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Evaluation of phytocompounds from *Azima tetracantha* using UV-VIS and FTIR analysis

R. Devi Anbarasi, V. Ramamurthy*

P.G & Research Department of Biochemistry, Maruthupandiyar College, Thanjavur, Affiliated to Bharathidasan University, Tiruchirappalli, Tamil Nadu, India

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ABSTRACT

The aim of this research work is to evaluate the pharmacological potentials of the *Azima tetracantha*. Phytochemical, antioxidant and antibacterial properties of ethanolic extract were carried out. For UV-VIS spectrophotometric analysis, the ethanolic extract of *Azima tetracantha was* scanned in the wavelength ranging from 250-900 nm by using Perkin Elmer Spectrophotometer and the characteristic peaks and their absorption values were detected. For FTIR Analysis, the ethanolic extract of *Azima tetracantha* was focused in the transmittance ranging between 400-4000 cm^{-1} on a spectrophotometer system and the characteristic peak values and their functional groups were detected. The UV-VIS profile showed the peaks at 211.15, 213.01, 354.40 and 470.64 nm with the absorption values 2.6812, 2.6821, 0.21950 and 0.15169 respectively. The result of UV-VIS spectroscopic analysis confirms the presence of phenols and flavonoids in the *Azima tetracantha* extract. The results of the present FTIR study confirms the presence of Phenol, Alkane, Alkene, Carboxylic acid, Aromatic compound, Nitro compound, Alcohol, Benzene and Bromo alkanes compounds. The selected sample has a high inhibitory performance like antimicrobial activity against fungal species. Since bioactive compounds occurring in *Azima tetracantha* have broad spectrum like phenols, flavonoids, anti-inflammatory, hypocholesterolemic, cancer preventive, hepatoprotective, nematicide insectifuge, antihistaminic etc. Moreover help to identify the natural compounds from wild mushroom.

***Corresponding author:** V. Ramamurthy ✉ v.ramamoorthy07@gmail.com

INTRODUCTION

In India treating specific ailments by the use of the different parts of several medicinal plants has been in vogue from ancient times. The indigenous system of medicines namely Ayurvedic, Siddha and Unani has been in subsistence for several centuries. Some drugs from Ayurveda approaching modern diseases, have already reached the market place (Kumar *et al.*, 2010). It is estimated that nearly 70000 plant species have been used for medicinal purposes. India recognizes more than 2500 plant species having medicinal value, Sri Lanka around 1400 and Nepal around 700 (Prajapati *et al.*, 2003). About 40% of doctors' especially in India and in China have reverted to increasing use of indigenous drugs and natural medicines (Agarwal and Paridhavi, 2007; Kokate *et al.*, 2004). The World Health Organization (WHO) estimates that about 80% of the populations living in the developing countries rely almost exclusively on traditional medicines for their primary health care needs.

Azima tetracantha is widely used in the alternative systems of medicine for the treatment various disease conditions including rheumatoid arthritis, cough, cold, fever, body pain, bronchitis, asthma, dropsy, etc. (Kekuda and Raghavendra, 2017). The roots of the plant are used in the herbal formulation called Pilavaikkalimbu, which is used topically in the treatment of tumors. The root of this plant is one of the components of Parangichakkai Choornam, polyherbal Siddha formulation which is indicated in the treatment of various diseases of pitha and kabha origin (Kumarasamy and Kumarswamy, 2014). There are studies that have corroborated pharmacological actions of leaf extract of this plant. However, there is little information about phytochemical composition and pharmacological actions of root extracts.

Azima tetracantha Lam., (Salvadoraceae) commonly known as "mulluchangu" is a glabrous, rigid, rambling, thorny shrub commonly called "Bee sting bush" found in Africa, India and Madagascar. Several medicinal properties are attributed to this plant in the Indian systems of medicine and included in the check list of traded medicinal plants. The ethno-botanical survey reveals the usage of this plant as a unique folk medicine by the adivasis (tribal) (Hebbar *et al.*, 2004; Mohamed *et al.*, 2007; Ignacimuthu *et al.*, 2008).

The root, root bark and leaves are administered with food as a remedy for rheumatism (Chopra *et al.*, 1956; Kirtikar *et al.*, 1984). It is a powerful diuretic given for rheumatism, dropsy, dyspepsia and chronic diarrhoea and as a stimulant tonic after confinement (Nadkarni, 1976). Efficient acute phase anti-inflammatory drug is traditionally used by Indian medical practitioners (Ismail *et al.*, 1997). The leaves are found to contain azimine, azcarpine, carpine and isorhamnitine-3-O-rutinoside etc., (Rall *et al.*, 1967; Williams and Nagarajan, 1988; Bennet *et al.*, 2004), which are used to treat cough, phthisis, asthma, small pox and diarrhoea. The decoction of the stem bark is considered as astringent, expectorant and antipatriotic (Duraipandiyan *et al.*, 2010).

The aqueous extract of the roots of this plant has traditionally been used for treatment of various liver disorders and jaundice (IMPCOPS Publisher, 1989), is considered diuretic and is also used to treat dropsy, dyspepsia, chronic diarrhoea and as a stimulant tonic. In western India, the leaf juice is applied as eardrops against earache and crushed leaves are placed on painful teeth. The fruit is edible and used by livestock. It is planted as live fence in Bangalore (India). In Malaysia pickled leaves are used as an appetizer and against colds. The plant is promoted as ornamental in the United States and in East Africa. The pounded roots are applied directly to snakebites and an infusion is taken orally as a treatment for them, while in Zimbabwe a mixture of roots and leaves are used similarly. The Bajun people of the Kenyan coast use the root decoction to treat stomach disorders. In Madagascar an infusion of the leaves is used to treat venereal diseases.

In the Cape Province the juice of the berries is applied directly into the ear to treat earache and the dried root is ground, put in cold water and given to cows to facilitate difficult parturition. The Zulu people of

South Africa apply the sap of the plant directly to treat toothache and bleeding gums after tooth extraction and also use it as a disinfectant (Gowthami *et al.*, 2012).

Though many pharmacological works have been carried out in *Azima tetrachantha*, their active ingredients have not been clearly defined. Previous ethno-botany reports have made it clear that all parts of this plant have medicinal value, but major pharmacological work has been carried out in leaves, rest of the parts such as stem and root were not clearly studied.

Our present study is to rationalize the usage of various parts of this medicinal plant of the folklore medicine and to give the scientific validation.

UV-Visible Spectrophotometry is one of the most frequently employed techniques in pharmaceutical analysis and involves measuring the amount of ultraviolet absorbed by a substance in solution. Instrument which measure the ratio or function of ratio of the intensity of two beams of light in the UV-Visible region are called Ultraviolet-Visible spectrophotometers. In qualitative analysis, organic compounds can be identified by use of spectrophotometer, if any recorded data is available and quantitative spectrophotometric analysis is used to ascertain the quantity of molecular species absorbing the radiation.

Spectrophotometric technique is simple, rapid, moderately specific and applicable to small quantities of compounds (Davidson, 2004). A variety of techniques can be used to determine and estimate the presences of such phyto constituents in medicinal mushrooms. The spectroscopic techniques are the most useful and popular in tools used for this purpose. The Fourier Transform Infrared (FTIR) spectroscopy allows the analysis of a relevant amount of compositional and structural information in plants. Moreover, FTIR spectroscopy is an established time-saving method to characterize and identified functional groups (Aqil *et al.*, 2008).

Ultraviolet-visible spectrophotometry (UV-Vis) related to the spectroscopy of photons in the UV-visible region. UV-visible spectroscopy uses light in the visible ranges or its adjacent ranges. The color of the chemicals involved is directly affects the absorption in the visible ranges. Molecules undergo electronic transitions in these ranges of the electromagnetic spectrum (Gunasekaran, 2003). The whole plant is used in anticancer, inflammations, antiseptic, antipyretic, diuretic, antihistamine, antioxidant, antibacterial, CNS depressant, antifungal, snake venom neutralization, mosquito repellant activity, insecticidal, larvicidal efficacy, antinociceptive, anti-androgenic, hepato protective, antifertility, skin aging inhibitor and anti-dopaminergic effects to produce the UV-VIS and FTIR spectrum profile plant extracts of *Azima tetracantha*. The extracts were scanned in the wavelength ranging from 200-800 nm by using UV spectrophotometer and the characteristic peaks were detected.

FTIR analysis was performed using Perkin Elmer spectrophotometer system which was used to detect the characteristic peaks and their functional groups. The peaks values of the UV-VIS and FTIR were recorded. Therefore, the present research work was designed to investigate the phytochemical and functional constituents of *Azima tetracantha* by using of UV-VIS and FTIR analysis.

MATERIALS AND METHODS

Plant material

Azima tetracantha was collected from a Thanjavur, Tamil Nadu, India for further reference.

Chemicals

All chemicals and reagents used in the study were obtained commercially and were of analytical grade.

Preparation of extract

Ethanolic extract of *Azima tetracantha* leaves was washed and dried in hot air oven at 370°C for three days. Dried samples were packed into an air tight container to protect it from humidity. Fifty grams of

dried plant powder was extracted by stirring with 500 ml ethanol, at 300℃ at 150 rpm for 24 hours. It was then filtered through what man no 4 filter paper. The residue was again extracted with two additional 500 ml of ethanol. The combine ethanol extract was then rotary evaporated at 400℃ for 2 hours.

UV-VIS spectrophotometric analysis

The UV-VIS profile of ethanolic extract was taken at the 200 to 800 nm wavelength due to the sharpness of the peaks and proper baseline. The profile showed the peaks at 250-900 nm using Perkin Elmer Spectrophotometer and the characteristic peaks were detected (Iqbal hussain, 2010).

FTIR analysis

The FTIR spectrum was used to identify the functional groups of the active components present in plant based on the peaks values in the region of IR radiation. When the ethanolic extract was passed into the FTIR, the functional groups of the components were separated based on its peaks ratio. The results of FTIR analysis confirmed the presence of alcohol, phenol, alkanes, aldehyde, aromatic compound, secondary alcohol, aromatic amines and halogen compound. The transmittance was recorded between 500 and 3500 cm-1 on FTIR spectrophotometer (Jasco FT/IR-6300). The functional groups present in the leaves were identified from the spectra (Nanzeen bobby *et al.*, 2012).

RESULTS

The qualitative UV-Vis spectrum profile of ethanolic extract of *Azima tetracantha* was selected from 250 nm to 900 nm due to sharpness of peaks and proper baseline. UV-Vis spectrum profile of ethanolic extract of *Azima tetracantha* was given in Fig. 1 and its absorption values were given in Table 1.The profile showed the peaks from 250 to 900 nm and the profile showed the peaks at 211.15, 213.01, 354.40 and 470.64 nm with absorption values of 2.6812, 2.6821, 0.21950 and 0.15169 respectively. The UV-Vis spectrum of ethanolic extract of *Azima tetracantha* was taken at 2.6812 and 2.6821 respectively. UV-VIS analysis result compared with literature data. The spectra for phenolic compounds (tannins) and Flavonoids typically also lie in the range of 230-290 nm (Deepa *et al.*, 2014). The result of UV-VIS spectroscopic analysis confirms the presence of phenols and Flavonoids in the *Azima tetracantha* extract.

Table 1. UV-Vis peak values of ethanolic extract of *Azima tetracantha*

Sl	Wavelength (nm)	Absorption values	Literature (Neha *et al.*, 2006)
1	211.15	2.6812	
2	213.01	2.6821	Phenol and flavonoid
3	354.40	0.21950	
4	470.64	0.15169	

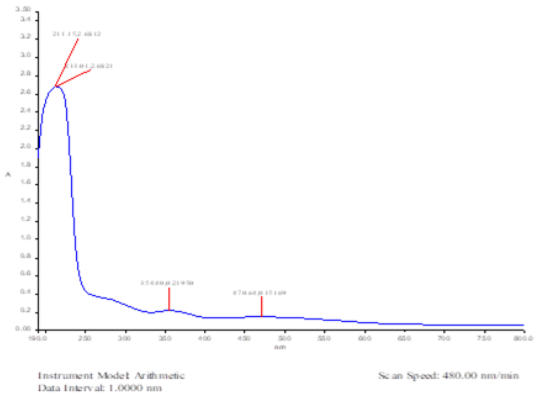


Fig. 1. UV-Vis spectrum of ethanolic extract of *Azima tetracantha*

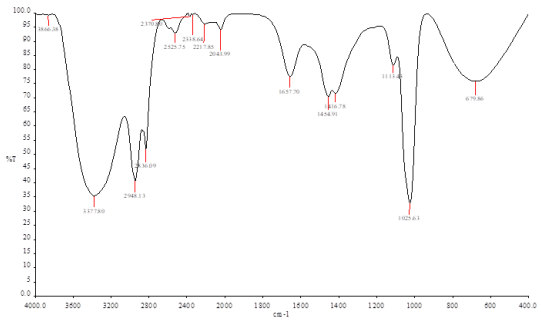
FTIR spectroscopy

Fourier Transform Infrared Spectrophotometer (FTIR) is perhaps the most powerful tool for identifying the types of chemical bonds (functional groups) present in compounds. The wavelength of light absorbed is characteristic of the chemical bond as can be seen in the annotated spectrum. By interpreting the infrared absorption spectrum, the chemical bonds in a molecule can be determined. Dried powder of different solvent extracts of each plant materials were used for FTIR analysis. 10 mg of the dried methanolic extract of mushroom powder was encapsulated in 100 mg of KBr pellet, in order to prepare translucent sample discs. The powdered sample of each plant specimen was loaded in FTIR spectroscope (Shimadzu, IR Affinity 1, Japan), with a Scan range from 400 to 4000 cm^{-1} with a resolution of 4 cm^{-1} (Fig. 2 and Table 2.) When the *Azima*

tetracantha extract was passed into the FTIR, the functional groups of the components were separated based on its peaks ratio. The results of FTIR analysis confirmed the presence of phenol, alkane, alkene, carboxylic acid, aromatic compound, nitro compound, alcohol, and benzene and bromo alkanes compounds which shows major peaks at 3866.38, 3377.80, 2948.13, 2836.09, 2525.75, 2370.80, 2338.64, 2217.85, 2043.99, 1657.70, 1454.91, 1416.78, 1113.43, 1025.63 and 679.86 respectively (Parag *et al.*, 2013).

Table 2. Functional group analysis of ethanolic extract of *Azima tetracantha* by using FTIR spectroscopy

Sl	Peak values	Bond	Functional groups
1	3866.38	O-H stretch	Alcohol, Phenol
2	3377.80	O-H stretch, H bonded	Alcohols, Phenols
3	2948.13	C-H stretch	Alkynes
4	2836.09	H-C=O:C-H stretch	Aldehydes
5	2525.75	O-H stretch	Carboxylic acid
6	2370.80	C=C-stretch	Alkene
7	2338.64	C=H-stretch	Alkene
8	2217.85	-C=C-stretch	Alkynes
9	2043.99	C≡C stretch	Alkynyl
10	1657.70	C=O-stretch	Carboxylic acid
11	1454.91	C-C stretch (in-ring)	Aromatics
12	1416.78	C=C-stretch	Aromatic compound
13	1113.43	C-N stretch	Aliphatic amine
14	1025.63	C-N stretch	Aliphatic amine
15	679.86	C-X-stretch	Bromo alkenes



Wave number cm^{-1}

Fig. 2. Functional group analysis of ethanolic extract of *Azima tetracantha* by using FTIR spectroscopy

DISCUSSION

The ethanol extract filtrated through 0.22µm membrane filter and then finally exposed to UV-VIS test. For further use both extracts put in DMSO as a stock 500 mg/ml. Then stored at 4°C to prevent degradation of bioactive compound for further use. The results also suggest that the extract of *Azima tetracantha* has antioxidant and anti inflammatory properties (Sathyaprabha *et al.*, 2011). Spectroscopic ethods have become a powerful tool for secondary metabolite profiling as well as for qualitative and quantitative analysis of the pharmaceutical and biological materials. The present study of UV-VIS spectrophotometer revealed that the presence of phenolic compound like tannin and flavonid compound which indicates the medicinal properties of this plant. Phenolic compound tannin used as antioxidant, anti inflammatory and anti cancer and flavonoid compound used as antioxidative activity, hepatoprotective, anti-inflammatory, anticancer and antiviral activity of this plant extract also observed form this study (Wu *et al.*, 2008). By using FT-IR spectrum, we can confirm the functional constituent's presence in the given leaf extract and even evaluate the qualities of medicinal materials. The results of the present study spectrum also revealed the functional constituents present in ethanolic extracts of *Azima tetracantha*. The results of the present study confirms the presence of phenol, alkane alkene, carboxylic acid, aromatic compound, nitro compound, alcohol, benzene and bromo alkanes compounds in ethanolic extract of *Azima tetracantha*. The results of the present study suggest that various medicinal properties of the *Agaricus bisporus* (Rajeshwari Sahu and Jyoti Saxena, 2014). The results of the present study developed novel phytochemical marker to identify the medicinally important. Further advanced spectroscopic studies are required for the structural elucidation and identification of active principles present in the extract of *Azima tetracantha*.

CONCLUSION

The present study demonstrated that *Azima tetracantha* extracts a rich source of secondary metabolites. The antioxidant property of the *Azima tetracantha* extracts showed a correlation with the anticancer property .The suggests that the antioxidant activity of these *Azima tetracantha* extracts might be

helpful in preventing or slowing the progress of oxidative stress-related diseases like cancer. Identification of the antioxidant constituents of the *Azima tetracantha* extracts which are helpful for the anti-cancer properties are yet to be studied.

REFERENCES

Agarwal SS, Paridhavi M. 2007. Herbal drug technology. Hyderabad: Universities Press Private Limited, 625 pp.

Aqil F, Maryam Z, Ahmad I. 2008. Antimutagenic activity of methanolic extracts of four medicinal plants. Indian Journal of Experimental Biology **46**(9), 668–672.

Bennett RN, Rosa EA, Perkins L, Kroon PA. 2004. Profiling glucosinolates, flavonoids, alkaloids, and other secondary metabolites in tissues of *Azima tetracantha* L. (Salvadoraceae). Journal of Agricultural and Food Chemistry **52**(19), 5856–5862.

Chopra RN, Nayar SL, Chopra C. 1956. Glossary of Indian medicinal plants. New Delhi: CSIR, pp. 32, 218.

Davidson AG. 2004. Ultraviolet-visible absorption spectrophotometry. In: Beckett AH, Stenlake JB (eds.), Practical pharmaceutical chemistry. 4th ed. Part II. New Delhi: CBS Publishers and Distributors, 286–288.

Deepa Santhanakrishnan, Sripriya Nannu Shankar, Bangaru Chandrasekaran. 2014. Studies on the phytochemistry, spectroscopic characterization and antibacterial efficacy of *Salicornia brachiata*. International Journal of Pharmacy and Pharmaceutical Sciences **6**(6), 430–432.

Duraipandiyan V, Gnanasekar M, Ignacimuthu S. 2010. Antifungal activity of triterpenoid isolated from *Azima tetracantha* leaves. Folia Histochemica et Cytobiologica **48**(2), 311–313.

Gowthami M, Tamil Selvi S, Senthil Kumar G, Panneerselvam A. 2012. Phytochemical analysis and antibacterial properties of leaf extract of *Azima tetracantha* (Lam.). Asian Journal of Plant Science and Research **2**(2), 110–114.

Gunasekaran S. 2003. UV-VIS spectroscopic analysis of blood serum. Asian Journal of Microbiology, Biotechnology and Environmental Science **5**(4), 581–582.

Hebbar SS, Harsha VH, Shripathi V, Hegde VR. 2004. Ethnomedicine of Dharwad district in Karnataka, India—plants used in oral health care. Journal of Ethnopharmacology **94**, 261–266.

Ignacimuthu S, Ayyanar AK, Sankarasivaraman. 2008. Ethnobotanical study of medicinal plants used by Paliyar tribals in Theni district of Tamil Nadu, India. Fitoterapia **79**, 562–568.

IMPCOPS Publisher. 1989. Formulary of Siddha medicines. Chennai: IMPCOPS, 332 pp.

Iqbal Hussain. 2010. UV-VIS spectroscopic analysis profile of ascorbic acid in medicinal plants of Pakistan. World Applied Sciences Journal **9**(7), 800–803.

Ismail TS, Gopalakrishnan S, Begum VH. 1997. Anti-inflammatory activity of *Salacia oblonga* Wall. and *Azima tetracantha* Lam. Journal of Ethnopharmacology **56**, 145–152.

Kekuda PT, Raghavendra HL. 2017. Phytochemistry, traditional uses and pharmacological activities of *Azima tetracantha* Lam. (Salvadoraceae)-An updated review. International Journal of Green Pharmacy **10**, 217–229.

Kirtikar KR, Basu BD, An ICS. 1984. Indian medicinal plants. Vols. 1 & 2. 2nd ed. Dehradun: Bishen Singh Mahendra Pal Singh, pp. 582, 1541.

Kokate CK, Purohit AP, Gokhle SB. 2004. Pharmacognosy. Delhi: Vallabh Prakashan Publishers, 597 pp.

Kumar S, Malhotra R, Kumar D. 2010. *Euphorbia hirta*: Its chemistry, traditional and medicinal uses, and pharmacological activities. Pharmacognosy Reviews **4**(7), 58–61.

Kumarasamy S, Kumarasamy M. 2014. A conspectus on Siddha polyherbal formulation: Parangichakkai choornam. International Journal of Research in Ayurveda and Pharmacy **5**(2), 209–218.

Mohamed AF, Wurster M, Schroder G, Lindequist U. 2007. Antioxidant, antimicrobial and cytotoxic activities of selected medicinal plants from Yemen. Journal of Ethnopharmacology **111**, 657–666.

Nadkarni KM. 1976. Indian materia medica. 3rd ed. Bombay: Popular Prakashan, Vol. 1, p. 165.

Nazneen Bobby, Wesely EG, Johnson M. 2012. FT-IR studies on the leaves of *Albizia lebbeck* Benth. International Journal of Pharmaceutical Sciences **4**, 293–296.

Pednekar PA, Raman B. 2013. Antimicrobial and antioxidant potential with FTIR analysis of *Ampelocissus latifolia* (Roxb.) Planch. leaves. Asian Journal of Pharmaceutical and Clinical Research **6**(1), 67–73.

Prajapati ND, Purohit SS, Sharma AK, Kumar T. 2003. Handbook of medicinal plants. Jodhpur: Agrobios.

Rall GJH, Smalberger TM, De Waal HL, Arndt RR. 1967. Dimeric piperidine alkaloids from *Azima tetracantha*. Tetrahedron Letters **1967**, 3465–3469.

Sahu R, Saxena J. 2014. Ultraviolet-visible and Fourier transform infrared spectroscopic studies on non-conventional species of *Curcuma*. International Journal of Applied and Chemical Sciences **2**(4), 300–302.

Sathyaprabha G, Kumaravel S, Panneerselvam A. 2011. Bioactive compounds identification of *Pleurotus platypus* and *Pleurotus eous* by GC-MS. Advances in Applied Science Research **2**(6), 51–54.

Williams UV, Nagarajan S. 1988. Isorhamnetin-3-O-rutinoside from leaves of *Azima tetracantha* Lam. Indian Journal of Chemistry **27**, 387.

Wu Y, Shan L, Yang S, Ma A. 2008. Identification and antioxidant activity of melanin isolated from *Hypoxylon archeri*, a companion fungus of *Tremella fuciformis*. Basic and Applied Microbiology **48**, 217–221.