ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Phytochemical and Pharmacological Potential of Aristolochia indica: A review

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ABSTRACT

Aristilochia indica is credited with innumerable medicinal activities. The therapeutic value of A. indica has been recognized in different system of traditional medicine for the treatment of different ailments of human beings. Several phytoconstituents like aristolochic acid, ceryl alcohol, β- sitosterol, stigmast-4-en-3-one, friedelin, cycloeucalenol and rutin have been isolated from different parts of the plant. It has been recommended for the treatment of dry cough, joints pain, inflammation, biliousness, dysphoea of children, snake bite and also used as abortifacient. Most importantly, the studies have shown that the plant exhibited significant antimicrobial activity. This probably explains the use of this plant by the indigenous people against a number of infections. It has significantly decreased the fertilizing capacity in experimental animals.

Keywords: Aristilochia indica, dry cough, inflammation, snake bite, abortifacient.

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ISSN: 0975-8585

INTRODUCTION

From the time immemorial, plants have been widely used as curative agents for variety of ailments. World Health Organization has listed 21,000 plant species used around the world for medicinal purpose. In India about 2,500 plants species belongs to more than 1000 genera are being used in the indigenous system of medicine. India is tenth among the plants rich countries of world and fourth among the Asian countries. Many herbal remedies individually or in combination have been recommended in various medical treatments for the cure of different diseases. Aristolochia indica a shrub or perennial herb, prostrate or twining belongs to the family Aristolochiaceae and well documented in Ayurveda and Unani system of medicine to treat different ailments [1,2].

VERNACULAR NAMES

Sanskrit : Ahigandha, Arkamula, Ishvara, Nakuli, Sunanda.
Hindi : Isharmul
English : Indian Birthwort
Bengali : Isarmul
Gujarati : Arkmula, Ruhimula
Telugu : Dulagovela, Eswaramulli, Ettakalabanda, Govila, Isvara
Tamil : Adagam, Isadesatti, Isura, Isuraver, Karudakkodi, Perumarindu
Tulu : Isaraberu
Malayalam: Eswaramullu, Garalavegam, Iswaramuli, Perumarunna

Distribution: The species is well distributed in West Peninsula and in Ceylon

Morphology

Leaves: Variable, in the broad form 10-12.5 by 7.5 cm; in the narrow form 3.8-10 by 1.3 to 2.5 cm from linear oblong to obovate –oblong or sub-panduri form, usually obtusely acuminate, glabrous, entire with somewhat undulate margines, base cuneata, rounded, subtruncate or subcordate.

Flowers: Flowers are few-flowered axillary racemes; bracts small, ovate, acuminate, opposite the pedicels; pedicles long, thickened above perianth greenish white, reaching 4.5 cm long, with globose inflated base, then bent at a right angle and suddenly narrowed into a cylindric tube with oblique trumprt shaped mouth gradually passing into a long narrow, linear- oblong obtuse brownish lip. Anthers 6 style 6- lobed, capsule 3.8 to 5cm long, oblong or globose-oblong, opening from below upwards, 6 valved, the pedicles splitting into 6 filaments [3].

Seeds: Deltoid-ovate, acute, flat, winged.

ISSN: 0975-8585

Traditional Uses

Ayurveda: The root is pungent, bitter, alexiteric, emmenagogue, useful in "tridosa", pain in the joints, bowel troubles of children.

Yunani: The seeds are tasteless, useful in inflammation, biliousness, dry cough, joints pain, dysphoea of children, purgative. The plant is good for snake bite.

The juice of fresh leaves is useful in the croup of children, by inducing vomiting without causing any depression.

In Murshidabaad, the plant is used as an abortifacient.

The root, stem and leaves are recommended for the treatment of snake bite (Charaka, vaghbhata, bapat, ainslie, rheede, Roberts) and scorpion- stings (Charaka).

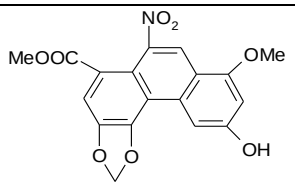
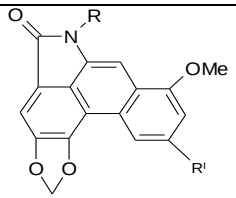
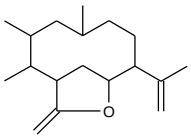
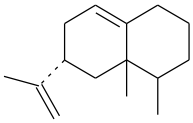
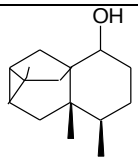
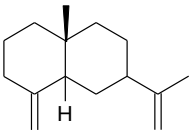
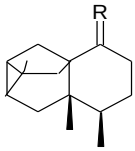
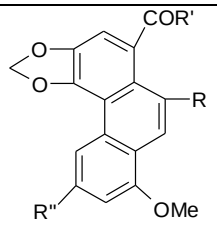
PHYTOCHEMICAL WORK REPORTED ON A.indica

Two new sesquiterpene hydrocarbons ishwarane and aristolochene from roots and structure of a tetracyclic sesquiterpene ishwarone was determined [4, 5]. Ishwarol isolated from roots and its structure was established [6]. A new sesquiterpene hydrocarbon (I) isolated and characterized as 5β-H, 7β, 10α-selina-4(14), II-diene [7]. Five new phenanthrene derivatives (II-VI) isolated and characterized in addition to isolation of stigmast-4-en-3-one, sitosterol and two uncharacterized isomeric sesquiterpene alcohol M.P 103^0C and 150^0C [8]. A new type of sesquiterpene was reported and characterized as (12S)-7, 12-Secoishwaran-12-ol [9]. A phenanthrene derivative Aristololactam N-β-D-glucoside and two steroids 3β-hydroxy-stigmast-5-en-7-one and 6β-hydroxy-stigmast-4-en-3-one was isolated from A.indica [10]. The roots contain aristolindiquinone, aristolide, 2-hydroxy-1-methoxy-4Hdibenzo quinolone-4,5-(6H)-dione, cephradione, aristolactam IIa, stigmastenones II and III, methylaristolate, β-sitosterol-β-D-glucoside aristolactam glycoside I, ishwarol, ishwarone, methylaristolate and aristolochene [11, 12]. A new naphthoquinone Aristolindiquinone [13], Aristolochic acids and Aristolactams [14] was reported from A.indica.

The plant contain methyl ester of 12-nonacosenoic acid [15], besides n-heptadecane, n-triacontane, palmitic acid, hexacosanoic acid, stigmast-4-en-3-one, friedelin, cycloeucalenol and rutin . A cytotoxic lignin, savinin has been isolated from the roots of the plant. The chemical constituents of A.indica. and their structures are shown in Table 1.

ISSN: 0975-8585

Table 1: Chemical Constituents of Aristolochia indica

Chemical name	Chemical structure
Aristolochic acid	
Aristolochic acid D me ether lactam (R=H, R^1= OMe) **Aristolactam-β-D glucoside** (R=Glu, R^1= H)	
Aristolactone	
Aristolochene	
Ishwarol	
5β-H, 7 β, 10α-Selina-4(14),11-diene (A new sesquiterpene hydrocarbon)	
Ishwarane (R= H) **Iswarane** (R= O)	
New Phenanthrene Derivatives a) R,R^{II} = H, R^1= OH b) R,R^{II} = H, R^1= NH_2 c) R=H, R^{I1}= OMe d) R=NO_2, R^1= Me, R^{II} = H	

ANTIMICROBIAL ACTIVITY

The essential oil of A.indica, containing β- caryophyllene and α–humulene as major constituents, was found to show a moderate anti-bacterial activity [16].

A series of 61 Indian medicinal plants belonging to 33 different families used in various infectious disorders, were screened for their antimicrobial properties, Screening was carried out at 1000 and 500 mµg/ml concentrations by agar dilution method against Bacillus cereus var mycoides, Bacillus pumilus, Bacillus subtilis, Bordetella bronchiseptica, Micrococcus luteus, Staphylococcus aureus, Staphylococcus epidermidis, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Streptococcus faecalis, Candida albicans, Aspergillus niger and Saccharomyces cerevisiae. Twenty eight plant extracts showed activity against at least one of the test organisms used in the screening. On the basis of the results obtained, it was concluded that the crude extracts of Dorema ammoniacum, Sphaeranthus indicus, Dracaena cinnnabari, Mallotus philippinensis, Jatropha gossypifolia, Aristolochia indica, Lantana camara, Nardostachys jatamansi, Randia dumetorum and Cassia fistula exhibited significant antimicrobial activity and properties that support folkloric use in the treatment of some diseases as broad-spectrum antimicrobial agents. This probably explains the use of these plants by the indigenous people against a number of infections [17].

Antimicrobial activity of 10 traditional coastal medicinal plants species from South west coast of India were tested against 12 human bacterial pathogens and two cattle pathogens. Among the plant species tested, a butanolic extract of Bacopa monnieri showed maximum inhibitory activity against the human pathogen Escherichia coli, whereas the butanolic extract of Aristolochia indica. L showed maximum inhibitory activity against the cattle pathogen Listeria monocytogen. The mean zone of inhibition indicates that the growth of Salmonella enteritidis and Pseudomonas aeruginosa were highly inhibited by the coastal medicinal plant extract than the other bacterial species and also the antibacterial activity was found higher in the butanolic extract than water extract [18].

Ishwarane, a constituent of A. indica was isolated. The essential oil inhibited the growth of UCH 655 strain at 5mg/ml on which standard antibiotic drugs were ineffective [19].

PHARMACOLOGICAL WORK

Effect of pregnancy

Distruption of pregnancy in mouse by aristolic acid has been done. Aristolic acid which is obtained from A. indica, disrupted nidation in mice when administered on day first of pregnancy. The plant inhibiting effect of the compounds was assessed with respective certain parameters which were characterize of earlier pregnancy, such as tubal transport of ova in the uterus, hyperpermiability of the endometrial capillaries, increase in the uterine weight and total protein content, endometrial bed preparation and changes in uterine phosphatase enzyme on the 4-6th day of pregnancy [20].

Fertility regulation

A report review research on plant-derived agents that prevent sperm production if taken orally by the male or that incapacitates or kills sperm on contact if used vaginally by the female. It would be of great value to develop fertility inhibitors that are totally selective for reproductive systems and enzymes, and there is a possibility that a plant derived drug may have this effect. Plants that have been studied for their fertility inhibiting effects in the male including: A. indica L.(Aristolochiaceae) [21].

Biological evaluation of constituents isolated from the roots of Aristolochia indica have been done for fertility-regulating activity [22]. Research on plants for fertility regulation in India has mentioned the name of Aristolochia indica [23].

Antifertility effect

Antifertility efficacy of the plant has been studied on mouse. Two compounds isolated from the alcoholic extract of the roots of A. indica Linn were tested on 6th day in pregnant mice. One of the compounds, p-coumaric acid showed 100% interceptive activity at the single oral dose of 50 mg /kg of body weight. The antifertility efficacy of these two compounds is discussed [24].

Abortifacient activity

Methyl ester of aristolic acid, a pure compound isolated from the roots of (Linn.), was found to exert 100% abortifacient activity at a single oral dose of 60 mg/kg body weight when administered on 6^{th} or 7^{th} day of pregnancy; 20 and 25% abortifacient effect were observed at the same dose on day 10 and 12, respectively [25].

Anti-implantation activity

A sesquiterpene isolated from the roots of was found to exert 100% interceptive activity and 91.7% anti-implantation activity in mice at a single oral dose of 100 mg/kg body weight. No toxic effect was found at the dose levels used [26].

Interceptive activity

Effect of the extracts from A. indica on interception has been conducted in female mice. The crude petroleum ether, chloroform and alcoholic extracts from the roots of showed 100% interceptive activity in mature female mice at the single dose of 100mg/kg body weight. The follow up studies with the chloroform extract showed the most significant effect in the basic part and two acidic fractions at the single dose levels of 50 mg/kg body weight. No toxic effect was observed at the dose levels used [27].

The toxicity of in goat

There are few reports available on toxicity of A. Indica, shown diarrhoea, dyspnea, tympany, arching of the back, loss of condition, and loss of hair from the back were the prominent signs when was given orally to goats. The main lesions were hemorrhage in the lungs, heart, and kidneys, fatty change and congestion in the liver, mucoid abomasitis and enteritis and straw-colored fluid in serous cavities. An increase in aspartate amino transferase activity, ammonia and urea concentrations and a decrease in the concentrations of total protein and magnesium were detected in the serum [28].

CONCLUSION

Concentrated fruit or seed extracts can be found in various herbal preparations that are in market today. Most of the studies have been conducted using crude preparation of A. indica to find out its chemical profile and pharmacological potential. Although many studies have been claimed for fertility regulation, anti fertility effect, abortifacient effect and anti implantation but still it deserve detailed study on isolated phyto constituents to prove its utility.

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