

CHAPTER 3

Tylophora indica (Burm.f.) Merr.: A Medicinal Climber of India

Kuladeep P.P¹, Sweta Mishra², Shobha^{3*}

¹Department of Botany, Nehru Memorial College, Sullia, D.K., Karnataka, India

²Ambika Prasad Research Foundation, Odisha, India

³Department of Botany, University College Hampanakatta, Mangalore, D.K., Karnataka, India

*Email-Id: shobhadevadiga@yahoo.com

DOI:



Licensed under a Creative Commons Attribution 4.0 International License

ABSTRACT

Tylophora indica, a medicinally important climber belonging to the family Apocynaceae, has been widely recognized for its traditional and pharmacological significance. The plant is well-known in Indian systems of medicine for treating respiratory disorders, particularly bronchial asthma, as well as conditions such as inflammation, infections, and autoimmune diseases. Phytochemical investigations have revealed the presence of bioactive compounds, including alkaloids (tylophorine, tylophorinidine, and tylophorinine), flavonoids, tannins, saponins, phenolic compounds, and steroids. These constituents contribute to a broad spectrum of pharmacological activities, including anti-asthmatic, anti-inflammatory, immunomodulatory, anticancer, antioxidant, and antimicrobial effects. Various solvent extracts of *T. indica* show differing phytochemical profiles, highlighting its therapeutic versatility. Medicinal and pharmaceutical uses are discussed here to bring attention to the medicinal species from the family Apocynaceae.

Keywords: *Tylophora*, morphology, medicinal uses, bioactive compounds, pharmacological activities

INTRODUCTION

Tylophora indica (Burm f.) Merr., commonly known as Indian-Ipecacuanha in English; Aadu muttada balli (Kannada); Antrapachaka (Sanskrit); Antamool (Hindi); Ananthamul and Arkaparni in Ayurveda (Butani et al. 2007) is a perennial, slender, twining or climbing medicinal plant belonging to the family Apocynaceae. Distributed widely throughout the southern, eastern, and western parts of India, it grows abundantly in plains, hilly slopes, and forests, thriving in moist, humid, and well-drained soils (Gurav et al. 2011; Sabita Rani et al. 2012). The plant is commonly found in regions such as Uttar Pradesh, Bengal, Assam, Odisha, Maharashtra, Gujarat, and the sub-Himalayan tracts up to 1260 meters in elevation (Gupta et al. 2023). Morphologically, *T. indica* is a branching climber that reaches 1.5 to 4.5 feet in height. It has ovate to elliptic-oblong leaves, and minute greenish-yellow to greenish-purple flowers arranged in axillary umbellate cymes. The roots are long, fleshy, and covered with longitudinally fissured light brown bark (Gurav et al. 2011; Sabita Rani et al. 2012). Traditionally, *Tylophora indica* has held a prominent place in Ayurvedic, Unani, and Siddha systems of medicine. It is widely used for the treatment of bronchial asthma, jaundice, dermatitis, inflammation, and rheumatism. In certain parts of India, such as Northern Karnataka and Maharashtra, its roots and leaves are used as a folk remedy for liver disorders (Mohan et al. 2014; Kakde et al. 2015). Phytochemical investigations have revealed that the plant is rich in phenanthroindolizidine alkaloids, including tylophorine, tylophorinine, tylophorinidine, and tyloindicine, which exhibit a broad spectrum of pharmacological activities (Gupta et al. 2023). These compounds have demonstrated anti-inflammatory, antitumor, antioxidant, anti-amoebic, immunomodulatory, and smooth muscle relaxant properties (Kumar et al. 2011; Bembde et al. 2020). Modern herbal medicine continues to explore plant-based secondary metabolites for drug development, as they serve as natural defence mechanisms in plants and hold therapeutic potential for humans. Its traditional uses, along with emerging scientific evidence of its bioactive compounds, could be responsible for the development of herbal remedies for various chronic and inflammatory diseases.

TAXONOMY

T. indica is a branching climber that grows up to 1.5 meters in height. It is characterized by glossy, velvety foliage and long, fleshy roots with longitudinally fissured, light brown corky bark. The roots measure about 2.5–5 cm in thickness. Leaves are thick, ovate to elliptic-oblong with pointed tips,

measuring approximately 6–11 cm in length and 3.8–6 cm in breadth. The upper surface of the leaves is smooth while the underside is velvety. Petioles



Plate 1: Vegetative parts of *T. indica* a) Whole plant, b) Flower

are about 1.2 cm long. Flowers are small 1–1.5 cm across, arranged in 2–3 flowered fascicles in axillary umbellate cymes or racemes. The calyx is divided nearly to the base and is coarsely hairy on the outer surface, with lanceolate and acute segments. The corolla is greenish-yellow or greenish-purple, about 5–6 mm long, with oblong, acute lobes. Flowering occurs predominantly from August to December. The fruit is a striated, glabrous follicle, divaricate in nature, measuring up to 10 cm in length and 1–2 cm in width, tapering at the apex into a fine mucro. Seeds are ovate, 0.6–0.8 cm long and 0.3–0.4 cm wide (Gupta et al. 2010; Gupta et al. 2023; Plate 1).

TRADITIONAL USES

T. indica has been extensively utilized in traditional and folk medicine across various regions, especially in India. These plants are recognized for their wide range of therapeutic properties and are commonly used to manage ailments such as indigestion, bronchial asthma, bronchitis, cough, liver disorders, wounds, and ulcers (Gurav et al. 2011). They are traditionally employed as expectorants and blood purifiers and are also considered effective in the treatment of rheumatism. The dried leaves serve as emetic, diaphoretic, and expectorant agents (Sabita Rani et al. 2012; Lakshmi et al. 2024). In addition, both leaves and roots are used in the treatment of hydrophobia. Leaves are also applied to eliminate intestinal worms, and their extracts have demonstrated anti-tumour properties (Lakshmi et al. 2024). The roots are known for their potential use as a natural food preservative. It has gained significant attention for its proven effectiveness in treating respiratory ailments, particularly asthma. It is traditionally used for liver ailments like jaundice in Northern Karnataka. Kol tribal communities of Simlipal biosphere reserve, Odisha use it in respiratory problems (Kour and Gupta 2015). In various parts of India, common people continue to use this plant for treating bronchial asthma, cancer, dysentery, hay fever, inflammation, arthritis, and skin diseases like psoriasis. It is also believed to be effective against anaphylaxis and respiratory infections (Kakde et al. 2015). This demonstrates the immense pharmacological promise of this species.

BIOACTIVE COMPOUNDS

Phytochemical investigations of *T. indica* have revealed the presence of various bioactive constituents, including a range of alkaloids such as tylophorine, tylophorinidine, tylophorinine, tyloindicines A, D, F, G, H, and I, as well as 14-hydroxy tylophorine (Saidaiah and Reddy 2022; Palanisamy et al. 2024). Additionally, the plant contains stigmasterol, octacosanyl

compounds, skimmianide, along with secondary metabolites like tannins, saponins, and flavonoids. Among the alkaloids, tylophorine, tylophorinidine, and tylophorinine are particularly responsible for their pharmacological significance (Kumar 2011; Saidaiah and Reddy 2022). Previous studies also highlight the presence of major classes of phytochemicals such as alkaloids, flavonoids, tannins, and saponins. It was found that petroleum ether extract showed the presence of flavonoids, amino acids, steroids, terpenoids, and phenolic compounds (Mohan et al. 2014). In Chloroform extract alkaloids, carbohydrates, flavonoids, phenolic compounds, steroids, and terpenoids were found. Acetone extract showed the presence of glycosides, carbohydrates, flavonoids, tannins, phenolic compounds, steroids, and terpenoids (Singh et al. 2014; Palanisamy et al. 2024). Ethanol extract showed carbohydrates, flavonoids, amino acids, phenolic compounds, steroids, and terpenoids, while aqueous extract showed the presence of Steroids, terpenoids, phenolic compounds, amino acids, flavonoids, and carbohydrates. *T. indica* is a rich source of phytochemicals, prominently featuring alkaloids, flavonoids, tannins, and saponins, which contribute to its therapeutic potential (Kumar 2011).

PHARMACOLOGICAL ACTIVITIES

T. indica has demonstrated a range of pharmacological activities due to the presence of potent bioactive compounds, especially alkaloids like tylophorine, tylophorinine, and tylophorinidine (Figure 1).

Anti-asthmatic Activity

T. indica is traditionally used in the treatment of bronchial asthma. Clinical studies have shown that its alkaloids exert bronchodilatory effects, helping to relieve asthmatic symptoms by relaxing bronchial muscles and reducing inflammation (Kumar et al. 2019; Gupta et al. 2023).

Anti-inflammatory Activity

The plant exhibits significant anti-inflammatory effects by inhibiting the production of pro-inflammatory mediators such as prostaglandins and cytokines. This activity is attributed to flavonoids, alkaloids, and phenolic compounds (Gupta et al. 2023).

Immunomodulatory Activity

Alkaloids from *T. indica* have shown immunosuppressive effects, which help manage autoimmune diseases. Tylophorine specifically suppresses T-cell proliferation and cytokine production (Gupta et al. 2010; Bembde et al. 2020).

Anti-cancer / Cytotoxic Activity

Tylophorine and related alkaloids have demonstrated cytotoxic activity against various human cancer cell lines. These compounds inhibit cell proliferation and induce apoptosis in tumor cells (Pratheesh et al. 2014).

Antimicrobial Activity

Extracts of *T. indica* have shown antimicrobial properties against several bacterial and fungal strains. The presence of phenolic compounds, flavonoids, and tannins contributes to this activity (Gurav et al. 2011; Gupta et al. 2023).

Antioxidant Activity

The plant is rich in flavonoids and phenolics, which exhibit strong free radical scavenging activity, thereby reducing oxidative stress and protecting cells from damage (Kumar et al. 2019).

Antidiarrheal and Antispasmodic Activity

Traditionally used in gastrointestinal disorders, the plant has shown antispasmodic and antidiarrheal properties, likely due to its alkaloids and flavonoids (Pratheesh et al. 2014).

Hepatoprotective Activity

Some studies have reported hepatoprotective effects of *T. indica* extracts against chemically induced liver damage in animal models (Kumar et al. 2019).

Antidiabetic Activity

Preliminary studies have indicated a hypoglycemic effect of *T. indica* extracts, possibly through enhancement of insulin activity or glucose metabolism (Pratheesh et al. 2014).

CONCLUSION

T. indica is a valuable medicinal climber belonging to the family Apocynaceae, known for its rich phytochemical profile and broad spectrum of pharmacological activities. Traditionally used in Ayurvedic and folk medicine,

the plant possesses therapeutic potential against ailments such as asthma, inflammation, cancer, microbial infections, and autoimmune disorders. The presence of biologically active alkaloids like tylophorine, tylophorinidine, and tylophorinine, along with flavonoids, tannins, and saponins, underpins its diverse medicinal properties. Scientific investigations, both in vitro and in vivo, have validated many of its traditional uses. Continued exploration and standardization of its bioactive compounds can lead to the development of effective, plant-based therapeutics for modern medicine.

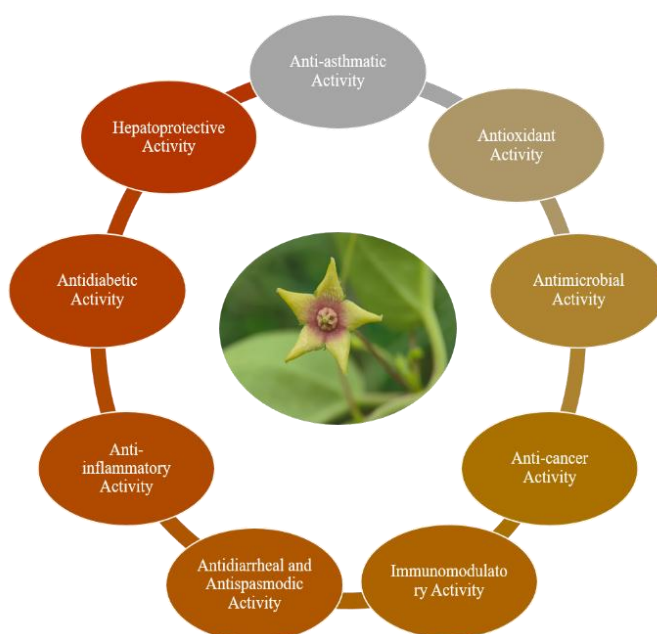


Figure 1: Pharmacological activities of *T. indica*

REFERENCES

- Bembde NS, Meshram PV, Patil MK and Shaikh J. (2020). The Preliminary Phytochemical Analysis of Ethanolic extract of *Tylophora indica*. Research Journal of Pharmacognosy and Phytochemistry. 12(1): 1-6.
- Butani AK, Panchal SR, Vyas NY, Khan MY and Kumar V. (2007). *Tylophora indica*—An ancient anti-asthmatic medicinal plant: A Review. International Journal of Green Pharmacy. 1 (2): 2–6.

Gupta A, Singh D, Prasad M, Saraswat P and Ranjan R. (2023). Sustainable utilization of *Tylophora indica* (Burm. f) Merrill, An endangered medicinal plant. International Journal of Botany Studies. 8(4): 25-33.

Gupta M, Mukhtar HM and Ahmad S. (2010). Phyto-pharmacological and plant tissue culture overview of *Tylophora indica* (burm f.) Merill. Journal of Pharmaceutical Sciences and Research. 2 (7): 401-411.

Gurav S, Devprakash GPS, Tembare R and Mani T. (2011). *Tylophora indica*: A review on its ethnobotany, phytochemical and pharmacological profile. Asian Journal of Biochemical and Pharmaceutical Research. 1 (3): 405–414.

Kakde N, Shimple L and Pandhure N. (2015). In vitro Studies in *Tylophora asthmatica* (Burm.F) Merill. International Journal of Advanced Research in Biological Sciences. 2(12): 204–207.

Kour N and Gupta M. (2015). Utility of *Tylophora indica* as anti-asthmatic plant: a review. Journal of Plant Development Sciences. 7 (12): 869-873.

Kumar S, Jain P, Saraswat S and Arora S. (2019). *Tylophora indica*: A brief review on pharmacological Aspects. Advance Pharmaceutical Journal. 4(3):70-75.

Kumar S, Nutan K, Ruangelic EE, Rainer E and Peter P. (2011). Isolation, Characterization and bioactivity of endophytic fungi of *Tylophora indica*. World Journal of Microbiology and Biotechnology. 27:571-577.

Kumar S. (2011). Qualitative Studies of Bioactive Compounds in Leaf of *Tylophora indica* (Burm. F.) Merr. International Journal of Research in Pharmaceutical and Biomedical Sciences. 2(3):1188-1192.

Lakshmi SVVNSM, Chandrika M, Nandin R, Pavithra MN, Korn R and Ahsan MJ. (2024). An Insight into the Traditional Uses, Phytoconstituents and Pharmacological Activities of the Genus *Tylophora*. Research Journal of Pharmacognosy. 11(1): 71–108.

Mohan CH, Devi BR, Manjula P, Kumar BK, Naresh B and Devi BP. (2012). Phytochemical investigations and micropropagation of *Tylophora indica* (burm. F.) Merill from nodal explants. The Journal of the Indian Botanical Society. 93 (1 & 2): 42-49.

Palanisamy P, Phagalavan M, Manojkumar K, Satyanarayana RKKVV and Teja N. (2014). Formulation and Evaluation of *Tylophora indica* Extract Loaded Topical Herbal Microgel for Rheumatoid Arthritis. 14(4):2172-2181.

Pratheesh KV, Shine VJ, Emima J, Renju GL and Rajesh R. (2014). Study on the Anti-Cancer Activity of *Tylophora indica* Leaf Extracts on Human Colorectal Cancer Cells International. Journal of Pharmacognosy and Phytochemical Research. 6(2): 355-361.

Sabita Rani S, Patnaik S, Sulakshanaand G and Saidulu B. (2012). Review of *Tylophora indica*- an antiasthmatic plant. FS Journal of Research in Basic and Applied Sciences. 1(3): 20-21.

Saidaiah S and Reddy SK. (2022). Phytochemical analysis and antibacterial activity *Tylophora indica* (Burm. F.) merill. International Journal of Botany Studies. 7(1):400-402.

Singh J, Singh S, Kaur P, Kapoor P, Rasool HI, Sharma J, Mir SS, Ibrahim B, Vasist D, and Bhatia D. (2014). Biochemical characterization of *Tylophora indica* and its immunomodulatory effect. South Asian Journal of Experimental Biology. 4 (2): 61-67.