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A review on medicinal uses, pharmacology and phytochemistry of *Aristolochia tagala* Cham. An endangered medicinal plant

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Abstract

Aristolochia tagala L. (Aristolochiaceae) has long been used in Indian subcontinent in the traditional system of medicine to treat cholera, fever, bowel troubles, ulcers, leprosy, skin diseases, menstrual problems and snakebites. The plant is also used as emmenagogue, abortifacient, antineoplastic, antiseptic, anti-inflammatory, antimicrobial, antipyretic, antifertility and antispermatogenic agent. Aristolochic acid, a major active constituent of the plant is reported to cause cancer, nephropathy, sister chromatid exchange and is a potent abortifacient. This study was carried out to compile all available data in the review form on the basis of its distribution, medicinal uses, pharmacology and phytochemistry.

Keywords: *Aristolochia tagala*, medicinal plant, snake bite, pharmacology, and phytochemistry

Introduction

Aristolochia tagala Cham. is a rare medicinal plant that belongs to the family Aristolochiaceae. The plant is commonly known as Oval leaf Dutchman's pipe. (Debelle *et al.*, 2008) [7]. It is having the chromosome number of $2n=12$ (Sugawara *et al.*, 2001) [28]. *Aristolochia* genus is distributed throughout the tropical and subtropical countries and occurs in the most diverse climates. These are evergreen or deciduous woody vines and herbaceous perennials distributed in India, Sri Lanka, China, Malaysia, Burma, Java and Australia (Murugan *et al.*, 2006) [5]. In India, found in the Himalayas, occurs along the Western Ghats in Maharashtra, Karnataka, Tamil Nadu, and Kerala. It is found growing at 1000 to 1400 m above sea level elevation (Nayar *et al.* 1976) [21]. The plant was found to have a significant role in traditional medicine, especially in South India.

Table 1: Names of *Aristolochia tagala* Cham. in different languages/ Regions

Language / region	Names
Telegu	Nallaisvara, Nallayisvari, Nallaeshvara
Kannada	Doddaeshwariballi, Gattadaeshvari
Tamil	Aadtheendapalai
Malayalam	Valia arayan

Table 2: Taxonomy

Kingdom:	Plantae	Family	Aristolochiaceae
Class	Dicotyledons	Genus	<i>Aristolochia</i>
Subclass	Monochlamydeae	Species	<i>A. tagala</i>
Order	Piperales	Binomial name	<i>Aristolochia tagala</i> Cham



Fig 1: a. Flower b. fruit c. opened pod d. leaf e. General view of *Aristolochia tagala* Cham.

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Table 3: Plant description

Habitat	Sun loving climber found in the semi evergreen and evergreen forests, open lowlands and thickets.
Plant	It is a climbing shrub
Leaves	Leaves are entire and alternate and are ovate, acute or acuminate and deeply cordate with narrow sinus. Upto 8 inches long and 4.5 inches broad (Rajashekharan <i>et al.</i> , 1989) [22].
Flower	Flowers are produced in axillary cymes and are distinctly stalked. They are bisexual, zygomorphic with an inferior ovary. The perianth consists of three united, tubular, 7–8 cm long, purplish-brown lobes. Flower exhibits special structural features, the fly-trap mechanism.
Pollination	It is pollinated by insect Chironomid fly (Diptera) (Murugan <i>et al.</i> , 2005).
Fruit	Fruits are long talked dehiscent capsule, splitting along the placenta and with many endospermic seeds that are flattened and broad-winged. (Rajashekharan <i>et al.</i> , 1989) [22]. The seeds are stacked in rows inside the globular capsule which looks like an inverted parachute.

Ecological importance

The caterpillars of the common birdwing (*Troides helena cerberus*) and common rose (*Pachliopta aristolochiae*) butterflies feed on the leaves of this plant.

Medicinal importance

Aristolochia tagala is extensively used in traditional medicine. Roots of the plant are mainly used to treat different ailments. Apart from roots. Leaves, flowers, fruits and whole plant is used for the preparation of different medicines.

Roots

In many of the tribal settlements, the fresh root of *A. tagala* is used against poisonous bites from snakes and scorpions. The Root paste of the *Aristolochia tagala* is applied locally immediately after a snake bite (Dey and De, 2012) [10]. Root decoction is consumed as tonic, carminative and emmenagogue (Biswas *et al.*, 2010) [2]. It is also used to treat high blood pressure, Beri Beri and swollen feet (Rajkumar and Rajanna, 2011) [24]. In Andhra Pradesh, roots are used to increase the production of breastmilk. The rheumatic area is massaged with the paste of the roots by tribal of Meghalaya. (Singh and Borthakur, 2011) [5]. Root decoction is used for treating Stomach pain, chest pain, fever, poultice in abdomen, skin disease, snake bite, malaria, dyspepsia and flatulent (Sharma *et al.*, 2018) [27] in Andaman and Nicobar. The root extract of the *Aristolochia tagala* used as female antifertility medicine (Balaji *et al.*, 2004) [3]. Bark or roots are abortive in Papua New Guinea.

Leaves

Oral consumption of leaf juice is done immediately after snake bite (Biswas *et al.*, 2010) [2]. For the treatment of stomach-ache and bowel complaints, leaves are grounded and taken as such (Ranjith *et al.* 2009). Medicated leaf oil is Externally applied during night to prevent of snake bite. (Murugesan *et al.*, 2005) [20]. To Prevent implantation and to stimulate uterine flow about 10ml of the decoction of the leaves is taken with honey for one week in Paliyars community, Tamil Nadu. (Bose *et al.*, 2014) [6]. To cure diarrhea and vomiting, Leaves and tender stem were ground and administered orally (Murugesan *et al.*, 2005) [20].

Whole plant

The plant paste taken internally to cure abdominal pain. (Shyma T. B. and Devi prasad, 2012) [1] and for headache, cold and fever (Kamatchi and Parvathi, 2018) [15]. The whole plant decoction is taken orally 3 times per day for 3 days and leaf paste applied locally for 5 days for Bowel problems (Rajendran *et al.*, 2003) [23]. To cure some gynaecological disorders and to stimulate the menstrual flow, the whole plant is used (Ghosh., 2014) [11]. Decoction of whole plants can be

used against Bowel complaints (DeFilipps and Krupnick, 2018) [8]. The whole plant is used for Bone fracture treatment. In the Philippines, for treatment of cancer *A. tagala* is used. (Heinrich *et al.*, 2009) [18]. For the treatment of malaria, toothache and dyspepsia, fruits and roots are used. Fruits are also used as a laxative and tonic (DeFilipps and Krupnick, 2018) [8]. *Aristolochia tagala* flower decoction is taken to regulate the Menstrual disorders (Britto and Mahesh, 2007) [13] by the Kaniin Agasthiayamalai Biosphere Reserve, South India.

Pharmacology

The antibacterial activity found in the plant extracts. The antimicrobial potency of *A. tagala* is believed to be due to steroids, phenolic compounds, and flavonoids. The antibacterial properties were showed by the ethanolic, acetone and chloroform extracts of *A. tagala* (Kalaiarasi *et al.*, 2014) [14]. The acetone extract showed greater activity against gram-positive organism than against gram-negative organism. (Hercluis *et al.* 2018) [18].

Ethanol extract of the leaves of *Aristolochia tagala* Cham. was investigated for antifertility activity in female Wistar rats. Rats treated with the leaf extracts showed a reduction in the number of corpora lutea and implantation sites. (Balaji *et al.*, 2004) [3]. According to this study, *A. tagala* is having the significant antifertility property which can be utilized in future.

The most effective antioxidant and DPPH (2,2-diphenyl picrylhydrazyl) radical scavenging potential were shown by petroleum ether and ethyl acetate extracts of *A. tagala*. It also showed the highest reducing power and amount of total phenolic compounds. (Thirugnanasampandan *et al.*, 2008) [29]. The antioxidant activity exhibited by Fraction I of *A. tagala* was due to the present of compounds like magnoflorine which was also reported to have anti-inflammatory activity, apigenin dimethyl ether; reported to have potential antidiabetic and anti-obesity properties, Aristo lone and N-Trans-Feruloyldopamine. (Hadem and Sen, 2018) [16, 17].

The leaf and root extracts of *Aristolochia tagala* revealed a higher antifeedant activity (56.06%) against *Spodoptera litura*. The ethyl acetate extract of *A. tagala* at 5.0% concentration showed higher antifeedant, larvicidal and pupicidal activities, prolonged the larval and pupal duration (Baskar *et al.*, 2010) [4].

Phytochemistry

Chemical constituent of *A. tagala* were reported by many scientists. Phytochemical screening of different extracts of *A. tagala* revealed the presence of steroids, phenolic groups and flavonoids. The ethanolic, acetone and chloroform extracts of *A. tagala* showed antibacterial activity. (Kalaiarasi *et al.*, 2014) [14]. A total of 21 compounds were identified.

Aristolochic acid I, aristolactam IIIa, β -sitosterol, kaempferol, and stigmasterol were reported in *A. tagala*. Aristolochic acid I showed the highest cytotoxic and apoptotic activity. Aristolochic acid reported to have antitumor and anticancer effects. It also causes nephrotoxic effect. (Hadem and Sin, 2018) [16, 17]. Extract of the whole herbs of *Aristolochia tagala* were consisting fifteen compounds which were divided into eight aristolactam-type alkaloids and seven aristolochic acid derivatives. They were identified as aristolactam BII, aristolactam II, sauristolactam, aristolactam I, 7-methoxyaristolactam IV, aristolactam AII, 3-hydroxy-4-methoxy-10-nitrophenanthrene-1-carboxylic acid methyl ester, ariskanin A, ariskanin D, ariskanin E, aristolochic acid C, ariskanin C, ariskanin B, aristolactam-N- β -D glucoside and cepharanone A N- β -D-glucoside. (Lui and Zhang, 2020) [26]. The root and rhizomes contain isoaristolochic acid, Allantonin, alkaloid Aristolodin, Sesquiterpene hydrocarbon, Ishwarane Aristolochine, alcohol Ishwararol and essential oil containing carboxyl compounds [Dey and De, 2012] [10].

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