhibiting NF-κB and its downstream target COX-2. It also limits the invasion capacity of OSCC cells by up to 55–60% [39].

8.14 Larvacidal activity

In a study, the petroleum ether and acetone extracts of *Operculina turpethum* showed mosquito larvicidal action against Anopheles stephensi malarial vector [40].

9. Conclusion

In this review, an effort has been made to gather information on pharmacological actions, therapeutic uses, and morphological description including unani explanation. Survey of literature revealed the presence of Turpethinic acids A, B, C, D and E glycosides, saponins, flavanoids, steroids and carbohydrates, starch, glucoside, scopoleptin, triterpenes (etulinic acid, betulin, and lupeol), sitosterol glucose and rhamnose and other phytochemcials also. Activities of various extracts have been proven for several pharmacological actions like anti-obesity, CNS depressant, antimicrobial etc. Hence, the extensive literature survey clearly implies that *O. turpethum* is a very effective Unani medicinal plant which was used since ages in traditional medicine and further preclinical, clinical and safety studies are required for its safe, and efficient use, so that it can be beneficial for the masses.

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11. Conflicts of interest

There is no conflict of Interest.

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