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Critical review on phytopharmacological attributes of *Operculina turpethum* (L) Silva Manso

Original Article

Manisha Mohapatra
Department of Biotechnology, Trident Academy of Creative Technology, Bhubaneswar, Odisha-751024, India
ORCID: 0000-0001-9883-1555
manishamohapatra7@gmail.com (corresponding author)

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Abstract:

Medicinal plants contain numerous bioactive compounds with significant therapeutic potential and are widely used in the synthesis of various drug formulations. *Operculina turpethum* (L.) Silva Manso (family: Convolvulaceae), commonly known as Nishoth and Tihudi, is one such valuable climbing plant native to India. Its different plant parts have several ethno-medicinal and pharmacological attributes. Since ancient times, it has been used as an anti-tumor, anti-fungal, anti-hypertensive, asthma inhibitor, anti-ulcer, and antioxidant agent. The current study is a compilation of the morphological and pharmacological activities of *Operculina turpethum*, along with validation of its geographical distribution and phytoconstituents, to provide a brief idea of its therapeutic potential. The plant consists of several phyto-constituents, including α- and β-turpethein, turpethinic acids, lanosta-5-ene, etc. The study focuses on a complete plant profile, including its availability and propagation practices. This review examines each part of *O. turpethum*, including its structural morphology, phytochemical composition, and therapeutic properties.

Key words:
Operculina turpethum, Convolvulaceae, pharmacological properties, phyto-constituent

Apstrakt:

Kritički pregled fitofarmakoloških osobina Operculina turpethum (L.) Silva Manso

Lekovite biljke sadrže brojna bioaktivna jedinjenja sa značajnim terapijskim potencijalom i široko se koriste u sintezi različitih farmaceutskih preparata. *Operculina turpethum* (L.) Silva Manso (familija: Convolvulaceae), poznata i pod imenima Nishoth i Tihudi, predstavlja jednu od značajnih penjačica koja je autohtona u Indiji. Različiti delovi biljke poseduju brojne etno-medicinske i farmakološke osobine. Još od davnina, koristi se kao antitumorski, antifungalni, antihipertenzivni agens, inhibitor astme, antiulcerativno sredstvo i antioksidant. Sadašnja studija predstavlja pregled morfoloških i farmakoloških aktivnosti *Operculina turpethum*, zajedno sa potvrdom njene geografske distribucije i fitosastava, kako bi se dala kratka predstava o njenom terapijskom potencijalu. Biljka sadrži više fitosastojaka, uključujući α- i β-turpetein, turpetinske kiseline, lanosta-5-en i druge. Studija se fokusira na kompletan profil biljke, uključujući njenu dostupnost i metode razmnožavanja. Ovaj pregled analizira svaki deo *O. turpethum*, uključujući strukturnu morfologiju, fitohemijski sastav i terapijske osobine.

Ključne reči:
Operculina turpethum, Convolvulaceae, farmakološka svojstva, fito-sastojak

Introduction

Plants are the most critical source of natural therapeutic compounds that enhance longevity and quality of life, and they are gaining prominence worldwide (Parekh & Chanda, 2007). These are a valuable sources of a wide array of bioactive compounds, synthesized and economically beneficial for various commercial applications across several medicinal industries. Egression of quest in plant-based health care nowadays paved the way for the use of medicinal flora in drug formulation processes instead of synthetic chemical compounds (Gondaliya et al., 2014). This revitalization of interest in medicinal flora has led to increased global market demand and to adulteration with substitutes of minimal or no medicinal potency (Sarwat et al., 2011). Due to the diminishment of its natural habitat and ruthless harvesting practices, many of plant species are on the verge of extinction. The use of indigenous

knowledge for healing practices is a valuable approach that promotes sustainable livelihoods by harnessing unexplored natural resources in local communities. Indigenous knowledge often includes a deep understanding of medicinal plants and their healing properties. Integrating traditional medicine with modern healthcare practices can provide holistic, sustainable healthcare solutions while also supporting the conservation of medicinal plant species (Sarwat et al., 2011).

The systematic attempt to understand the secondary metabolites of medicinal plants will definitely help to mitigate the threat status and ensure the quality of the species. Scientific validation of such documentation, combined with ethno-pharmacological studies of specific medicinal herbs, will facilitate the estimation of the safety and efficacy of traditional medicinal practices. In this context, *Operculina turpethum* (L.) Silva Manso is one of the indispensable RET medicinal plants in the family Convolvulaceae and has very diverse medicinal uses, particularly in Ayurvedic and Unani Systems of Medicine (Alam et al., 2010; Hoq et al., 2019). It has several common local synonyms, viz. Trivrit, Turbud, Nishoth, Dudholomo, Tihudi, etc. This medicinal plant is unique in both its morphological appearance and its phyto-pharmaceutical applications.

To date, several studies have been conducted on this plant; however, most findings focus either on validating specific therapeutic attributes of the plant or on the phytochemicals present in its various parts. Most of these articles are based on research into specific attributes. Some review articles, though available, present the plant mostly from an Ayurvedic perspective. However, this article is a comprehensive compilation of all aspects of this plant, including morphological structure, taxonomic classification, types, distribution, phytochemical composition, and pharmacological properties. Furthermore, this article also provides an Ayurvedic perspective on the use of this plant in the preparation of many drug formulations. The above study is unique in that it not only validated the plant and compiled all its biological attributes associated with all plant parts but also examined its use in the development of Ayurvedic formulations, along with available techniques suitable for plant propagation.

Materials and Methods

The review article discusses the validation of *Operculina turpethum* (L.) Silva Manso for its morphological, phytochemical, and pharmacological properties. The literature search included taxonomic, pharmacognostic, and phytochemical validation of Nisoth, along with validation of its pharmacological applications. For this purpose, we have considered the most relevant articles from PubMed/MEDLINE, EMBASE, Scopus, ScienceDirect, ScopeMed, Scifinder, and Google Scholar. The articles were selected from the database using relevant keywords and their combinations, such as *Operculina turpethum*, plant morphology, phytochemistry, and pharmacological applications. Several studies have been carried out to validate the use of the *Operculina turpethum* plant for its morphological and phytopharmacological attributes, which are extensively used in the treatment of various diseases. Statistical data from ScienceDirect on the same shows only around 100 articles in this direction. However, the present study is a comprehensive compilation of the taxonomic, morphological, phytochemical, and pharmacological attributes of the plant. In this study, importance is also given to Ayurvedic Rasa panchak, organoleptic characteristics, and its Ayurvedic properties to justify the plant's potency in Ayurvedic formulations.

The inclusion criteria included only studies on the use of the plant in relation to its geographical distribution, classification, available types, current phytochemical profile, and use in the treatment of different disorders (irrespective of the plant part used), as well as all possible formulations and their impact. Database searches could retrieve a total of 400-500 review papers using the aforementioned keywords. The remaining articles (around 1000-2000) were mostly research articles evaluating the specific therapeutic properties of the plant or its associated bioactive compounds. The quality screening considered parameters like relevance to the theme. The plant has been widely utilised in the Ayurveda system for the treatment of many disorders. In the following sections, a brief description of the plant is provided.

Common name & botanical classification

Operculina turpethum (L) Silva Manso is a medicinal plant from the Convolvulaceae family with several synonym names. It is an indigenous plant that is endemic to India (Wealth of India, 1952). Some of its common vernacular names include Turpeth and/or Nisoth in Hindi, Trivrit in Sanskrit, Indian Jalap or Turpeth in English, Tegada in Telugu, Turbud in Bengal, and Tihudi or Dudholomo in Oria (Alam et al., 2010; Hoq et al., 2019; Kirtikar & Basu, 2003). The scientific nomenclature of this plant is based on its morphological and taxonomic characteristics evaluated collectively (Alam et al., 2010; Gupta & Ved, 2017) and is classified as follows: Domain *Eukaryota*, Kingdom *Plantae*, Division *Angiosperm*, Class *Dicotyledons*, Order *Solanales*, Family *Convolvulaceae*, Genus *Operculina*, and Species

O. turpethum. Some of its common taxonomic synonyms include *Ipomoea turpethum* (L.), *Ipomoea silvana* (L.), *Ipomoea diplocalyx* (L.), *Convolvulus anceps* (L.), *Convolvulus turpethum* (L.), *Convolvulus triqueter* (L.), *Merremia turpethum* (L.), and *Spiranthera turpethum* (L.).

Morphological description

It is a large herbaceous perennial twiner or large climber, with stems, petioles, leaves, and inflorescences that are shortly pubescent, downy, or glabrescent. When old, the stem is narrow and 3-winged (**Fig. 1**). Lower leaves are broadly ovate, cordate, often 15 x 11.8 cm, acuminate or acute and apiculate; upper ones are often oblong, obtuse, and mucronate. Petioles are 1.8-7.5 cm with crisped wings above on the lower leaves (Hoq et al., 2019). Flowers are 3-5 cm long, peduncle cymes, 5-7.5 cm long, bracts large, oblong, 1.2-2.5 cm long, cuspidate, subpersistent, pedicels 2.5-3 cm, lengthen and become stouter in fruit. Ovate sepals, oblong or broadly elliptic, 18 cm long, outer 2 sub-herbaceous, very broad, pubescent, 3 inner membranous, all enlarged, hardened, and often split in fruits. Corolla white, funnel-shaped or broadly campanulate, 3-4.5 cm long, glabrous, glandular. Capsule depressed globous, 1.5 cm diameter, 2-celled. Seeds 4-1, obovoid, 5 mm long, brown, minutely reticulate glabrous (Hoq et al., 2019; Sharma & Singh, 2012; Ahmad et al., 2017). The leaves are also consumed as vegetables (Sharma, 2006).

Classification of Operculina turpethum

The two kinds of Trivrit, also known as Turpeth (**Fig. 2**), are distinguished by their color: Shweta or white Turpeth (botanical name: *Operculina turpethum*, formerly known as *I. turpethum*) and Krishna or black Turpeth (botanical name: *Ipomoea petaloidea* Chois). These two types have slightly different botanical classifications (Celeghini et al., 2001; Mondal et al., 2006; Srikantha et al., 2008).

1. Shweta or White Turpeth (*Operculina turpethum*)

It is found throughout India at altitudes of up to 900 meters. It is also scattered in various regions around the world including Australia (Northern Territory, Queensland), Africa (Kenya, Tanzania, Mozambique, Zimbabwe; Western Indian Ocean islands such as Madagascar, Mauritius), parts of the Pacific (Micronesia), and various Asian countries (India, Nepal, Pakistan, Sri Lanka, Indochina, Myanmar, Thailand, Indonesia, Malaysia, Papua New Guinea, Philippines). It is a native herb in India (Mondal et al., 2006).

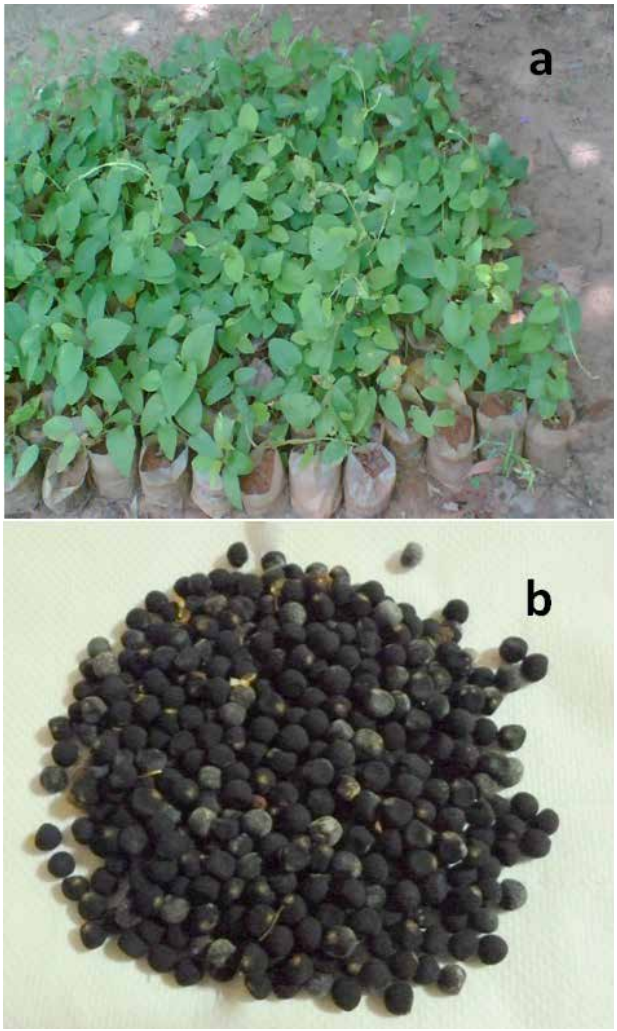

Fig. 1. *Opeculina turpethum* plant. (**a**) whole plant, (**b**) seeds

2. Krishna or Black Turpeth (*Ipomoea petaloidea* Chois)

Its natural range includes parts of Asia, specifically China (Guangdong province) and Taiwan. It is also found in Southern America, particularly in the West Indies. It is native to the regions mentioned above (Srikantha et al., 2008).

Results and Discussion

Ayurveda Rasa Panchaka

In Ayurveda, *Rasa Panchaka* refers to the five basic tastes (*Rasa*) associated with substances. These tastes are Sweet (*Madhura*), Sour (*Amla*), Salty (*Lavana*), Pungent (*Katu*), Bitter (*Tikta*), and Astringent (*Kashaya*). Each taste is believed to have specific effects on the doshas (Vata, Pitta, and Kapha). *Operculina turpethum* is primarily associated with the bitter (Tikta) taste in Ayurveda (Seleena et al., 2020).

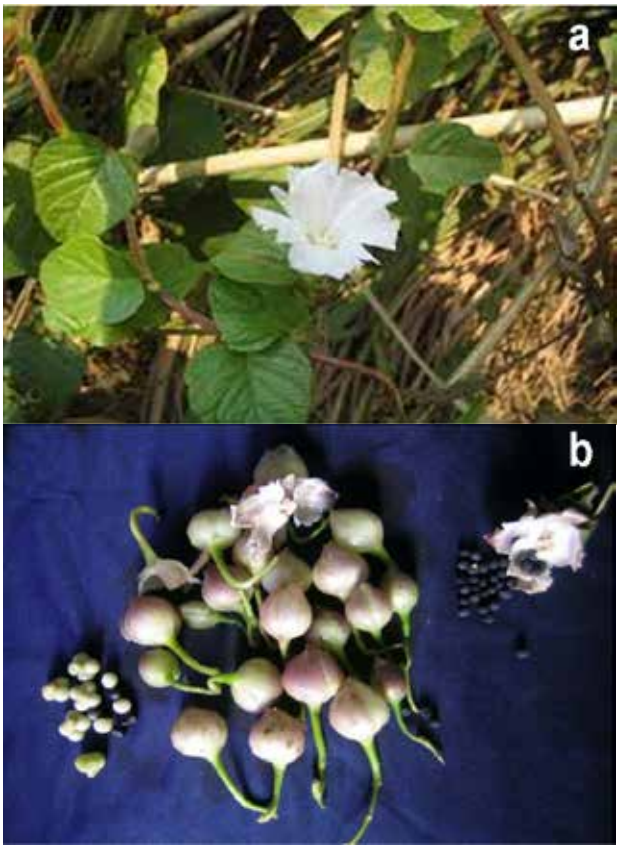

Fig. 2. Types of *Operculina turpethum*. (**a**) white turpeth, (**b**) black turpeth

The taste (*Rasa*) of Operculina turpethum is described as bitter (*Tikta*), while its other attributes (*Guna*) are characterized as dry (*Ruksha*) and light (*Laghu*). Its potency (*Veerya*) is considered hot (*Ushna*), and the post-digestive taste (*Vipaka*) is pungent (*Katu*). Regarding its effect on the doshas, it balances Kapha and Pitta but may increase Vata if used excessively. Its *Prabhava* (specific pharmacological effect) is classified as *Rechana* (purgative).

Therapeutic actions in Ayurveda

In Ayurveda, *Operculina turpethum* exhibits several therapeutic actions. It functions as a laxative (*Sara*), helping to soften and promote bowel movements, and as a purgative (*Rechana*), exerting a stronger laxative effect that facilitates complete intestinal clearance. The plant also acts as *Deepana*, enhancing the digestive fire and thereby improving digestion, and as *Pachana*, supporting the digestion and metabolism of food.

Additionally, it demonstrates *Krimighna* activity, indicating anti-parasitic properties beneficial in expelling intestinal worms, and *Vatahara* action, helping to alleviate conditions associated with the Vata dosha. Its *Krumihara* effect contributes further to the reduction of worm infestations. The plant is also recognized for its *Panduhara* action, being traditionally used to support the management of anemia and liver-related disorders. Finally, its *Udavartahara* property assists in reducing bloating. (Seleena et al., 2020)

Organoleptic characters

The organoleptic characteristics of *O. turpethum* refer to the sensory properties perceived through human senses (Seleena et al., 2020). In terms of appearance (*Rupa*), the roots are typically thick, fleshy, and tuberous, varying in size and shape, with a generally brownish outer surface. The smell (*Gandha*) is described as earthy, woody, or herbal, although it may be subtle and not always strongly noticeable.

Regarding taste (*Rasa*), *Operculina turpethum* is primarily characterized by a bitter taste (*Tikta Rasa*), which represents one of its most prominent organoleptic features. The texture (*Sparsha*) of the root's outer surface tends to be rough or slightly coarse due to its natural structure. The color (*Varna*) of the plant powder sample typically appears yellowish brown.

In terms of potency (*Veerya*), Turpeth is considered *Ushna* in nature, meaning it produces a heating effect on the body when consumed. Its qualities (*Guna*) are primarily light, or *Laghu*, according to Ayurvedic classification.

Geographical Distribution

Operculina turpethum is mostly native to Asia and is distributed sporadically in tropical regions of Mauritania, India, Philippines, America, Africa, Bangladesh, Australia, Madagascar, Pakistan, Shri Lanka, Nepal, Taiwan, Bangladesh, Thailand, China, Malaysia, Tanzania, Myanmar, Indonesia, and the Philippines (Ahmad et al., 2017; Bhande et al., 2006; Kohli et al., 2010). In India, the native states that have populations of *Operculina* include Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Andhra Pradesh, Telangana, Karnataka, Kerala, Tamil Nadu, and parts of the Himalayan region. However, within Odisha, it is found in Jajpur, Bargarh, Balangir, Khurda, and Sambalpur sporadically (Hoq et al., 2019; Saxena & Brahmam, 1995; Mohapatra & Basak, 2014).

Phytoconstituents

The root bark of *Operculina turpethum* contains a glycosidic resin called turpethein, which is insoluble. It also contains secondary metabolites (**Fig. 3**), including saponins, flavonoids, glycosides, phenolics, essential oils, glucose, and fructose (Shastry, 2014; Shankaraiah et al., 2017). The roots of *O. turpethum* contain different types of

triterpenoids such as lanosta-5-ene, cycloartenol, and 24-methylene-δ-5-lanosterol (Kirtikar & Basu, 2003). Additionally, it also contains various other bioactive compounds such as albumin, lignin salts, volatile oil, starch, ferric oxide, lupeol, α- and β-turpethein, betulin, α- and β-rhamnose, fructose, β-sitosterol, scopoletin, and some ether-soluble resin (Gupta & Ved, 2017). *Operculina turpethum* is rich in various phytoconstituents, including glycosidic resin, coumarin, beta-sitosterol, reducing sugars, and essential oils, which have therapeutic benefits for treating various ailments and diseases. Additionally, this plant contains resins, a mixture of alpha and β-turpethein, glycosides, coumarins, scopoletin, saponins, flavonoids, steroids, and carbohydrates (Saxena & Brahmam, 1995; Mohapatra & Basak, 2015; Hoq et al., 2019).

The plants in the *Ipomoea* category (approximately 500–600 species) have the highest concentrations of the alkaloid ergoline in their seeds and are therefore utilised as medicines and ornamentals (Meira et al., 2012). The methanolic extracts of leaves of *O. turpethum* were evaluated for phenolic compounds through high-performance liquid chromatography with a total phenol content of 1.89 mg/mL and flavonoid content of 1.0 mg/mL (Jalaj & Madhavan, 2016). Different types of flavonoids are present in the stems and roots of *Operculina turpethum* and exhibit maximum antibacterial activity, along with inhibition of heat shock protein production in malignant cell lines, providing a potent treatment for several types of cancer (Doss et al., 2011). In one of the studies, several secondary metabolites from root extracts were evaluated. According to this study, the ethanolic root extracts of *Operculina turpethum* (OT) contain carbohydrates, steroids, gums, and saponins. The ether and chloroform root extracts of OT contain carbohydrates, steroids, gums, flavonoids, and saponins. Additionally, the ethanolic, ether, and chloroform leaf extracts of OT contain carbohydrates, steroids, gums, flavonoids, tannins, alkaloids, reducing sugars, and saponins (Arif et al., 2013).

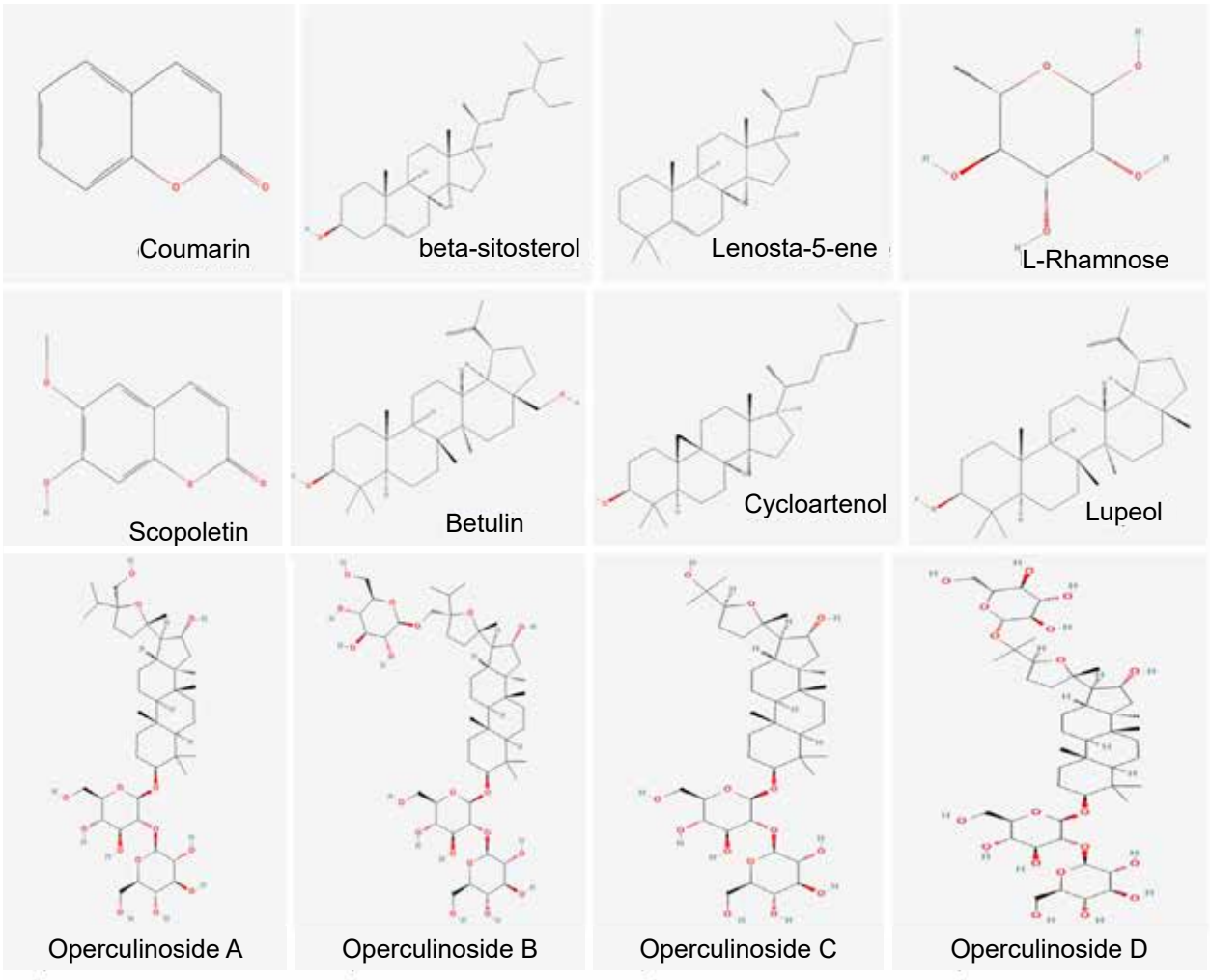

Fig. 3. Phytoconstituents available in *Operculina turpethum*

Propagation of Operculina turpethum

The vegetative macropropagation of *Operculina turpethum*, a red-listed medicinal plant, is essential, as conventional seed propagation faces problems due to low seed viability, low germination rates, and poor survivability. These challenges make it difficult to produce adequate quantities of high-quality planting materials through seed propagation alone; hence, in one of the studies, this was achieved by applying IBA (Indole-3-butyric acid) at 2000 ppm and NAA (Naphthaleneacetic acid) at 3000 ppm. Among the various types of nodal stem cuttings used as explants, those treated with this specific combination of auxins demonstrated the most promising results. Interestingly, the nodal cuttings consisting of a single node and a single leaf emerged as the most suitable explant material for macropropagation of *Operculina turpethum* (Mohapatra & Basak, 2014). Similarly, in another study, the nodal segments were cultured in MS medium supplemented with 1.0 mg l-1 BAP (Benzylaminopurine). This resulted in rapid shoot bud proliferation, with an impressive success rate of 85.33% (Alam et al., 2010).

Therapeutic applications of Operculina turpethum

Operculina turpethum exhibited anti-diabetic, anti-inflammatory, antimicrobial, antioxidant and anti-arthritic activity, further affirming its therapeutic versatility. This review highlights *Operculina turpethum* as a valuable botanical resource with a broad spectrum of therapeutic activities, making it a subject of continued research and potential pharmaceutical development, as demonstrated by its significant therapeutic potential across various traditional medicinal systems. The therapeutic applications of *Operculina turpethum* are being validated by several researchers (Alam et al., 2010; Hoq et al., 2019; Seleena et al., 2020; Bhande et al., 2006; Shastry, 2014; Shankaraiah et al., 2017) and a few are depicted in **Tab. 1**.

The *Operculina turpethum* root bark contains turpethum resin with turpethin, as the substitute ally of jalapine and convolvulin. It also contains turpethinic acids A, B, C, D, and E and has potent anthelmintic, anti-inflammatory, and analgesic activities (Islam et al., 2015; Hoq et al., 2019; Seleena et al., 2020). The antimicrobial activity of *O. turpethum* has been validated by several researchers (Alam et al., 2010). Alam et al. (2010) validated the antimicrobial potency of OT against *Streptococcus*, *Bacillus*, *Pseudomonas*, *Shigella sonnei*, and *Shigella* using minimum inhibitory concentration (MIC) testing. Apart from its use as a therapeutic ingredient, OT is also used in *Panchakarma* treatment as *Virechana* (Shastry, 2014). *Operculina turpethum* root is used as a potent ingredient in *Avipattikara churna* for the treatment of hyperacidity, gastric ulcers, and other associated gastrointestinal issues (Bhande et al., 2006). It is also utilised in several skin allergies, rashes, obesity, ulcers and constipation (Mohapatra & Basak, 2015). The other popular Ayurvedic formulations, those included *Operculina*, as one of the vital ingredients are *Trivrit choornam*, *Trivritadi choornam* (Ignatius et al., 2013). The *O. turpethum* root and stem methanolic extracts showed antidiabetic activity in a streptozotocin-induced type 2 diabetic mouse model (Ahmad et al., 2017). Ethanolic root extract showed hepatoprotective activity against a paracetamol-induced hepatotoxic rat model by administering 100-200 mg/kg body weight of *O. turpethum*, reducing serum SGOT, SGPT, and alkaline phosphatase levels (Kumar et

Table 1. Phyto-pharmacological properties of *Operculina turpethum*

Phyto-pharmacological Properties	References
Antihelmintic activity	Shankaraiah et al., 2017
Antimicrobial activity	Alam et al., 2010; Kumari et al., 2010
Anti-ulcer activity	Bhande et al., 2006;Mohapatra and Basak, 2015
Immunomodulatory activity	Venugopala et al., 2013
Hepatotoxicity activity	Kumar et al., 2006
Anti-inflammatory activity	García-Argáez et al., 2000; Ignatius et al., 2013
Antioxidant activity	El-Far and Taie, 2009; Kostova et al., 2011
Analgesic activity	Prabhavathi et al., 2012; Islam et al., 2015; Ezeja et al., 2015
CNS activity	Islam et al., 2015; Guang-Tong et al., 2018
Antidiabetic effects	Pulipaka et al., 2012
Antidiarrheal activity	Shareef et al., 2014

al., 2006). In another study, the antidiabetic effects of methanol extracts from *O. turpethum* stems and roots in streptozotocin-induced diabetic rats were validated. With administration of both extracts at a 100 mg/kg body weight dose, a reduction in fasting glucose levels by the end of the 21-day study period was comparable with glibenclamide, a standard drug (Pulipaka et al., 2012). In one of the studies, different stem extracts of *Operculina* showed antibacterial activity (Kumari et al., 2010). Similarly, the petroleum ether and ethanol extracts of the leaves of *O. turpethum* were found to have antimicrobial properties against various human pathogenic bacteria, with minimum inhibitory concentrations (MICs) ranging from 0.13 to 0.75 mg ml^{-1}, indicating their effectiveness in inhibiting pathogenic growth (Alam et al., 2010).

A recent study investigated the ulcer-preventive and protective properties of two different extracts derived from the stem bark of *O. turpethum* and validated them. The high- and medium-alcohol stem extracts of *O. turpethum* at a dose of 100 mg/kg, b.w., orally showed enhanced ulcer-preventive activity. The study used an aspirin-induced peptic ulcer model with pylorus ligation in experimental rats (Ignatius et al., 2013). In another study, the cytotoxicity of *Operculina turpethum* stem extracts (at a dose of 100 mg/kg) was validated in a rat model of breast cancer induced by DMBA (7,12-dimethylbenz [a] anthracene) at a dose of 20 mg over a period of 45 days. The results revealed a lowering in lipid peroxidation and minimal cellular damage (Anbuselvam et al., 2007; Ghosh et al., 2016). Anticancer activity of different plant extracts including *Holoptelea integrifolia*, *Operculina turpethum*, *Cardiospermem halicacabum* L, *Dilonix regia*, and *Sesbania grandifora* seeds, was validated, depicting *Operculina turpethum* ethanolic extract as the one having the highest cytotoxic activity (Rizwani et al., 2014). In one study, the potential protective effects of the methanolic extract of *Operculina turpethum* stems were investigated at a dose of 100 mg/kg body weight in female Sprague-Dawley rats with 7,12-dimethylbenzanthracene (DMBA)-induced breast cancer. The study demonstrated the potency of the plant extract by enhancing the antioxidant activities of superoxide dismutase, glutathione peroxidase, ascorbic acid, and α-tocopherol, thereby protecting against DMBA-induced breast cancer (Ahmad et al., 2017). *Operculina turpethum* extract emerges as a promising candidate for cancer patients, offering cost-effectiveness and minimal side effects. The study delves into its potential as an antitumor agent against oral squamous cell carcinoma (OSCC) cell lines (SCC-4, KB, SCC-9, and SCC-25). The extract demonstrated a dose-dependent inhibition of cell growth and colony formation, while also disrupting the cell cycle at the G0/G1 phase and inducing early apoptosis through P53 upregulation and a significant decrease in invasive potential of OSCC cells, reducing it by up to 55-60% (Arora et al., 2017). The anticancer activity of *Operculina* stem extract was validated using a 7,12-dimethylbenzanthracene-induced breast tumor model in female rats at an oral dose of 100 mg/kg, with the same 7,12-dimethylbenzanthracene as the inducer at 20 mg for at least 45 days. The study revealed potent reduction in lipid peroxidation, elevated antioxidant levels, and lowered breast tumor weight in rats (Anbuselvam et al., 2007).

In another study, the potential anti-arthritic activity of ethanolic root extracts of *Operculina turpethum* was assessed using *in vitro* models. The ethanolic root extracts, in combination with bovine serum albumin, showed 67.22% inhibition of protein denaturation, resulting in potent anti-arthritic activity (Sharma & Singh, 2013). Prakash et al. (2010) had evaluated the hepatoprotective effects of *Operculina turpethum* root powder in a rat model of carbon tetrachloride-induced hepatotoxicity. The results provided valuable insights into the hepatoprotective properties of OT, suggesting its potential as a natural agent and traditional use in herbal medicine (Prakash et al., 2010). The plant extract is found to be useful in snakebites, itching, fever, abdominal trouble, muscle pain, inflammation, liver disorders, and anaemia (Kohli et al., 2010; Mohapatra & Basak, 2014). The analgesic and anti-inflammatory effects of *Operculina turpethum* plant has been confirmed in albino mice (Prabhavathi et al., 2012). In the study, they used *Avipattikar churna* containing the potent ingredient *Operculina turpethum* at 100 mg/kg to validate a lower rate of rat paw edema of at least 36.45% (Prabhavathi et al., 2012). In another study, the antidiarrheal activity of the root extract of *Operculina* using ethanol as a solvent system was validated on castor oil-induced diarrhea in a mouse model, with Loperamide used as a standard at a dose of 10 mg/kg, and the results validated the antidiarrheal activity of *Operculina* root samples (Shareef et al., 2014). Furthermore, studies have shown that the *Ipomoea turpethum* root extract loaded in N-vinyl pyrrolidone and acrylic acid (NIPAAM-VP-AA) copolymeric nanoparticles tested on Wistar rats are non-toxic and efficient for therapeutic use against inflammation, CNS diseases, and cancer (Swami et al., 2023). Studies have shown that *O. turpethum* exhibits analgesic and central nervous system depressant properties, in addition to demonstrating laxative and hepatoprotective effects (Sudan et al., 2016), while anti-cancer activity was validated in breast cancer cell lines (Mughees et al., 2019).

Conclusion

The use of Indigenous knowledge-based healing practices supported by scientific validation would not only facilitate higher success rates but also harness empirical knowledge in a properly documented format for popularization and widespread use, benefiting the livelihoods of a wide range of populations. Prioritizing the ethical and sustainable sourcing of herbal ingredients from selected plants is one of the novel approaches to social responsibility and improved livelihoods. *Operculina turpethum*, known by various vernacular names including Turpeth or Trivrit, embodies a rich repository of ethno-pharmacological properties rooted in traditional medicinal practices across different cultures. Widely employed in Ayurveda and Unani systems, it exhibits a diverse array of therapeutic actions. The ethnographic study of available empirical and indigenous knowledge systems for healing practices using *Operculina turpethum* could facilitate harnessing the available IKS on this aspect. Notably, it serves as a potent purgative and laxative, making it invaluable for digestive disorders. Moreover, *Operculina turpethum* has found application in alleviating arthritis, gout, sciatica, hemiplegia, epilepsy, and as an analgesic. It stands out for its potential to address peptic ulcers, counter renal carcinogenesis, and provide hepatoprotection. The plant's anti-diabetic and anti-arthritic effects further amplify its significance in holistic healthcare. This compilation underscores *Operculina turpethum*'s multifaceted ethno-pharmacological profile, emphasizing its enduring importance in traditional medicine and its potential as a source for modern therapeutic exploration for fully unlocking of its pharmacological potential. The above study, conducted with a focus on Trivrit, underscores the extensive pharmacological validation of various extracts from different plant parts. The establishment of such validated reports is imperative to assess the effectiveness and safety of Trivrit, providing scientific confidence in its traditional use in Ayurveda and contributing valuable data for the development of future drugs or therapies, particularly for addressing many chronic diseases.

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