

Review of *Ipomoea pes-tigridis* L. : Traditional Uses, Botanical Characteristics, Chemistry and Biological Activities

¹Nataraja Thamizh Selvam, ² Acharya M V

¹Research Officer Scientist-II (Biochemistry), ²Director, NRIP
National Research Institute for Panchakarma
(Central Council for Research in Ayurvedic Sciences,
Ministry of AYUSH, Govt. of India, New Delhi)
Thrissur, Kerala- 679 531.
Email: nthamizhselvam@gmail.com

Abstract

Convolvulaceae known as the morning glory family is widely distributed in tropical, subtropical and temperate regions. The Convolvulaceae are mostly twining herbs or shrubs, sometimes with milky sap, comprising about 60 genera and nearly 1600 species in the world. The present study has been taken up to review one of the ethnomedicinal important plant under this family, *Ipomoea pes-tigridis* L. (Tiger Foot Morning Glory in English). The study documented the details of its taxonomical, phytochemical, physiochemical characteristics, its folk lore uses and other scientific studies that were carried out on this plant.

Key words: *Ipomoea pes-tigridis*, Convolvulaceae, Tiger foot morning glory, Ethnomedicinal value

Introduction:

Ipomoea pes-tigridis L. is a twining, herbaceous, hairy, annual vine. This plant belongs to the family Convolvulaceae and is commonly known as “Tiger Foot Morning Glory” in English and locally known as ‘Pulichuvadi’ or ‘Pulichuvadu’ in Malayalam (1,2). It is usually found in bush land, riverside, cultivated ground and sandy soil. All parts of the plant is covered with long, spreading, pale or brownish hairs. The leaves are rounded, 6-10 cm in diameter, palmately 5- 9 lobed, heart-shaped at the based and hairy on both surfaces. The lobes of the blade are elliptic, with narrowed base and rounded sinuses (3-5). The 5- lobed leaf resembles tiger’s paw, that inspired its common name, as well as the botanical species name pes-tigridis. The flowers occur in axillary, head, usually only one opening at a time. The sepal is green colour and 1 cm long; flowers are white and about 4 cm long. Flowers open at evening time and fade next morning.

Taxonomical details (6,7):

Botanical Name : *Ipomoea pes-tigridis* L.

Kingdom : Plantae

Subkingdom : Viridiplantae

Infrakingdom : Streptophyta

Superdivision : Embryophyta

Division : Tracheophyta

Subdivision : Spermatophytina

Class : Magnoliopsida

Superorder : Solanales

Family : Convolvulaceae

Genus : Ipomoea

Species : *Ipomoea pes-tigridis* L.

Synonyms : *Ipomoea biloba* Forsk., *Convolvulus pes-caprae* L.

Vernacular Names: Panchpatia (Hindi), Tiger’s Foot (English), Pulichuvadu (Malayalam)



Figure 1 a. *Ipomoea pes-tigridis* L. Leaf and flower



Figure 1 b. Hairy nature of *Ipomoea pes-tigridis* L.



Figure 2. Herbarium of *Ipomoea pes-tigridis* and its Authentication

Geographical Distribution:

The plant is distributed in tropical, sub-tropical and temperate regions. It is distributed in Western ghat regions of India and other places. It is also found in tropical Africa and Asia (8,9).

Plant Parts used:

Leaves and Whole plant are widely used.

Folklore:

In Java, it is used for poulticing sores, pimples, boils, carbuncles etc. In Sri Lanka, entire creeper is crushed and the juice is given orally for treatment of prevention of rabies if bitten by a rabid dog. In India, the plant is used for wound healing (2, 10-11). The tribal community in Kerala state of India use the herb for various painful conditions like headaches, swellings, poisonous stings, snake bites etc. Some of the important species under Convulvalaceae and their reported uses have been mentioned in Table 1.

Reported Scientific Studies:

Histology studies

Histological characteristics and ethnopharmacognostical investigations of *I. pes-tigridis* has been extensively studied by Pratap *et al.*, 2011 (12). Fresh leaves and roots of the plant were studied for their microscopical and macroscopical characteristics and their reaction with specific chemicals have been shown in Table 2. The presence of abundant calcium oxalate crystals in the cork and cortex region, simple starch grains in the cortex regions were reported. Powder microscopy revealed the presence of abundant elongated trichomes and fibers.

Phytochemical studies

The preliminary Phytochemical analysis reported by Pratap *et al.*, 2011 showed the presence of alkaloids, saponins, flavanoids and tannins in root and leaf extracts (12).

Analgesic Activity

The study was conducted by Tail Flick Response Method and Acetic-acid Induced Writhing in Mice. The experiment showed the ethanolic leaf extract of *Ipomoea pes-tigridis* has significant activity with a dose-dependent significant reduction of writhes using plate reaction time. It showed that the *I. pes-tigridis* extract is capable of inhibiting non-inflammatory reactions as well as inflammatory pain (13). Analgesic and neuro-pharmacological effect of Ethyl acetate extract of *I. pes-tigridis* was carried on Albino mice by Hot plate method, Hole cross test and Open field test (14) and these tests showed significant activities. The brief information regarding biological studies carried out on *I. pes-tigridis* has been documented in Table 3.

Antimicrobial Assay

The antimicrobial activity of *I. pes-tigridis* was evaluated by disc diffusion method against selective gram positive bacteria *Staphylococcus aureus* and *Bacillus subtilis* and gram negative bacteria *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Salmonella paratyphi* and *Vibrio cholera*. The ethyl acetate extract and N-hexane extract of *I. pes-tigridis* showed prominent activity against *S. aureus*, *B. subtilis* and *V. cholera* (15).

Thrombocytic activity

The ethyl acetate and n-hexane extracts of *I. pes-tigridis* leaves showed clot lytic activity in the controlled study conducted by *in vitro* method. The activity was much more significant for ethyl acetate extract than n-hexane extract (15).

Cytotoxic activity

The ethyl acetate and n-hexane extracts of *I. pes-tigridis* were tested for Brine Shrimp Lethality Bioassay using brine shrimp naupli. The study showed that LC₅₀ of the ethyl acetate and n-hexane extract is found to be 14.12 µg/ml and 33.13 µg/ml respectively (15). The study on ethanolic extract of *I. pes-tigridis* against HepG2 cell line (liver cancer cell line) showed that the extract has significant cytotoxic effect at the concentration of 500 µg/ml producing 99.87% cell inhibition (16).

Chemical properties:

There is no much literature regarding specific chemical constituents of *Ipomoea pes-tigridis*. However, it has been reported that *Ipomoea* genus has components like ergoline alkaloids, indolizidine alkaloids, nortropane alkaloids, flavonoids, glycolipids, lignin, and triterpenes. These compounds were reported for their psychotropic, uterotonic, haemostatic properties (17).

Table 1. Traditional uses of some important *Ipomoea* species (Meira *et al.*, 2012) and their study details.

S.No.	Species	Medicinal uses References (18-31)
1	<i>Ipomoea aquatica</i>	Treatment of diabetes (Jayaweera, 1982; Malalavidhane <i>et al.</i> , 2001). Scorpion venom antidote (Uawonggul, <i>et al.</i> , 2006), as emetic, diuretic, purgative, to treating debility, liver complaints, against nosebleed and high blood pressure (Mamun, <i>et al.</i> , 2003).
2	<i>Ipomoea cairica</i>	Treatment of rheumatism and inflammations (Ferreira <i>et al.</i> , 2006).
3	<i>Ipomoea digitata</i>	The powdered root is used in emaciation of children and also as tonic, alterative, aphrodisiac, demulcent, lactagogue, and cholagogue. Decoctions of root against constipation (Singh <i>et al.</i> , 2004).
4	<i>Ipomoea asarifolia</i>	Against itch (Silva, 2002)
5	<i>Ipomoea pes-caprae</i>	Treatment of inflammatory and analgesic processes (Souza <i>et al.</i> , 2000)
6	<i>Ipomoea leptophylla</i>	The smoke of burned the roots in treatment of nervousness (Native Americans Pawnee) (Gilmore, 1977). The root for stomach distress (Lakota people) and tonic (early European settlers) (Barnes <i>et al.</i> , 2003).
7	<i>Ipomoea muricata</i>	Glycerol preparations of the crude drug plant are used for the treatment of pharyngitis and for the treatment of otitis externa (Ysrael, 2003).
8	<i>Ipomoea orizabensis</i>	As purgative (American and European pharmacopeas) (Pereda-Miranda, 1995), anthelmintic and to treat abdominal fever, dysentery, epilepsy, hydrocephaly, meningitis and tumors (Martinez, 1990).
9	<i>Ipomoea stoloifera</i>	As diuretic and to treat pain after childbirth, stomach problems, inflammations, (Paula <i>et al.</i> , 2003).

Table 2. Response of Leaf and Root powder with different chemical agents reported by Pratap et al., 2011.

S.No.	Test Details	Colour observations on plant parts	
		Root Powder	Leaf powder
1	Powder + Distilled water	Light Brown	Light Green
2	Powder + 5% Aqueous FeCl ₃	Black colour	No change
3	Powder + 5% HNO ₃	No change	No change
4	Powder + N/10 Iodine solution	Brown colour	Blue colour
5	Powder + Con HCl	Dark Brown	Light Green
6	Powder + Con H ₂ SO ₄	Black	Black
7	Powder + 5% Aqueous NaOH	Light Brown	Light Green

Table 3. Details of studies carried out on *I. pes-tigridis* with reference to ethnomedicinal value.

S.No.	Medicinal uses and other characteristic studies	Study Details (4, 11-17, 32-33)
1	Analgesic and neuropharmacological effect	<i>In vivo</i> study on Albino mice Ramesh 2010; Chowdhury <i>et al.</i> , 2014
2	<i>Ethnopharmacognostical</i> investigations	Plant taxonomy and histology studies Pratap <i>et al.</i> , 2011
3	Cytotoxic activity against HepG2 cell line	<i>In vitro</i> cytotoxic studies against liver cancer cell line Begum <i>et al.</i> , 2015
4	Antimicrobial, Thrombolytic and Cytotoxic activity	<i>In vitro</i> studies on plant leaf. Chowdhury <i>et al.</i> , 2015
5	Nutritive value and digestibility studies	Meira <i>et al.</i> , 2012
6	Leaves are used for poulticing sores and pimples	<i>In vivo</i> study. Quisumbing, 1951.
7	Biochemical studies on Ipomoea pollen for understanding species homology	Isozyme studies and Phylogenic mapping. Das and Mukherjee, 2015
8	<i>Ethnopharmacognostical</i> Investigation with taxonomical characteristic studies	Pratap <i>et al.</i> , 2011
9.	Extract of plant used in Snake bites	Chopra <i>et al.</i> , 1956.
10	Laxative, sores and boils	Amor-Pratsa <i>et al.</i> , 1993.

Conclusion:

Ipomoea pes-tigridis L. is one of the important medicinal plants under Convolvulaceae family. The present review has brought out overall details of the plant regarding its botanical characteristics, distribution, folk lore uses, medicinal uses claimed and scientific studies carried out. It has been noted that there are some areas not much explored like chemical characteristics of the plant with reference to its active ingredients, principle compound quantification, parameters for quality assurance of the plant etc. Even though, there are number of research reports found for *in vitro* cytotoxic activity (cancer cell lines) of *I. pes-tigridis*, not much reports seen for the research studies carried out in the aspects of anticancer activity through tumour induced animal model system extending to validate the safety and efficacy of the plant at *in vivo* level. The detailed in depth studies have to be carried out focussing on mode of action of the plant at tissue and molecular level for exploring the plant in a better way.

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