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A review on *Operculina turpethum* (L.) Silva Manso.: A threatened medicinal plant

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Abstract

Operculina turpethum (L.) Silva Manso. is a threatened medicinal plant belonging to the family Convolvulaceae. It is used in the Ayurvedic system of medicine and is popularly known as 'Trivrit or Turbud'. It has been attributed to contain numerous medicinal properties of high commercial value. But, rapid depletion of natural habitat has greatly reduced the distribution of this species and increased the risk of genetic diversity loss. Hence, much emphasis has to be laid on conservation of this medicinal species. The present review provides bird eye view on the literatures pertaining to *Operculina turpethum* and current status of research helping to fuel further research in the various unexplored activities that are attributed to this plant.

Keywords: *Operculina turpethum*, threatened, medicinal uses, conservation

Introduction

Medicinal plants are considered as the "backbone" of traditional medicine (Ahvazi *et al.*, 2012) [3]. India is the world's largest producer of medicinal herbs and is popularly known as the "botanical garden" with a rich heritage of medicinal species, having pharmaceutical potential. There are about 4,000 medicinal species, with its abundance in Eastern Himalayas, Western Ghats and Andaman and Nicobar Islands (Swamy *et al.*, 2018) [32]. In rural India, 70 percent of the population relies on Ayurvedic system of medicine and it is considered as an important component of the health care system (Patro, 2016) [19]. Every plant that exist in nature has either one or the other medicinal property and the detailed study on medicinal plants and its products has evolved a separate shastra known as Dravya Guna Shastra. Approximately 80 percent of people in developing countries depend exclusively on herbal medicines for their primary healthcare, while 25% of medicines in developed countries come from wild plant species. In recent days, the demand on herbal drugs, natural health products and secondary metabolites of medicinal plants is increasing at an alarming rate due to its safer effects on health. International Union for Conservation of Nature and World Wildlife Fund has released a data consisting of 50,000 to 80,000 flowering plant species which has immense medicinal value. But due to overharvesting and habitat destruction, 15,000 species are at a verge of extinction (Gopi *et al.*, 2018) [9]. The potency and therapeutic effectiveness of herbal medicine has been severely harmed as a result of the gradual depletion of medicinal plant diversity (Ahana and Hegde, 2018) [1]. The recovery of biodiversity through habitat protection and enhancement of endangered medicinal plants is one of the positive step towards the sustainability of natural resources. Therefore, there is a need for the development of conservation strategies which protects them from extinction. *Operculina turpethum* (L.) Silva Manso. is one among the important medicinal species, endemic to Western Ghats and is gaining popularity due to its wide range of applications in pharmaceutical industries.

Operculina turpethum

O. turpethum is a perennial climber used in the Indian system of medicine, belonging to the family Convolvulaceae. It is commonly known as trivrit or turbud. The word 'Turbud' is coined from Sanskrit name 'Tripatak' which means triangulated as its stems are triangular in shape (Nafees *et al.*, 2020) [18]. Most of the South Indian physicians of traditional Ayurveda and Unani medicine system use trivrit to treat various kinds of diseases starting from fever to

cancer. There are two varieties of Trivrit namely Aruna or Shweta [*Operculina turpethum* (L.) Silva Manso.] having reddish or whitish coloured root and Shyama [*Operculina petaloides*] having blackish root (Sharma and Singh, 2012) [29].

Taxonomic classification (Hoq and Tamanna, 2019) [12]

- **Kingdom:** Plantae
- **Division:** Angiosperma
- **Subkingdom:** Tracheobionata- vascular plants
- **Superdivision:** Spermatophyta- seed plants
- **Class:** Dicotyledons
- **Order:** Solanales
- **Family:** Convolvulaceae
- **Genus:** *Operculina*
- **Species:** *turpethum*
- **Binomial name:** *Operculina turpethum* (L.) Silva Manso.

O. turpethum has several vernacular names in different languages. They are presented in the table below (Nafees *et al.*, 2020) [18].

Table 1: Multilingual Synonyms of Turpeth Root in Various Languages

Sl. No.	Languages	Synonyms
1	Arabic	Turbud
2	Bengali	Teudi, tvuri, Dhdhakalami
3	Gujarati	Kala Nashotar
4	Hindi	Nisothe, Pitohri
5	English	Turpeth root, Indian Jalap, Transparent Wood Rose, White day Glory
6	Sanskrit	Nishotra, Trivrutha, Triputa
7	Kannada	Bangada balli, Bilitigade, Tigade Beru
8	Malayalam	Chivaka, Thrakoolpakkonna
9	Marathi	Nisottar
10	Telugu	Tegada, Trivrut Tellatega, Erra tegada
11	Tamil	Caralam, Civatai, Paganrai

Distribution

The species is distributed across India, Bangladesh, Nepal, China, Sri Lanka, Australia, Africa, South America, Pakistan, Taiwan, Myanmar, Indonesia, Malaysia, Thailand, Papua New Guinea, Philippines and is naturalized in West Indies (Sharma and Singh, 2012) [29]. In India, it is commonly found in the dry zones of Tamil Nadu and Karnataka (Hoq and Tamanna, 2019) [12].

Ecology

It requires a warm climate during the growing season followed by cool climate for several months. Sandy loam to clay loam soils are best suitable for its cultivation. It is a semi-deciduous plant that sheds its leaves during winter and the growth of new flush can be seen in the month of January. Flowering and fruiting occurs twice a year from September to November and then from March to May. Pollination is usually carried out by honey bees (Kohli *et al.*, 2010) [16].

Plant description

It is a herbaceous perennial climber with purplish stem and milky white exudates. Roots are long, slender, fleshy and branched. Stems are angled, pubescent, tough and brown when they are old. Leaves are alternate, slightly oblong or

ovate having reticulate venation with small pubescent hair on both the sides and the leaf base is either cordate or truncate. Inflorescence is a few flowered cyme forming globose capsule enclosed within the brittle sepals. Flowers are axillary, bisexual, solitary and white in colour. Fruits are round measuring 1 to 1.5 cm in diameter containing 3-4 black smooth seeds (Hoq and Tamanna, 2019) [12].

Harvesting

The plant lasts for about 10 to 12 months. Roots, stems and leaves are harvested in the month of March, when the plants begin to dry. Freshly harvested roots are cleaned thoroughly with fresh water and dried under sun for two to three days followed by shade drying for 10 days until the moisture content is reduced to 8 percent. Mature fruits contain 3-4 black, smooth and round shaped seeds which are harvested on complete drying. April-May is the best time to gather the seeds (Sharma and Singh, 2012) [29].

Chemical composition

Turpethin is the major active principle present in the root bark, having medicinal properties. Root contains glucoside, jalapine and convolvuli which are insoluble in ether, benzene and carbon sulphide whereas resins, volatile oil, yellow colouring matter, albumin, starch, lignin, salts and ferric oxide are soluble in ether (Choudhary *et al.*, 2020). Apart from these, the presence of various bioactive compounds like β -sitosterol, scopoletin, betulin, cycloartenol, lanosta-5-ene, coumarin, acrylamide 3-(4-hydroxy-phenyl)-N-[2-(4-hydroxyphenyl)ethyl] and salicylic acid are reported (Gupta and Ved, 2017) [10]. The aerial parts of the plant contain turpethoside A, glycoside resin B, turpethic acid A-C (Ding *et al.*, 2012) [6] and Operculinosides A, B, C, D are four new dammarane-type saponins separated from plant roots (Ding *et al.*, 2011) [7].

Propagation

They can be propagated through seeds. But due to poor seed viability, low percentage of germination, survivability and dormancy, there is a need to go for seed treatments. Collected seeds are water soaked for 24 hours followed by mechanical scarification which is done by rubbing the treated seeds with sand paper and are planted in polybags containing a mixture of sand, soil and farmyard manure in equal proportions. This method has proved to be effective as it helps in 95% germination (Tiwari *et al.*, 2018) [34]. Others methods include vegetative propagation using cuttings of 10 cm length, having two nodes are planted in the field with a spacing of 30 cm x 30 cm. The best time for planting these cuttings is June- July (Mohapatra and Basak, 2014) [17]. Apart from this, *in-vitro* propagation using nodal explants serves as an efficient tool for rapid production of true-to-type plants which have excellent vigor and are free from virus infection. Nodal segments with axillary bud when cultured on MS medium supplemented with BAP (1mg/l) gave good response with respect to shoot length, number of leaves and number of shoots (Sebastianraj *et al.*, 2013) [27]. Cotyledonary nodes (1 cm long) were cultured on MS medium with different concentrations of Kinetin and maximum shoot proliferation was reported at a concentration of 1.5 mg/l (Alam *et al.*, 2010) [4].

Medicinal uses: Roots are used in the treatment of fever, cough, asthma, edema, anaemia, ascites, anorexia,

constipation, gout, rheumatism, hepatitis, haemorrhoids, intoxication, ulcers, fistulas abdominal tumors, wounds, worm infestation, scorpion sting and snake bite (Thamizhmozhi and Nagavalli, 2017) ^[33]. They have anti helminthic, purgative, antipyretic and alexiteric properties (Harun *et al.*, 2002) ^[11] and are effective in relieving muscle and joint pain (Shareef *et al.*, 2014) ^[28]. Root bark oil is used in curing skin diseases. Fresh juice of trivit leaves are used for treating corneal opacity. Rhizome powder mixed with honey and butter is used in treating tuberculosis, herpes and vomiting. Flowers are used as a remedy for headache in Western India (Kohli *et al.*, 2010) ^[16].

Pharmacological potential

O. turpethum roots serve as a potential source of natural antioxidant by inhibiting the production of free radicals, thereby reducing the risk of cancer (Sharma and Singh, 2013; Santhosh, 2017; Ezeja *et al.*, 2015; Pulipaka *et al.*, 2013) ^[30, 26, 8, 22]. Oral administration of the root extract is effective in the treating painful inflammatory conditions (Sharma and Singh, 2013; Islam, 2016; Prabhavati, 2012) ^[30, 14, 20]. The anticancer activity of five medicinal plants

namely *Holoptelea integrifolia*, *Operculina turpethum*, *Cardiospermum halicacabum* L, *Diloxia regia*, *Sesbania grandiflora* were examined and the results indicated that the ethanolic extract of *O. turpethum* was effective in fighting against six cancer cell lines when compared to the other plant extracts (Rizwani *et al.*, 2014) ^[25]. The stem and root extract was helpful in reducing the blood sugar levels which showed the anti-diabetic nature of *O. turpethum* (Raut *et al.*, 2014; Pulipaka *et al.*, 2012) ^[24, 21]. They possess antibacterial activity against six bacterial species namely *Escherichia coli*, *Enterobacter aerogenes*, *Klebsiella oxytoca*, *Proteus vulgaris*, *Bacillus cereus* and *Staphylococcus aureus* (Ahmed *et al.*, 2013; Kiran *et al.*, 2018; Rathnan *et al.*, 2012) ^[2, 15, 23].

Ayurvedic formulations of Trivrit

Trivrit is considered as a vital ingredient in preparation of more than 135 herbal formulations. Shweta trivrit is used as a purgative and Shyama is used in treating intoxication and abdominal tumors (Kohli *et al.*, 2010) ^[16]. Some of the formulations are presented in the table below (Sharma and Singh, 2012; Ignatius *et al.*, 2013) ^[29, 13].

Table 2: Ayurvedic Formulations and Their Therapeutic Uses

1	Trivrit Avaleha	GI disorders, abdominal tumors
2	Panchasama Churna	Flatulence, constipation, anorexia, dysentery
3	Alambushadi	Ascites, edema, arthritis
4	Malashodhak Churna	Constipation, flatulence
5	Avipattikar Churna	Acid peptic disorder, constipation
6	Abhayadi Modak	Constipation, therapeutic purgative
7	Agnimukh loha	Anaemia, edema, haemorrhoids and GI disorders
8	Kalyanak Gud	Gastro-intestinal disorders, tumors, ascites, edema and skin diseases
9	Vyoshadi Gutika	Gastro-intestinal disorders, debility, vertigo, urinary disorders
10	Narach Churna	Ascites
11	Sukhavirechak Churna	Habitual constipation
12	Tryushanadi Churna	Abdominal tumor, chest pain
13	Haridra Khanda	Urticaria and other skin disorders
14	Punarnavadi Mandoor	Anaemia, ascites, edema, hepatosplenomegaly
15	Mahamanjishthadi Kwath	Skin disorders, paralysis, elephantiasis, wounds
16	Trivritadi Kalka	Worm infestation
17	Kaishore Guggulu	Musculoskeletal disorders, skin ailments, diabetes, wound, ascites
18	Aragwadhadhi Kwath	Anticarcinogenic, laxative and colon cleanser
19	Chandraprabha Vati	Urinary & musculoskeletal disorders
20	Ashwagandharishta	Anxiety, stress, sexual or general debility
21	Bharangyadi Kwath	Flu, asthma, pneumonia
22	Trivritadi Modak	Respiratory disorders, backache
23	Trivrit Arishta	Abdominal tumor, edema, anaemia & sprue
24	Vachadi Lepa	Topically for skin disorders, alopecia, lymphadenitis, & fistula
25	Jambvadi Taila	Topically for wounds and Gonorrhea (genital ulcers)

Need for conservation

Trivrit is an important ingredient in preparation of many drugs. It is mainly used for the treatment of fever, hepatitis, tumors, scorpion sting, snake bite and skin disorders. It is gaining lot of importance in pharmaceutical field to be used as a future potent drug for curing many diseases. But rapid depletion of natural habitat has greatly reduced the distribution of this species and increased the risk of genetic diversity loss (Alam *et al.*, 2010) ^[4]. Destructive harvesting of root as a source of raw material for ayurvedic drug preparation and other anthropogenic activities have made the species severely threatened in nature and it is Red-listed (vulnerable) medicinal species by IUCN (International Union for Conservation of Nature). Hence, there is an urgent need for conservation.

Future prospects

O. turpethum is a very potent herb having wide pharmacological actions and therapeutic significance. This review is a collection of literature regarding the different aspects starting from plant introduction to future scope. Recent studies have revealed the phytochemistry and wide spectrum attributed to pharmacological activities but still there is a scope for isolation of various phyto-constituents which gives a clear idea of plant mechanism. Much emphasis has to be laid on effective conservation, utilization and multiplication of this threatened medicinal plant.

Conclusion

Operculina turpethum is a valuable yet threatened medicinal plant with diverse therapeutic applications in traditional

medicine. Its significant pharmacological properties, including anti-inflammatory, antioxidant, and antimicrobial activities, highlight its potential in modern medicine. However, habitat destruction and overharvesting have led to its declining population, necessitating urgent conservation efforts. Sustainable cultivation practices, propagation techniques, and biotechnological interventions can aid in preserving this species. Further research is essential to explore its bioactive compounds and therapeutic mechanisms, ensuring its continued use in pharmaceuticals while promoting conservation strategies for long-term ecological sustainability.

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