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# A BRIEF PHYTOPHARMACOLOGICAL OVERVIEW OF *TYLOPHORA INDICA*- AN ENDANGERED MEDICINAL PLANT

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## ABSTRACT

*Tylophora indica* is an important medicinal plant from the repository of valuable plant species of Indian subcontinent. The plant has a long reputation in curing various health ailments including asthma, bronchitis, rheumatism and other respiratory problems. Due to its vast medicinal importance, the plant is exploited on a large scale and its uncontrolled and unmonitored harvesting from the wild has categorized the plant among the endangered plant species.

**INTRODUCTION:** *Tylophora indica* (Burm. f.) Merrill (family Asclepiadaceae) commonly known as 'Antmool' is indigenous to India found in the sub-Himalayan tract extending from Uttar Pradesh to Meghalaya [1]. The plant forms dense patches in the forest with moist and humid conditions, in open hill slopes and narrow valleys.

The plant inhabits up to an elevation of 1,260 m in the sub-Himalayan tract. *Tylophora* comprises of 50 species which are widely distributed in Africa, Asia, Australia and Oceanic Islands and it also harbors in Ceylon, Malay island and Borneo. It grows well on a wide range of well drained soils preferring sandy localities and shows stunted growth in the areas with lesser rainfall.

*Tylophora indica* is a slender, perennial climber with long, fleshy and Knotty roots and semi shrubby with long and twinning stem. Leaves are ovate-oblong to elliptic oblong, green in color with leaf Mesophyll differentiated into 2-3 layered palisade tissue and 6-8 spongy parenchyma layers, containing rosettes of calcium oxalate crystals [2].

The normal method of propagation is through seeds, but seeds are too small and have low seed viability and germination.

Moreover, propagation by vegetative cuttings like stem cuttings is rather difficult as they failed to produce proper roots [3]. Therefore, micropropagation is the only best alternative for producing true to type and rapid copies of this important plant.

Plant is traditionally used as a folk remedy in the treatment of bronchial asthma, bronchitis, rheumatism, allergies, inflammation, dysentery, whooping cough, diarrhea [4, 5, 6]. The leaves and roots of the plant contain 0.2-0.46 % therapeutically important alkaloids viz. tylophorine, tylophorinine and tylophorinidine.

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**FIG. 1: *TYLOPHORA INDICA***

These potent alkaloids endowed this plant with a variety of medicinal value to cure various human ailments. Numerous pharmacological investigations have established the pharmaceutical potential of this important medicinal plant. Major alkaloid tylophorine has immunosuppressive, anti-inflammatory [7], anti-tumor [8], anti-candidal [9] and anti-amoebic and anticancerous properties [10] while alkaloid tylo-phrinidine has antileukemic [11] properties. Tyloindicines F, G, H and I, a group of minor alkaloids, are cytotoxic.

Many research activities on the phytochemical, biological and chemical properties of the plant have been done so far but the data available in literature is quite scattered. Therefore an attempt has been made to compile the available data on different pharmacological activities of the plant in the current paper.

**Phytoconstituents:** Major alkaloids such as tylophorine ($C_{24}H_{27}O_4N$), tylophorinine ($C_{23}H_{25}O_4N$), tylophrinidine ($C_{22}H_{22}O_4N$) and septidine have been isolated from the leaves and roots of *T. indica* by number of workers [10, 12]. Set of seven additional phenanthroindolizidine alkaloids known as tyloindicines A–E isolated from *Tylophora indica*, bore novel structural features [13].

In a follow-up study, another set of tyloindicines from *T. indica* with even more intriguing structural features were also isolated [10]. Of this set, tyloindicines F and G featured a unique tertiary hydroxy group and were screened for anti-tumor potential.

Other major alkaloids include tylophorindine, desmethyltylophorine, desmethyltylophorinine, des-methyltylophoridine, anhydrous dehydrotylo-phorinine [14]. Apart from these, some rare alkaloids namely tyloindicines H, I and J, desmethyltylophorine, des-methyltylophorinine, isotylocrebrine, 4, 6- des-methylisodroxy-o- Methyltylophorinindine have been reported.

The non-alkaloidal compounds isolated from *Tylophora indica* are kaempferol, quercetin, α- and β- amyrins, tetratriacontanol, octaosanyl octacosanoate, sigmasterol, β-sitosetrol, tyloindane, cetyl-alcohol, wax, resin, coutchone, pigments, tannins, glucose, calcium salts, potassium chloride, quercetin and kaempferol [2].

**Pharmacological studies**

1. **Anti-inflammatory activity:** *Tylophora indica* has been used traditionally as a remedy for various anti-inflammatory activities against asthma, bronchitis, bronchial asthma, hay fever and rheumatism. The major alkaloid tylophorine is conceivable to account for the therapeutic efficacies. Anti-inflammatory activity of phenanthroindolizidine alkaloids were examined in an *in vitro* system mimicking acute inflammation by studying the suppression of lipopolysaccharide (LPS)/interferon (IFN) induced nitric oxide production in RAW264.7 cells. Two of the phenanthroindolizidine alkaloids, tylophorine and ficuseptine-A, exhibited potent suppression of nitric oxide production and did not show significant cytotoxicity to the LPS/IFN stimulated RAW264.7 cells [15].

2. **Antitumor activity:** Tylophorine and its analogs have gained attention for drug development and have been proposed to exert antitumor effects in a novel mode of action [16]. Tylophorine analogs were found to inhibit the activity of cAMP response elements in HepG2 lung carcinoma cells treated with forskolin, TPA, and TNFα respectively. Tylophorine retarded S-phase progression along with arrest of growth at G1 phase in HepG2, HONE-1 and NUGC-3 in carcinoma cells [17]. Another two phenanthroindolizidine alkaloids namely, pergularine and tylophorinidine, were found to

inhibit the activity of dihydrofolate reductase and thymidylate synthase, highlightening the mechanism of action for anticancer activity [18, 19].

3. **Antiallergic activity:** Studies were carried out to elucidate the anti-allergic activity of tylophorine and other related alkaloids. The anti-allergic effect of aqueous extract of *Tylophora indica* was compared with that of disodium cromoglycate on perfused rat lung in sensitized rats by observing the changes in the volume of the perfusate per minute. Administration of extract intraperitoneally (5 mg/kg) increased the rate of flow from 7.65 to 19.55 ml/min. The action of *Tylophora indica* may be due to direct bronchodilator property and membrane stabilizing and immuno-suppressive effects [20].

4. **Hepatoprotective activity:** Alcoholic (ALLT) and aqueous (AQLT) extracts of leaves of *Tylophora indica* were assessed for hepatoprotective activity in ethanol-induced hepatotoxic rats. Ethanol produced significant changes in physical, biochemical, histological and functional liver parameters but pretreatment with ALLT or AQLT extract significantly prevented all these changes induced by ethanol in the liver. This clearly indicates that both the extracts possessed hepatoprotective activity although it was much higher in the alcoholic extract as compared to aqueous extract [21]. Methanolic extract of *T. indica* leaves was also screened for hepatoprotective activity in carbon tetrachloride induced hepatotoxic albino rats [22]. Significant reduction in serum hepatic enzymes was observed when compared to rats treated with carbon tetrachloride alone.

5. **Antimicrobial activity:** Antimicrobial activity of ethyl acetate and methanolic leaf extracts of *T. indica* were investigated by well-diffusion method against bacterial pathogens (such as *Pseudomonas aeruginosa, Klebsiella pneumoniae, Escherichia coli, Staphylococcus aureus* and *Salmonella typhi*) mainly associated with HIV. Highest inhibitory activity when compared with all treatments was shown by the methanolic leaf extract of *Tylophora indica* [23]. Similarly in another study, aqueous and alcoholic extracts of *in vitro* raised plants of *Tylophora indica* were evaluated for antimicrobial activity against *Staphylococcus aureus, Streptococcus agalactiae, Enterococcus faecalis, Staphylococcus epidermidis, Streptococcus pyogenes* and *Bacillus* species. The study clearly showed that alcoholic extract of *in vitro* raised plants showed significantly higher levels of antibacterial activity against *Staphylococcus aureus, Staphylococcus epidermidis* and *Bacillus* species but aqueous leaf extract showed antimicrobial activity only against *S. epidermidis* [24].

6. **Diuretic activity:** Aqueous and alcoholic leaf extracts of *T. indica* were studied for diuretic activity in rats. Different parameters like body weight before and after test period, total urine volume, urine concentration of $Na^+$, $K^-$ and $Cl^-$ were examined per rat and it was concluded that both alcoholic and aqueous extracts possessed good diuretic activity. Urine volume, cation and anion excretion, $Na^+/K^+$ ratio increased thereby supporting the ethno pharmacological use of leaf extracts as a potential diuretic [25].

7. **Immunomodulatory activity:** Immunomodulatory activity of Tylophora alkaloids were studied in *in vivo* systems. Crude extract of the leaves of *Tylophora indica* inhibited delayed hypersensitivity reaction to sheep red blood cells in rats when the alkaloid mixture was administered before and after immunization with these cells. The alkaloid mixture also inhibited contact sensitivity to dinitro-fluorobenzene in mice when given prior to or after contact sensitization [26].

**CONCLUSION:** From the present review, it can be concluded that exhaustive work has been done on the plant but still there is a need to explore other potent phytoconstituents from the plant with valuable pharmacological properties which can serve as a source of novel high quality formulations.

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