Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2013, 4 (11):70-75
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

GC-MS analysis of *Polygala arillata* Buch.-Ham Ex D. Don

Radhamani T.[1] and S. John Britto[2]

[1]Department of Botany, Seethalakshmi Ramaswami College, Tiruchirappalli
[2]The Rapinat Herbarium and Centre for Molecular Systematics, St. Joseph's College (Autonomous)
Tiruchirappalli, Tamilnadu, India

ABSTRACT

The present study presents the bioactive profile of Polygala arillata Buch.-Ham ex D.Don using GC-MS. The phytochemical constituents of leaf and stem ethanolic extracts of Polygala arillata were investigated using Fisons Gas-chromatography – Mass spectrometry. The mass spectra of the compounds in the leaf and stem extracts was matched with National Institute of standards and Technology (NIST) Library. GC-MS analysis of ethanolic extracts of leaf and stem revealed the presence of eight compounds. The retention time and peak areas of the identified compounds are presented in the table. The identified chemical compounds will prove valuable in pharmacology investigations.

Key words: *Polygala arillata*, ethanol, GC-MS, NIST.

INTRODUCTION

Medicinal and aromatic plants are resources useful in drug preparation. India is endowed with about 49,000 species of plants and is considered rich in biodiversity. Among them, 8000 species are known to be medicinal. The Indian system of medicine uses around 2500 plant species. The WHO [1] estimates that about 80% of the population of developing countries rely on plant based traditional medicine, for their primary health care. Traditional knowledge with modern advances in pharmaceutical, chemical and biotechnological tools has the potential to help in the evolution of novel health care products and drugs. Often ethnic knowledge on medicinal plants paves way to validate the reported traditional use and preparation of extracts. The phytochemical research based on ethnopharmacological insight is aruguably the indispensable base in the discovery of new lead compounds. [2]

Species of *Polygala* have traditionally been used for the treatment of snake bites [3] besides their use as an expectorant to treat cough and bronchitis. They are also considered as effective in promoting human cognition and reasoning capacity. [4] *Polygala arillata* Buch.-Ham ex D.Don (Polygalaceae) grows as a wayside shrub in most of the tropical hills and widely distributed in Indian peninsular hill tops.

Description of the plant

Polygala arillata is a large shrub to small tree upto 4 m tall, trunk and bark greyish brown, lenticellate, blaze whitish cream; branchlets terete, pubescent, when young. Leaves broad, elliptic, ovate to 12 × 5 cm, glabrous, base acute, apex acuminate, petiole to 1 cm, Racemes to 15 cm , more than 20 flowered, pendulous, peduncle to 3 cm. Flowers 1.5 × 0.7 cm, pedicel to 0.8 cm, sepals 5, upper one boat shaped, 6 × 4 mm, lateral 2, lower one boat shaped, 6 × 6 mm, apex crested with forked appendages, laterals 2 boat shaped, 8 × 8 mm. Disk annular, fleshy undulate. Stamens 8, adnate to petals, staminal sheath to 7 mm, filaments connate at different levels, anthers ovoid, Ovary ovoid, glabrous; style to 8 mm, apically incurved; stigma knob-shaped, 2-lobed, upper lobe actue, lower one appendaged,, muricate. Capsule obcordate, 8 × 14 mm, striate. Seeds 2, globose, 5 × 7 mm, compressed, glabrous; caruncle 2,

reddish, appendged membranous. They are grown in the elevation of 2000 – 2400 m, specially in shade of sholas.

Hill tribals in several parts of India consider them useful to alleviate pain, gastrointestinal disorder and other infectious diseases. They also use them commonly for wound healing, respiratory troubles, chronic bronchial asthma, chronic bronchitis, whooping cough, diuretic, secretion of Saliva and as an antimicrobial agent especially against candidacies. Such reported uses need validation from phytochemical purview. The aim of present study was to analyse the phytochemical profile of the ethanolic extract of leaf and stem of *Polygala arillata* by GC-MS.

MATERIALS AND METHODS

The healthy plants of *Polygala arillata* were collected from the Palni hills of Tamilnadu. A voucher specimen was deposited in the Rapinat Herbarium, St. Joseph's College Tiruchirappalli 620 002.

Extraction

The collected plant parts were washed with tap water followed by distilled water. Shade dried leaves and stem were powdered (100 – 500 µm) with mechanical blender separately. About 50 g of each powder was used for extraction using a soxhlet apparatus with 300 mL of ethanol. The process was run to 48 hours after which the sample was concentrated using rotary evaporator and freeze dried to powder form. The dried extracts were weighed and kept in labeled sterile specimen bottles and stored in refrigerator at 4°C.

GC-MS-Analysis

The extracts were analyzed in GC-MS. Fisons GC-MS instrument. A split-less mode was chosen with helium as carrier gas. The column was Das MS of 30 m in length, 0.25 mm in diameter and 0.25 mm film thickness and (1mg / ml). The active fractions (substances) dissolved in ethanol were injected in the following conditions: injector temperature – 280°C, carrier helium, pressure 150 Kpa. ionization mode E^+ solvent delay (min) 2.00, temperature gradient, 20°C per minute from 100 to 315°C. The analysis was carried out at Amphigene, Tanjore, South India.

RESULTS AND DISCUSSION

GC-MS chromatogram analysis of ethanolic extract of leaves and stem showed five peaks indicating the presence of five phytochemical compounds. The phytocompounds with their retention time (RT), molecular formula molecular weight (mW) and concentration (%) in the ethanolic extracts of leaf and stem are presented in table 1 and 2. Eight compounds were identified in the ethanolic extract of leaf and they are Dodecane (0.9%), Nonadecane, 2 methyl (3.8%), Hexadecanoic acid (2.86%) Myrcene (10.1%) and the compounds present in the ethanolic extract of stem are Erucylamide (0.1%), 9, 12 octadcadienolic acid (Z,Z)- 0.7%), Mandelic acid O-Methyl ester (3%) and sparteine (8.9)%.

The mass spectra of all the phytochemicals identified in the ethanolic extracts of leaves and stem are presented in Figure 1 and 2.

In ethanolic extract of the seed of *Pueraria phaseoloides*, 18 different – compounds were identified and they are hydrocarbons, sesquiterpenes and fatty acids [5]. The presence of biologically active compounds such as phenols, polyphenols, tannins, alkaloids, flavanoids and terpenoids in various plant are known to possess antibacterial activity [9]. Methyl salicylate is also known as salicylic acid. Methyl ester is used in flavoring foods, candies, beverages and pharmaceuticals and it is also an odorant, perfume and ultraviolet absorbs in cosmatics. This compound is used in traditional medicine mainly as anti-inflammatory, analgesic, expectorant and anti-rheumatics [10]. Volatile compounds obtained from natural products are important in industry such as pharmaceutical, cosmetic and food companies. Volatile components was based on retention indices (RI) relative to n-alkanes (C_8 - C_{19}). [11]. Methyl salicylate has been identified in several polygala species [12] Two compounds from the roots of *Polygala arillata* such as 1, 3 dihydroxy-2 methoxy Xanthan and T-hydroxy – 1 – methoxy – 2, 3 –Methylene dioxy Xanthan have inhibitory effect on aldolase reductase activity [6]. The major components of the fat oil such as oleic acid, linoleic acid, palmitic acid, licosenoic acid and stearic acid were identified in *Polygala tenuifolia* by GC-MS [7] The extract fractions and pure compounds obtained from *Polygala sabulosa* that produced marked antinociception against the acetic acid – induced viscerol nociceptive response, supporting the ethnomedical use of *P. sabulosa* [8]. Nearly 14 compounds have been identified from the ethanolic extract of the whole plant of *Polygala chinensis*. 1, 5 anhydro-d-fructose is a metabolite of 1, 5 anhydro – d- mannitol is an useful anticarcinogenic agent as it inhibits the growth of the oral pathogens *Staphylococcus mutans* [13].

The major components present in the ethanolic extract of *P.arillata* leaf and stem were evaluated by GC-MS, are dodecane, nonadecane, 2 Methyl, hexadecanoic acid, myrcene, erucylamide, 9, 12-octa decadienoic acid (Z,Z)-,

mandelic acid, O-methyl ester and sparteine. (Figure 1&2) shows the mass spectrum and structures of medicinally important phytochemical constituents which contribute to the medicinal activity of the ethanolic extracts of *P.arillata*. The phytochemical Dodecane is used to emulate the laminar flame speed, Nonadecane, 2 methyl is act as an antioxidant. Hexadecanoic acid exhibits antipsychotic mediation and myrcene is used in fragrance industry. Erucylamide has various functions like fabric softner, pesticide etc and 9,12 octadecadienoic acid (Z,Z) – also shows pesticidal properties. Mandelic acid, O-methyl ester is used in the treatment of urinary tract infections and sparteine acts as a source of antiarrhythmic drugs.

Table-1

Phyto-Components identified in *Polygala arillata* Leaf (GC-MS Study)

SNo	RT	Name of the compound	Molecular Formula	Molecular Weight	Peak area %	Compound Nature
1	181	Dodecane	$CH_3(CH_2)_{10}CH_3$	170.33	0.9	Alkane hydrocarbon
2	203	Unknown	-	-	0.4	-
3	223	Nonadecane, 2 methyl	C20H42	282.5475	3.8	Volatile Heterocyclic
4	238	Hexadecanoic acid	$C_{16}H_{32}O_2$,	256.42	2.86	saturated fatty acids
5	361	Myrcene	$C_{10}H_{16}$	136.23	10.1	Monoterpene

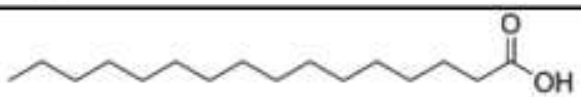
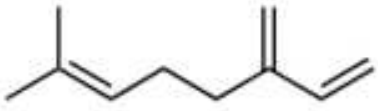
S. No	Compound Name	Structure	Function
1	Dodecane		To emulate the laminar flame speed
2	Nonadecane, 2 methyl		Antioxidant
3	Hexadecanoic acid		Antipsychotic medication
4	Myrcene		*Use in fragrance industry*

Table-2

Phyto-Components identified in *Polygala arillata* Stem (GC-MS Study)

SNo	RT	Name of the compound	Molecular Formula	Molecular Weight	Peak area %	Compound Nature
1	123	Erucylamide	$CH_3(CH_2)_7CH=CH(CH_2)_{11}CONH_2$	337.58	0.1	Carboxylic acid amide
2	185	9,12-Octadecadienoic acid (Z,Z)-	C18H32O2	280	0.7	Linoleic acid
3	225	Unknown	-	-	5	-
4	230	Mandelic acid, o-methyl ester	C10H12O4	196	3	Aromatic alpha hydroxy acid
5	343	Sparteine	$C_{15}H_{26}N_2$	234.380	8.9	lupin alkaloid

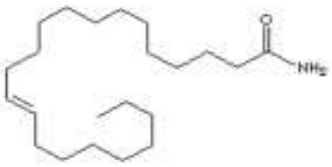
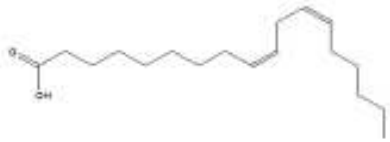
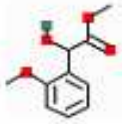
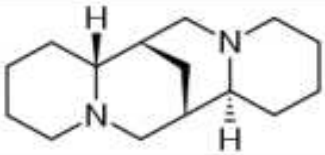
S. No	Compound Name	Structure	Function
1	Erucylamide		Fabric softener, anti-static agent, germicide, insecticide, emulsifier, anti-caking agent, lubricant and water treatment agent.
2	9,12-Octadecadienoic acid (Z,Z)-		Pesticide
3	Mandelic acid, o-methyl ester		Treatment of urinary tract infections.
4	Sparteine		Antiarrhythmic drugs.

Figure-1 *Polygala arillata* Leaf

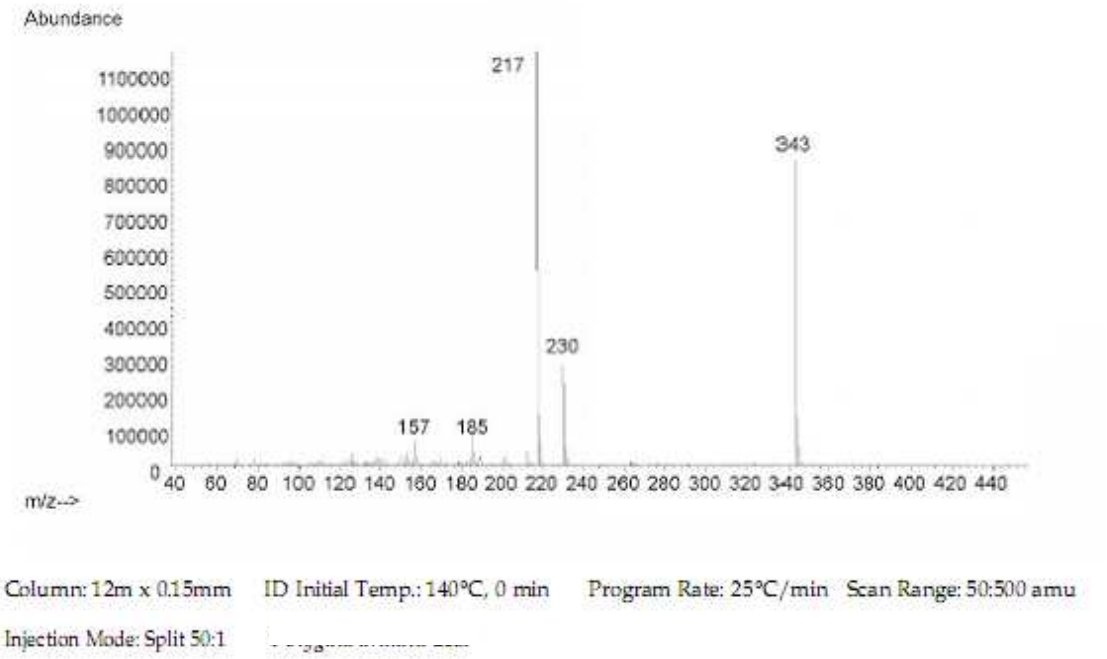
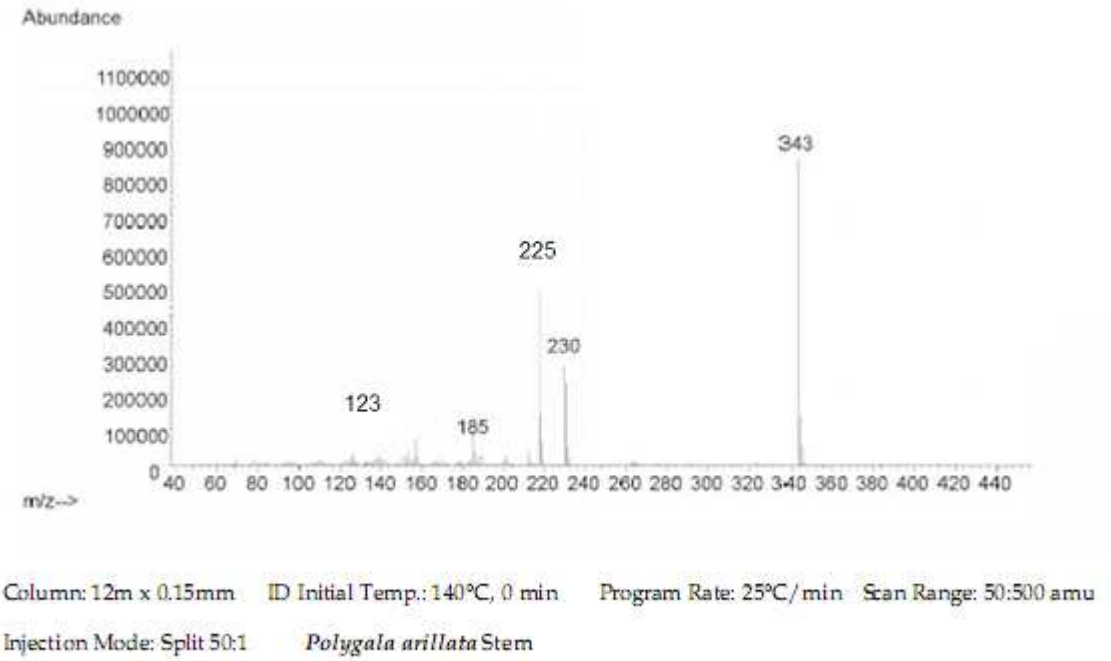


Figure-2 *Polygala arillata* Stem



CONCLUSION

The presence of various bioactive compounds in *Polygala arillata* justifies the use of plant parts like leaf and stem for treating various ailments by traditional practitioners. Isolation of individual phytochemical constituents and subjecting them to the biological activity will definitely enhance the pharmacological usefulness.

Acknowledgment
I thank the Director, the Rapinat Herbarium and Centre for Molecular Systematics, St. Joseph's College (*Autonomous*), Tiruchirappalli for facilities provided.

REFERENCES

[1] WHO (World Health Organization). **1990**. *World Health Organization, Regulatory Situation of Herbal Medicines*, a worldwide review.
[2] Duraipandian,V. Ayyanar, M. and Ignacimuthu, S. (**2006**). Antimicrobial Activity of some Ethnomedical plants used by Paliyar Tribe from TamilNadu, India. BMC complementary and alternative medicine, pp. 635.
[3] Mc Guffin,M., Hobbs,C., Upton,R. (eds) **1997** American Herbal Products Associations. Botanical Safety Hand book Boca Raton, FL: CRC Press, P. 89.
[4] Teeguarden,R. (**1998**). Radiant Health. The Ancient Wisdom of Chinese Tonic Herbs. New York; Warner Books P. 194-95.
[5] Jaseentha, MO., Britto, SJ and Kochuthressia, K.P. (**2012**). *International Journal of Biology, Pharmachy and Allied Sciences* (IJPBAS) 1(11): 1741-1746.
[6] Mao, SL., Liao,Sx., WU. JH., Ling, N., Chen, H., Lianq, HQ., Liu, MZ (1997). *Studies on chemical constitutents of Polygala arillata* Buch.-Ham., Yao Xue Xue Bao 32(5): 360-2.
[7] Sun, X., Shi,S., Yang,G., (**2000**). *Journal of Chinese medicinal materials* 23: 1 P. 35-7.
[8] Flavia Carla Meotti, Juliana,V. Ardenghi, Juliana B. Pretto, Marcia M. Souza, Janaina, d' Avila Moura, Anildo Cunha Junior, Cristian soldi, Moacir Geraldo Pizzolatti and Adair R.S. Santos. (**2006**). *Journal of pharmacy and Pharmacology*, 58(1): 107-112.
[9] Panizzi,L., Flamini,G., Cioni,PL. Morelli,I. (**1993**). *J. Ethnopharmacy* 39: 167-170.
[10] Effmert,U., Saschenbrecker, S., Ross, J., Negre,F., Fraser, C.M., Noel. JP., Dudareva,N. and Piechulla, B (**2005**). *Phytochemistry*, **66**: (11) 1211-1230.
[11] Vanden Dool, H. and Kratz, PO., (**1963**). *Journal of chromatography*, 11; 463-471.
[12] 12.Weinhold, TS., Bresciani,LPV., Tridapalli, CW., Yunes, RA., Hense, H and Ferreira, SRC (**2008**). *Chemical Engineering and Processing: Process Intensification*, 47: 109-117.
[13] Allagammal,M., Tresinasoris,P. and Mohan, V.R. (**2011**). *Chemical investigations of Polygala chinensis*, L. *by GC-MS Science Research Reporter* 1(2): 49-52.