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FT-IR ANALYSIS OF METHANOL EXTRACT OF LEAVES OF *ARISTOLOCHIA INDICA*

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Abstract:
The Aristolochia indica is called as Eswara mooli, Thalaisuruli,Tharasu kodi, Urikodi thalai and perumarunthu in Tamil language.This plant is mainly used as antidote for all types of unknown poisonous animals bite and to cure foot-and-mouth disease *caused by viral infection (komarinoi) in cow. The leaf garlands are prepared from this plant and wear to in the neck of cow. Hence, the present study the FT-IR analysis was made to evaluate the bioactive phytocompounds present in the methanol extract of leaf of Aristolochia indica. The obtained results showed that the fraction-I of the methanol extract of leaves showed napthalenes, 1, 2, 3.4- tetrasubst benzenes, siloxanes, primary amides, pyridine derivatives, anhydrides, phosphines, aliphatic compounds, aromatic amines, primary amines and ides, alcohol and phenols and fraction –II showedacid chlorides, naphthalenes, iodo compounds, alkynes, chloro compounds, siloxanes, esters and lactones, sulfonyl chlorides, carboxylic acids, Pyridine derivatives, carboxylic acids, substituted benzene ring, phosphines, aliphatic compounds, alcohol and phenols.*

Key words: FT-IR, *Aristolochia indica, foot-and-mouth* disease*, perumarunthu, Eswara mooli, antitode.*

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INTRODUCTION:

Traditional medicine is still recognized as the preferred primary health care system in many communities, with over 60% of the world's population and about 80% in developing countries depending directly on medicinal plants for their medical purposes (Shestha, 2003). Modern medicine today utilizes active compounds isolated from higher plants, and about 80% of these active ingredients indicate a positive correlation between their modern therapeutic use and the traditional uses (Sarkar, 2015). Hence, in the present study has programed to evaluate the bioactive phytocompounds present in the methanol extract of leaves of Aristolochia indica. The results obtained from these studies showed the phytocompounds napthalenes, 1, 2, 3.4- tetrasubst benzenes, siloxanes, primary amides, pyridine derivatives, anhydrides, phosphines, aliphatic compounds, aromatic amines, primary amines and ides, alcohol and phenols in fraction-I. The acid chlorides, naphthalenes, iodo compounds, alkynes, chloro compounds, siloxanes, esters and lactones, sulfonyl chlorides, carboxylic acids, Pyridine derivatives, carboxylic acids, substituted benzene ring, phosphines, aliphatic compounds, alcohol and phenolsin fraction-II.

MATERIALS AND METHOD:

The fresh leaves of *Aristolochia indica* were procured from Vallimalai hills, Vellore District, Tamilnadu. The plant herbarium was authenticated by Dr. Rajendran, Associate Professor, Department of Botany, Thiagarjaor College, Madurai, Tamilnadu. These leaves were meticulously cleaned with autoclaved water. The leaves were then left to dry under shade. Then the leaves were smashed by a mixer grinder. The smashed leaf powders were packed inside the thimble of Soxhlet apparatus. The required amount of methanol was filled inside the bottom flask. The temperature of the heater was set based on the solvent temperature. The extract flow from the condensation chamber through siphon was collected in a conical flask and then air dried up to complete evaporation of solvents. Then the dried extract was taken to FT-IR analysis

Biology of the study plant
Aristolochia Indica

The plant *Aristolochia indica* is a rare endangered plant belongs to family Aristolochiaceae. This family consists around 300 species. This plant is a native of India and commonly known as Iswar mul and also named as birthwort, because of its traditional use in preventing the postpartum infection and snakeroot because of its use against snakebite.

Name in various languages

Bengali : Isarmul, English : Indian Birthwort, Gujarati : Arkmula, Ruhimula, Hindi : Isharmul, Malayalam: Kadalivegam, Karanavalli, Karalakam, Karalayam, Kudukkamooli,Garudakodi, Urikizhangu, Eswaramullu, Garalavegam, Iswaramuli, Perumarunna, Kannada: Isvaberusa , Marathi: Sampsun, Tamil : Adagam, Isadesatti, Isura, Isuraver, Karudakkodi, Perumarindu, Telugu : Dulagovela, Eswaramulli, Ettakalabanda, Govila, Isv ara Tulu : Isaraberu Sanskrit : Ahigandha, Arkamula, Ishvara, Nakuli, Sunanda

Description

Aristolochia indica is a shrub or perennial, twining and semi woody herb. This plant has branchlets slender, simple with alternate leaves and the size ranges from 10-
12.5 breadth and 3.8 to 10 lengths. The shape of the leaves are from linear oblong to obovate, oblong or sub-panduri form, usually obtusely acuminate, glabrous, entirely undulate margines, base cuneata, rounded, subtruncate or subcordate. The young leaves are in light purplish colour. The petioles are short with 2.5cm long. The flowers are few, racemes and positioned in axillary or terminal region. Bracts has 1.5 mm long with lanceolate. Perianth tube is dull brown in colour with 1-1.5 cm long and green 3.5 mm bulbous base. Limb is 2-2.5 cm long, linear-oblong, rounded at apex, greyish-green. Stamens are in 6 numbers. The ovary is 2 mm long with 6 fleshy stigmas. Capsule is one-lipped, greenish-purple colour, 1.5-3 x 1.5-2 cm, globose- pyriform, 6-ridged and dehiscing from the base. The shape of the capsule after dehiscence is parachute-like. Flowering period is from December to February. The seeds are deltoid-ovate, acute, flat, winged

Distribution

The family Aristolochiaceae is distributed worldwide particularly in India, China, Srilanka, Afghanistan, Pakistan, Bunglaesh, Burma, Thailand, Vietnam, Yemen and Malaysia. This plant is found in low hills, plains of India, Nepal and from lower Bengal to Chittagong in Bangladesh and in Coromondal Coast.

Classification

Kingdom: Viridiplantae
Phylum: Streptophyta
Division: Magnoliophyta
Order:Piperales
Family:Aristolochiaceae
Genus:*Aristolochia*
Species:*A. indica*

Chemical Constituents Alkaloides
Aristolochine.
Lactones
Aristololide.

Quinones
Aristolindiquinone.

Sesquiterpenes

5β –H, 7β, 10α- selina-4(14), II-diene, (12S) - 7, 12-Secoishwaran -12-01,

6 ishwarol, 7 ishwarone; ishwarane; aristolochene,9 ishwarene, selina-4(14), 11- diene.
Terpenes
Mono- and sesquiterpenes including linalool, β-caryophyllene, a-humulene, ishwarone, aryophyllene oxide, ishwarol, ishwarane and aristolochene, and a-terpinolene.

Others
Ceryl alcohol, allantoin, p-coumaric acid/o d-camphor,15 sitosterol and stigmast-4-en-3-one, Aristolochic acid, Aristolochic acid D me ether lact am (R=H, R1= OAristolocheneMe), Aristolactam-β-D glucoside (R=Glu, R1= H), Aristolactone, Aristolochene, Ishwarol, 5β-H, 7 β, 10α-Selina-4(14),11-diene, Ishwarane (R= H),Iswarane (R= O),New Phenanthrene Derivatives such as R,RII = H, R1= OH, R,RII = H,R1= NH2, R=H, RI1= OMe , R=NO2, R1= Me and RII = H.

Medicinal uses
The plant *Aristolochia indica* is well documented in ancient Ayurveda and Unani system of medicine to treat different ailments. The root of this plant is used to cure the inflammations, biliousness, and dry cough. The root and leaf of this plant used as a specific antidote for cobra poisoning. It is also reported to be a stimulant, and used as a good medicine for bronchial asthma, high blood pressure, remedy for troublesome gas problem in the stomach dropsy and loss of appetite, diarrhoea and intermittent fever.

Fig -1.Plant *Aristolochia indica* with leaves

Fig-2.Dry fruits of *Aristolochia indica*

RESULTS AND DISCUSSION:
The plant selected for the present study, *Aristolochia indica* L. is known by different vernacular name in different languages viz Ishwar balli (Kannada), Indian Birthwort (English), Isharmul (Hindi), Ishwari (Sanskrit). *Aristolochia indica* is a large genus comprising more than 800 species, most of them twining lians, and is widely distributed in tropical and subtropical regions almost all over the world (Gonzalez, 1999 and Nortier *et al*., 2000). This plant has rich amount of medicinally important bioactive compound aristolochic acid (AA) and is used to treat

cholera, fever, bowel troubles, ulcers, leprosy, poisonous bites (Kanjilal *et al.,* 2009) and also used as emmenagogue, abortifacient, antineoplastic, antiseptic, anti-inflammatory, antibacterial, antioxidant and phospholipase A2 inhibitor (Achari *et al.,* 1983 and Chopra *et al.,* 2006). In Ayurveda, the leaves and roots are used for treatment of fever, insect bites, cholera, bowel troubles, ulcers, leprosy, poisonous bites (Krishnaraju *et al.,* 2005 and Kanjilal *et al.*,2009), arthralgia, inflammation, leprosy, leucoderma, leprosy, skin diseases, colic, cough, catarrh, constipation, flatulence and dysmenorrhoea (Prajapathi *et al.,* 2007), emmenagogue, abortifacient, antineoplastic, antiseptic, anti-inflammatory, antibacterial and Phospholipase A2 inhibitor (Achari *et al.*,1983 and Das *et al.*,2010), postpartum infections and snake bites(Ramachandran *et al.*, 2008), antivenom (Abubakar *et al.*,2006; Jimenez-Ferrer *et al.,* 2005; Otero *et al.,* 2000), antibacterial (Gadhi *et al.,* 2001a, b, 1999), antifertility *et al.* (Gupta, 1996; Pakrashi and Chakrabarty 1978; Pakrashi and Pakrasi 1979), cytotoxic (Hinou *et al.*,1990; Kupchan and Doskotch 1962), antimicrobial or trypanocidal (Abe *et al.,* 2002; Elizabeth and Raju 2006;Kumar *et al.*, 2006), and insecticidal (Broussalis *et al.,* 1999; Jbilou *et al.*, 2006; Lajide *et al.,* 1993; Nascimento *et al.*,2004), appetizer, aphrodisiac and anthelmentic (Khare,2003), ethno veterinary aches and pains, rheumatism, antineoplastic effect and antiarthritic effect (Panda,2004), anthrax, madness, antibacterial effect (Shafi *et al.*,2002), antiestrogenic activity, abortifacient activity and interceptive activity (Pakrashi *et al*,1976), Antitumour activity (Masud ana *et al.,* 2002) and antifertility(Ganguly *et al.,* 1986), anti allergic activity(Chitme *et al.*,2010) ,and antibacterial and antifungal activities (Kavitha and Nirmaladevi, 2007), abortifacient, antiseptic, antipyretic and antifertility agent (Dey and De, 2011) fever, malaria, parasitic infestations, various skin diseases, as an aphrodisiac, an anthelmintic and oedema, intestinal disorders (Michael Heinrich *et al.,* 2009) fungal and bacterial infections(Shafi *et al.*,2002 and Kumar *et al.*,2006). The fraction I of methanol leaf extract of *Aristolochia indica* indicated the presence of functional groups related to napthalenes, 1, 2, 3.4- tetrasubst benzenes, siloxanes, primary amides, pyridine derivatives, anhydrides, phosphines, aliphatic compounds, aromatic amines, primary amines and ides, alcohol and phenols. In the present sudy, the fraction I of methanol leaf extract of *Aristolochia indica* indicated the presence of functional groups related to napthalenes, 1, 2, 3.4-tetrasubst benzenes, siloxanes, primary amides, pyridine derivatives, anhydrides, phosphines, aliphatic compounds, aromatic amines, primary amines and ides, alcohol and phenols. The fraction II indicates the acid chlorides, naphthalenes, iodo compounds, alkynes, chloro compounds, siloxanes, esters and lactones, sulfonyl chlorides, carboxylic acids, Pyridine derivatives, carboxylic acids, substituted benzene ring, phosphines, aliphatic compounds, alcohol and phenols. Many researcher world wide identified and isolated many phytocompounds such as sesquiterpene hydrocarbons ishwarane and aristolochene, tetracyclic sesquiterpene (Govindachari *et al*., 1970, Mix *et al.,* 1982 and Fuhrer *et al.*,1970), 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 (Achari *et al.,* 1981), 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 (Achari *et al.,* 1982 and 1983) naphthoquinone Aristolindiquinone (Che *et a.l,* 1983), Aristolochic acids and Aristolactams (Mix *et al.*, 1982).

Table-6.3. Peak values, band type and functional group for FTIR (Fourier Transform Infrared Spectroscopy) spectra of fraction I methanol extract of *Aristolochia indica*

No	*Peak value*	*Bonds*	*Functional group*
1.	418.55	Cl-C═O plane deformation	Cl-C═O in acid chlorides
2.	466.77	out of plane ring bending	Napthalenes
3.	601.79	SO_2 scissoring	SO_2 in sulfones
4.	1114.86	C-N Stretch	C-NH_2 in primary aliphatic amines
5.	1354.03	NO_2 sym stretch	NO_2 in aromatic nitro compounds
6.	1427.32	OH Plane bending	Carboxylic acids
7.	1620.21	C=C stretch	C=C in vinyl ethers
8.	2931.8	CH- antisym and sym streching	CH_3 and –CH_2
9.	3404.36	OH stretch (Solids and Liquids)	-OH in alcohols and phenols
10.	3533.59	-----	-OH in alcohols and phenols

Table-6.4 Peak values, band type and functional group for FTIR (Fourier Transform Infrared Spectroscopy) spectra of fraction II methanol extract of *Aristolochia indica*

No	Peak value	Bonds	Functional group
1.	462.92	plane ring bending	Napthalenes
2.	802.39	CH out-of- plane deformation	1,2,3.4- tetrasubst benzene
3.	1089.78	Si-O-Si antisym stretch	Si-O-Si in siloxanes
4.	1415.75	C-N Stretch (Amide III band)	C-N Stretch in primary amides
5.	1612.49	Ring stretch ; doublet	Pyridine derivatives
6.	1867.09	C=O antisym doublet stretch ; part of	C=O in anhydrides
7.	2345.44	P-H Stretch ;sharp peak	-PH in phosphines
8.	2951.09	CH antisym and sym stretching	-CH_3 and –CH_{2-} in aliphatic compounds
9.	2964.59	CH_3 and –CH_2 antisym and sym stretching	CH_3 and –CH_{2-} in aliphatic compounds
10.	3441.01	-NH2 Stretch(dil soln)	-NH2 Aromatic amines, primary amines and amides.
11.	3780.48	OH Stretch(dil soln)	OH- in alcohol and phenols
12.	3859.56	OH Stretch(dil soln)	OH- in alcohol and phenols
13.	3942.5	OH Stretch(dil soln)	OH- in alcohol and phenols
14.	3969.5	OH Stretch(dil soln)	OH- in alcohol and phenols
15.	3986.86	OH Stretch(dil soln)	OH- in alcohol and phenols

Fig 6.5.FTIR Pattern of fraction –I methanol extract of leaf of *Aristolochia indica*

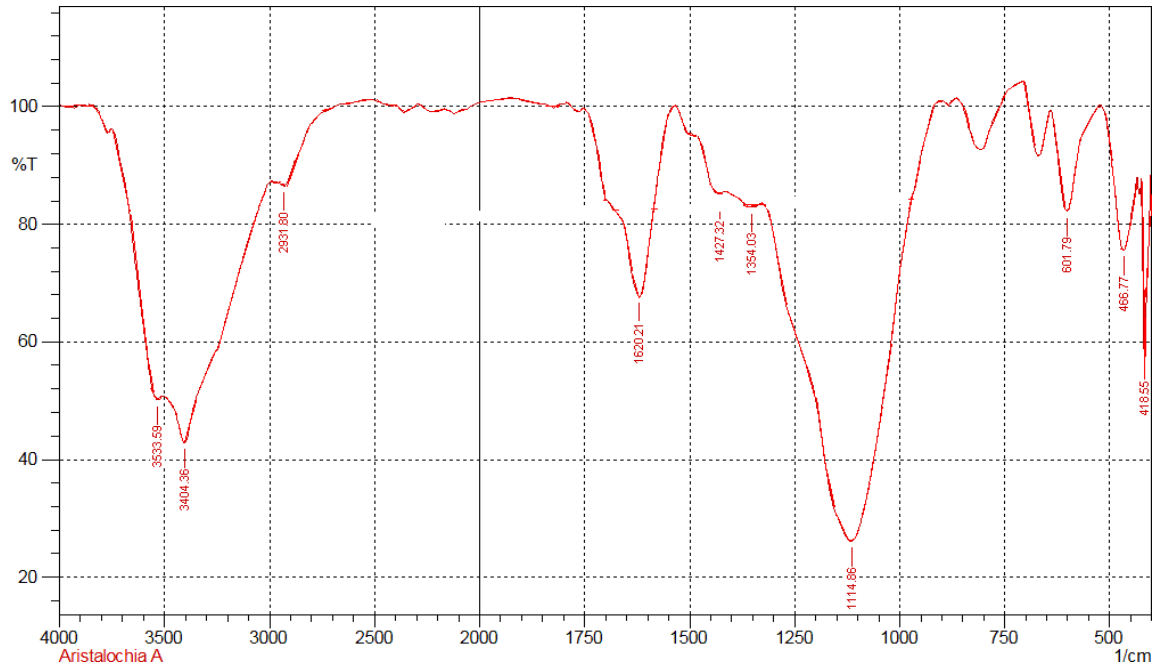
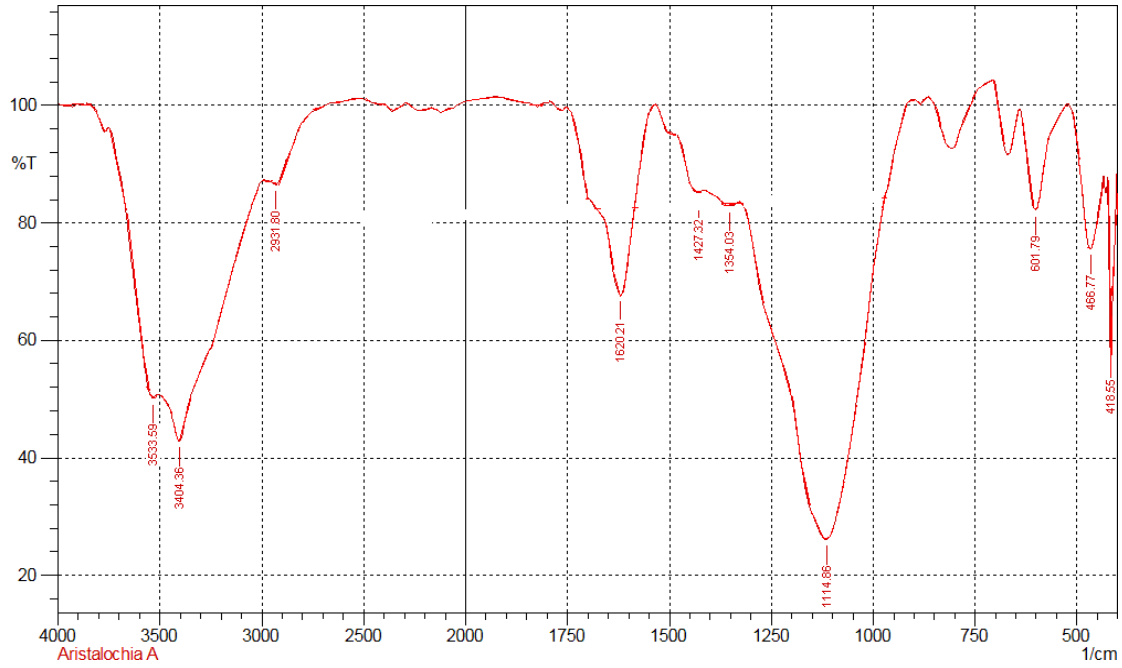


Fig 6.5.FTIR Pattern of fraction –I methanol extract of leaf of *Aristolochia indica*



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