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Phytochemical Profiling And GC-MS Study Of Antigonum leptopus Hook & ARN.

Vanitha K[1]*, Thangarasu S[2].

[1]Faculty of Marine Sciences, CAS in Marine Biology, Annamalai University, Parangipettai-608 502
[2]PG Department of Botany, Periyar EVR College, Trichy-620 023

***Corres. author: vanithakrish84@gmail.com**
Mobile No: 91- 9442858510

Abstract: The present study investigated the chemical constituents of a traditionally used ethanobotanical plant *Antigonum leptopus* using a GC-MS approach. Phytochemical analysis of *Antigonum leptopus* revealed the presence of alkaloids, saponium, steroid, phenolic compounds, fatty acids, flavonoids and volatile oils in leaves and tubers. Interestingly, ten phytochemical constituents were analyzed and characterized by GC-MS that confirmed the presence of (1) Glycerin (2.49%), (2) Propane,1,1,3-triethoxy (4.09%), (3) 4H-pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl- (14.34%), (4) methyl salicylate (1.14%), (5) 2-furancarboxaldehyde,5-(hydroxymethyl)- (24.45%), (6) dodecanoic acid (1.89%), (7) 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl)ester (6.06%), (8) n-hexadianoic acid (15.20%), (9) oleic acid (18.02%) and (10) 1,2-Benzenedicarboxylic acid, diisooctyl ester (12.33%). Results from this work indicated useful information on the phytochemistry of *A. leptopus* tuber, which can pave way to further applications and utility in the pharmaceutical and neutraceutical field.

Keywords: *Antigonum leptopus*, GC-MS, Phytochemical component.

Introduction

According to World health organization, medicinal plants would be the best source to obtain a variety of drugs. About 80% of individuals from developed countries use traditional medicine, which has been derived from medicinal plants. The medicinal plants are of great important to the health of individual and communities. The medicinal value of these plants lie in some active chemical substances called phytochemical that produce a physiological action on the human body. Phytochemicals are naturally occurring biochemical compounds in plants for color, flavor, smell and texture for pollination and define mechanism. Some plant secondary metabolites such as alkaloids, phenols, tannins, glycosides, terpenoids, saponins, flavonoids and steroids have been implicated in their ability to inhibit the formation of pro-inflammatory signaling molecules such as prostaglandin or leukotrienes[1].

However, such plants should be investigated to better understand their properties, safety and efficiency[2]. The herbal plant *Antigonum leptopus* are widely used by the tribal people as an efficient medicine that cures piles. Therefore, this study is conducted to provide a thorough knowledge on the tribal plant *A. leptopus*. Studies based on the ethnobotanical use of plants have often provided a more efficient method of drug discovery than random screening[3-4]. In the present study, we evaluated phytochemical screening of leaf and tuber of *A.*

leptopus on the quantitative and qualitative analysis by using the GC-MS method for the identification of compounds and their activity based on ethanobotanical databases.

Materials and methods

Plant material

The plant materials such as leaves and tubers were collected from the college outskirt region of the campus of H.H. The Rajah's College, Pudukkottai, a distinct headquarters of Tamilnadu state. The vegetative parts, leaves and tubers from *A. leptopus*, belonging to the family Polygonaceae was employed for the analysis. Herbarium specimens of the plant parts were prepared and deposited as voucher specimens in the departmental herbarium for future verification. The fresh leaves and tuber were dried thoroughly under shade and powdered finely and stored in a clean plastic container for phytochemical analysis.

Phytochemical estimation

The phytochemical estimation from fresh leaves and tuber powder of *A. leptopus* were quantitatively determined by adopting standard protocols *viz.*, Chlorophyll[5], carotenoid[6], total soluble sugars[7] and total soluble starch[8] using glucose as standard, total soluble proteins[9] by using bovine serum albumin as standard, total free amino acids[10] using leucine as standard, total phenols[11] using catechol as standard, hydroxy phenols[12] using catechol as standard. All experiments were repeated three times for precision and values were expressed in mean ± standard deviation in terms of fresh leaves and air dried tuber.

Preparation of plant extracts

Twenty gram of tuber powder was soaked in 50 ml of absolute alcohol overnight for alcoholic extraction. It was filtered through Whattmann filter paper No. 41 along with 2gm sodium sulfate which had been wetted with absolute alcohol to remove the sediments and traces of water in the filtrate. Then the filtrates were concentrated by bubbling nitrogen gas into the solution and reduce the volume to 1 ml. The extract contained both polar and non-polar phytochemical components.

GC-MS analysis

The plant sample (tuber extract) was analyzed in a Perkin Elmer GC Clarus 500 MS system for different components present in the extract, under the following conditions: column– dimethyl polysiloxane DB-1 fused silica capillary column (30m x 0.25 mm x 0.1µm of film thickness); carrier gas – helium (1ml / min); injector temperature –250^{o} C; detector temperature - 200^{o} C; column temperature – 35-180^{o} C at 4^{o} C / min – then 180 – 250^{o} C at 10^{o} C / min; MS electron impact 70 $_{e}$V.

Identification of compound

Interpretation on mass spectrum of GC-MS was conducted using the database of National Institute Standard and Technology (NIST Ver.2.1) having more than 62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The name, molecular weight and structure of the components of the test materials were identified. The activity of the tuber extract of biochemical compound was compared with Dr. Duke's Phytochemical and Ethnobotanical Databases.

Results

The present study carried out on the plant samples revealed the presence of medicinally active constituents. Quantitative estimation of the biochemical compounds of the plant parts such as leaf and tuber was studied and summarized in Table 1. The content of pigments like total chlorophyll (1.452± 0.06), chlorophyll a (0.772± 0.33), chlorophyll b (0.681± 0.02), and carotenoid (0.632± 0.05) in leaves and the components like total soluble sugars (312.31±12.76), total soluble starch (107.12±3.5), total soluble proteins (31.21±1.04) and free amino acids (76.32±4.49) as well as phenols (42.41±2.34) and total hydroxyphenols (156.13±5.73) in tubers was comparatively higher than that of leaves.

The presence of secondary metabolites in the leaf and tuber of the *A. leptopus* investigated were summarized **in** Table 2. The results show that the presence of saponin, steroid / triterpenoid, phenolic compounds, fatty acid, flavonoids and volatile oils were present in leaf and tuber of the plant. Tannins and glycosides were absent in leaf and tuber respectively, whereas alkaloids were present in the tuber.

Table 1. Basic biochemical components in leaves and tubers of *Antigonum leptopus* Hook.&Arn.

S.No	Basic biochemical components	Leaf (mg g^{-1} f.w.)	Tuber (mg g^{-1} d.w.)
1	Chl. *a*	0.772± 0.33	-
	Chl. *b*	0.681± 0.02	-
	Total chl.	1.452± 0.06	-
2	Carotenoids	0.632± 0.05	-
3	Total soluble sugar	47.72± 2.49	312.31± 12.76
4	Total soluble starch	42.51± 2.54	107.12± 3.5
5	Total soluble proteins	13.83± 0.65	31.21± 1.04
6	Total free amino acids	18.22± 4.71	76.32± 4.49
7	Total phenols	20.32± 1.29	42.41± 2.34
8	Hydroxy phenols	20.71± 1.43	156.13± 5.73

Table 2. Qualitative analysis of phytochemicals from *Antigonum leptopus* Hook. & Arn.

S.No.	Name of the compounds	Plant parts	
		Leaf	Tuber
1	Alkaloids	-	+
2	Tannin	-	-
3	Saponin	+	+
4	Triterpenoid	+	+
5	Phenolic compounds	+	+
6	Fatty acid	+	+
7	Flavonoids	+	+
8	Glycoside	-	-
9	Volatile oils	+	+

+ = Presence of constituent
- = Absence of constituent

GC-MS chromatogram of the alcoholic extract of *A. leptopus* showed ten peaks indicating the presence of ten compounds. The chemical compounds and there activity in the alcoholic extract of *A. leptopus* are presented in Table 3, 4 and Figure 1. The ten phytochemical constituents characterized by GC-MS peak are as follows: (1) Glycerin (2.49%), (2) Propane,1,1,3-triethoxy (4.09%), (3) 4H-pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl- (14.34%), (4) methyl salicylate (1.14%), (5) 2-furancarboxaldehyde,5-(hydroxymethyl)-(24.45%), (6) dodecanoic acid (1.89%), (7) 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl)ester(6.06%), (8) n-hexadianoic acid(15.20%), (9) oleic acid (18.02%) and (10) 1,2-Benzenedicarboxylic acid, diisooctyl ester(12.33%). The properties of the compounds and their bioactivities based on Dr. Duke's phytochemical and Ethnobotanical databases are listed below.

Compound 1 was detected as Glycerin and its molecular formula was assigned to be $C_3H_8O_3$ compound nature was alcohol group, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 1 to be Glycerol. This compound showed RT as 4.07, molecular wt as 92; and peak area as 2-49% (Figure 2.A). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: Hygrospic action, anti-inflammatory and antimicrobial properties and also used as softening agent and preservative. It had the following other synonyms: 1. 1,2,3-Propanetriol, 2. Glycerol, 3. Glycerine, 4. Glyceritol, 5. Glycyl alcohol,6. Glyrol, 7. Glysanin, 8. Osmoglyn, 9. Propanetriol, 10. Trihydroxypropane, 11. Synthetic glycerin, 12. 90Technical glycerin, 13. Dagralax and 14. Glycerin anhydrous.

Compound 2 was detected as Propane, 1,1,3-triethoxy- and its molecular formula was assigned to be $C_9H_{20}O_3$, compound nature was found to be belong to ether compound, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 2 to be α-Ethoxypropionaldehyde diethyl acetal. This had 5.93 RT, 176 molecular wt. as 4.09 peak area % (Figure2.C). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: No activity was reported so for. It had the following other synonyms: 1. α-Ethoxypropionaldehyde diethyl acetal; 2. 3-Ethoxypropionaldehyde

diethyl acetal; 3. Propionaldehyde, 3-ethoxy-, diethyl acetal; 4. 1,1,3-Triethoxypropane; 5. Propane, 1,3,3-triethoxy- 6. 1,3,3-Triethoxypropane.

Compound 3 was detected as 4H-Pyran-4-one, 2, 3-dihydro-3, 5-dihydroxy-6-methyl- and its molecular formula was assigned to be $C_6H_8O_4$ and compound nature was found to be Pyran ring, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 3 to be 4H-Pyran-4-one, 2, 3-dihydro-3,5-dihydroxy-6-methyl-. This had 7.58RT, 144 molecular wt and 14.34 % peak area (Figure 2.B). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: No activity was reported. It had the following other synonym: 3,5-Dihydroxy-6-methyl-2,3-dihydro-4H-pyran-4-one .

Compound 4 was detected as Methyl Salicylate and its molecular formula was assigned to be $C_8H_8O_3$, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 4 to be Methyl Salicylate. This compound showed RT as 8.78, molecular wt. as 152; and peak area as 1.14% (Figure 2.D). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: antipyretic, anti-inflammatory, analgesic, antiseptic, pesticide, insecticide, cancer-preventive carminative and perfumery. It had the following other synonyms: 1.Benzoic acid, 2-hydroxy-methylester; 2.Salicylic acid, methyl ester; 3.o-Hydroxybenzoic acid, methyl ester;4.Analgit; 5.Betula;6.Betula oil; 7.Betula Lenta; 8.Exagien; 9.Flucarmit;10.Gaultheria oil;11.Gaultheria Oil, artificial; 12.Gaultheriaoel; 13.Methylo-hydroxybenzoate; 14.Methyl2-hydroxy; benzoate;15.Oil of Wintergreen.

Compound 5 was detected as 2-Furan carboxaldehyde, 5-(hydroxymethyl)-and its molecular formula was assigned to be $C_6H_6O_3$ compound nature was lauric acid, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 5 to be 2-Furancarboxaldehyde, 5-(hydroxymethyl)-. This compound showed RT as 9.03, molecular wt as 126; and peak area as 24.45% (**Figure2.E). It** showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: antimicrobial, preservative. It had the following other synonyms: 1.2-Furaldehyde, 5-(hydroxymethyl)-; 2.5-Hydrxoymethylfurfural; 3.Hydroxymethylfurfurole; 4.HMF;5.5-(Hyddroxymethyl) Furfurole;6.5-(Hydroxymethyl)-2-formylfuran; 7.5-(Hydroxymethyl)-2-furaldehyde; 8.5-(Hydroxymethyl)-2-furancarbonal; 9. 5-(Hydroxymethyl)-2-furfural; 10. 5-(Hydroxymethyl) -2 -furfuraldehyde; 11. 5-(Hydroxymethyl)furan-2-aldehyde;12.5-Hydroxymethyl)furfural;13.5-Hydroxymethylfuraldehyde;14.5-Oxy methylfurfurole; 15.5-Hydroxymethylfurfuraldehyde;

Compound 6 was detected as Dodecanoic acid and its molecular formula was assigned to be $C_{12}H_{24}O_2$ compound nature was lauric acid, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 6 to be Dodecanoic acid. This compound showed RT as 17.41, molecular wt as 200; and peak area as 1.89%. It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: antioxidant, antibacterial, COX-1 & COX-2 inhibitor,antiviral hypochloesterolmic, candidicide.

Compound 7 was detected as 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester and its molecular formula was assigned to be $C_{16}H_{22}O_4$ compound nature was Plasticizer compound, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 1 to be 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester. This compound showed RT as 23.72, molecular wt as 278 and peak area as 6.06% (Figure 2.F). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: No activity was reported. It had the following other synonyms: 1.Phthalic acid, diisobutyl ester; 2.Diisobutyl phthalate; 3.Hexaplas M/1B; 4.Isobutyl phthalate.

Compound 8 was detected as n-Hexadecanoic acid and its molecular formula was assigned to be $C_3H_8O_3$ compound nature was Palmitic acid, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 8 to be n-Hexadecanoic acid. This compound showed RT as 25.35, molecular wt as 256; and peak area as 15.20% (Figure2.G). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: Antioxidant Hypocholesterolemic; Nematicide; Pesticide; Lubricant; Antiandrogenic; Flavor; Hemolytic; 5-Alpha reductase inhibitor. It had the following other synonyms: 1.Hexadecanoic acid;2.n-Hexadecoic acid;3.Palmitic acid;4.Pentadecanecarboxylic acid;5.1-Pentadecanecarboxylic acid;6.Cetylic acid;7.Emersol 140; 8. Emersol 143; 9. Hexadecylic acid; 10. Hydrofol ; 11. Hystrene 8016;12. Hystrene 9016; 13. Industrene 4516; 14.Prifrac 2960 ; 15.Glycon P-45 ; 16. Prifac 2960; 17. Univol U332.

Compound 9 was detected as Oleic Acid, and its molecular formula was assigned to be $C_{18}H_{34}O_2$ compound nature was Fatty acid, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 9 to be Oleic Acid, ethyl ester. This compound showed RT as 29.14, molecular wt. as 282; and peak area as 18.02% (Table3, 4 and Figure). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: Antiinflammatory; Antiandrogenic. It had the following other synonyms: 1.9-Octadecenoic acid (Z)-;2.ë(Sup9)-cis-Oleic acid;3.cis-ë(Sup9)-Octadecenoic acid;4.cis-Oleic Acid;5.cis-9-Octadecenoic Acid;6.Emersol 211;7.Emersol 220 White Oleic Acid;8.Emersol 221 Low Titer White Oleic Acid;9.Oelsauere;10.Oleine 7503;11.Pamolyn 100;12.Red oil.

Compound 10 was detected as 1,2-Benzene dicarboxylic acid, diisooctyl ester and its molecular formula was assigned to be $C_{24}H_{38}O_4$ compound nature was Plasticizer compound, based on the high-resolution GC-MS spectrum. The spectral features and physicochemical properties revealed 1 to be 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester. This compound showed RT as 35.67, molecular wt as 390 and peak area as 12.33% (Figure 5.H). It showed the following bioactivities, based on Dr. Duke's phytochemical and Ethnobotanical databases: No activity was reported and so further research has to be carried out with respect to this compound.

Table 3. Isolation and characterization of phytochemical components from alcoholic tuber extract of *Antigonum leptopus* Hook. & Arn. (**GC–MS** analysis)

No	RT	Name of the compound	Molecular Formula	MW	Peak Area %
1	4.07	Glycerin	$C_3H_8O_3$	92	2.49
2	5.93	Propane, 1,1,3-triethoxy-	$C_9H_{20}O_3$	176	4.09
3	7.58	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	$C_6H_8O_4$	144	14.34
4	8.78	Methyl Salicylate	$C_8H_8O_3$	152	1.14
5	9.03	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	$C_6H_6O_3$	126	24.45
6	17.41	Dodecanoic acid	$C_{12}H_{24}O_2$	200	1.89
7	23.72	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	$C_{16}H_{22}O_4$	278	6.06
8	25.85	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	15.20
9	29.14	Oleic Acid	$C_{18}H_{34}O_2$	282	18.02
10	35.67	1,2-Benzenedicarboxylic acid, diisooctyl ester	$C_{24}H_{38}O_4$	390	12.33

Table 4. Characterization of phytochemical components from alcoholic tuber extract of *Antigonum leptopus* Hook. & Arn., displaying their bioactivities

No	Name of the compound	Compound nature	Activity**
1	Glycerin	Alcohol	Antimicrobial, Preservative
2	Propane, 1,1,3-triethoxy-	Ether compound	No activity reported
3	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	Pyran compound	No activity reported
4	Methyl Salicylate		Antipyretic, Antiinflammatory, Analgesic, Antiseptic, Pesticide, Insectifuge, Cancer-preventive, Carminative, Perfumery
5	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	Aldehyde	Antimicrobial Preservative
6	Dodecanoic acid	Lauric acid	Antioxidant, Antibacterial, COX-1 & COX-2 inhibitor, Antiviral, Hypocholesterolemic, Candidicide.
7	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	Plasticizer compound	No activity reported
8	n-Hexadecanoic acid	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
9	Oleic Acid	Fatty acid	Antiinflammatory, Antiandrogenic Cancer preventive,

			Dermatitigenic Hypocholesterolemic, 5-Alpha reductase inhibitor, Anemiagenic Insectifuge, Flavor
10	1,2-Benzenedicarboxylic acid, diisooctyl ester	Plasticizer compound	No activity reported

****Source: Dr.Duke's Phytochemical and Ethnobotanical Databases**

Table 5. *A. leptopus* biochemical compounds identified form different plants and their uses.

S. N	Name of the Combound present	Plant Name	Plant Part	Uses	Reference
1.	Glycerin	*Mimosa pudica*	Leaf	Therapeutic uses	Sridharan *et al.* (2011)[25]
		Promsa serratifolia	Leaf	Therapeutic uses	Singh *et al*. (2011)[26]
		Alstonia venerate	Leaf	Rheumatic complaints	Sutha *et al.* (2012)[27]
		Morinda citrifolia	Leaf	Antibacterial, antiinflamatory, analgesis antioxidant and antitumor effect	Rivera *et al.* (2012)[28]
2.	Propane,1,1,3 triethoxy	*Vitex negundo*	Leaf	Antioxidant activity	Kumar *et al.* (2010)[29]
		Wattaka volubilis	Leaf	Antiflammatory	Vishnusithan and Kanaraj (2012)[30]
		Andrographis paniculata	Leaf	Upper respiratory infections	Kalaivani *et al.* (2012)[31]
		Caesalpinia sappan	Aerial part	Antioxidant	Sarumathy *et al.* (2011)[32]
		Vigna mungo	Gram	Liver diseases cancer & diabetes	Anbuselvi *et al*. (2012)[33]
		Clitoria ternatea	Aerial part	Nephroprotective antioxidant	Sarumathy *et al*. (2011)[32]
		Cadaba trifoliata	Leaf	Purgative and Phlogistree	Velmurugan and Kamaraj (2011)[34]
		Cadaba trifoliate	Root	Anticancer, anti diabetic, anti inflammatory	Velmurugan *et al* (2010)[35]
		Polygala chinensis	Whole plant	Cough and bronchitis	Alagammal *et al.* (2011)[36]
		Naringi crenulata	Leaf & bark	Dysentery and colic disorders.	Sarada *et al.* (2011)[37]
		Euphoria longan	Leaf	Amnesia insomnia, aneamia palpitations and neurosis.	Devi *et al.* (2009)[38]
3.	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl	*Euphoria longan*	Leaf	Amnesia insomnia, aneamia palpitations and neurosis.	Devi *et al.* (2009)[38]
4.	Methyl Salicylate	*Syzygium caryophyllatum*	Leaf & bud	Antibacterial, antifungal and antioxidant	Bhuiyan *et al.* (2010)[39]
		Mallotus philippensis	Root	Skin diseases and rheumatism	Velanganni *et al.* (2011)[40]
5.	2-Furancarboxaldehyde,5-(hydroxymethyl)	*Caesalpinia sappan*	Leaf	Emenagogue, emostatic and anti inflammatory	Sarumathy *et al.* (2011)[32]
6.	Dodecanoic acid	*Withania somnifera*	Root	Anti inflammatory	Kumar *et al.* (2011)[41]

7	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	*Cadaba trifoliate* *Euphoria longan* *Andrographis paniculata*	Leaf Leaf Leaf	Purgative Amnesia insomnia, aneamia palpitations and neurosis. Upper respiratory infections	Velmurugan and Kamaraj (2011)[34] Devi *et al.* (2009)[38] Kalaivani *et al.* (2012)[31]
8.	n-Hexadecanoic acid	*Alstonia venerate* *Cadaba trifoliate* *Cadaba trifoliate* *Morinda citrifolia* *Euphoria longan* *Andrographis paniculata* *Withania somnifera*	Leaf Leaf Root Lead & fruit Leaf Leaf Root	Rheumatic complaints Purgative Anticancer, anti diabetic, anti inflammatory Antibacterial, antiinflamatory, analgesis antioxidant and antitumor effect Amnesia insomnia, aneamia palpitations and neurosis. Upper respiratory infections Anti inflammatory	Sutha *et al.* (2012)[27] Velmurugan and Kamaraj (2011)[34] Velmurugan *et al* (2010)[35] Rivera *et al.* (2012)[28] Devi *et al.* (2009)[38] Kalaivani *et al.* (2012)[31] Kumar *et al.* (2011)[41]
9.	Oleic Acid	*Cadaba trifoliate* *Polygala chinensis* *Aloe vera*	Root Whole plant plant	Anticancer, anti diabetic, anti inflammatory Cough and bronchitis	Velmurugan *et al* (2010)[35] Alagammal *et al.* (2011)[36]
10.	1,2-Benzenedicarboxylic acid, diisooctyl ester	*Polygala chinensis* *Withania somnifera*	Whole plant Root	Cough and bronchitis Anti inflammatory	Alagammal *et al.* (2011)[36] Kumar *et al.* (2011)[41]

Figure 1. GC-MS chromatogram of the alcoholic extract of the tuber of *Antigonum leptobus*

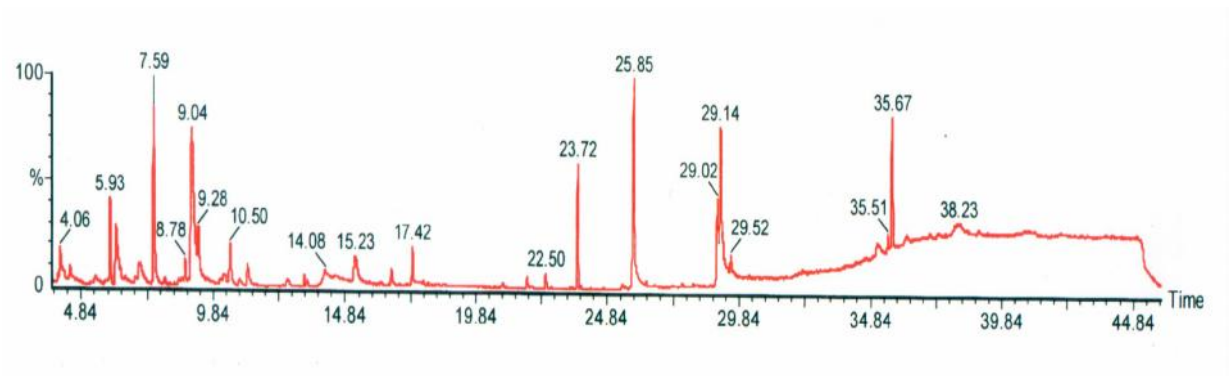
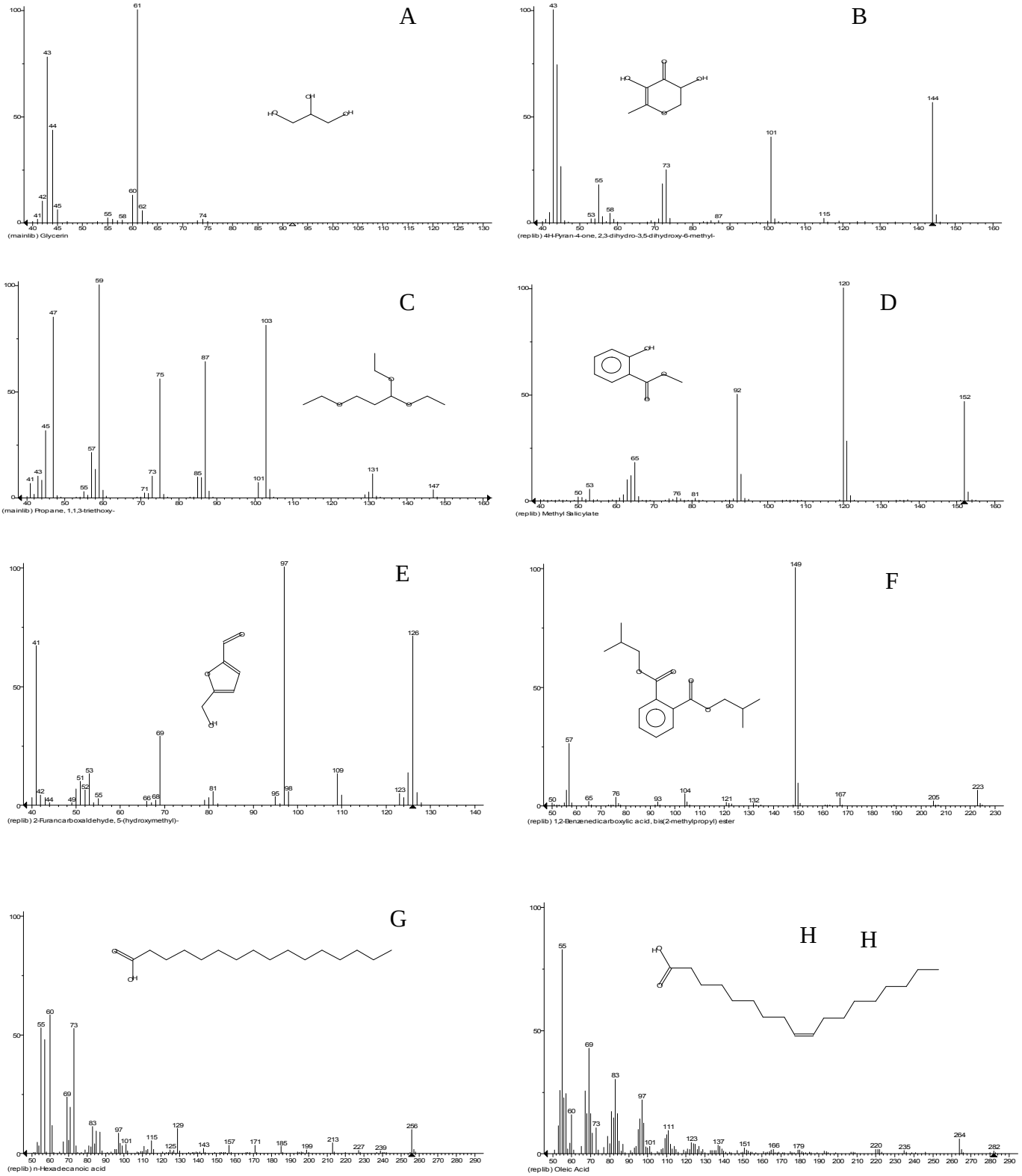


Figure 2. Chemical structure as well as spectrum of a compound viz., **A.** Glycerin 1, **B.** 4H-Pyran-4-one, 2, 3-dihydro-3,5-dihydroxy-6-methyl, **C.** Propane, 1,1, 3-triethoxy, **D.** Methyl Salicylate, **E.** 2Furan carboxaldehyde, 5- (hydroxymethyl), **F.** 1,2-Benzene dicarboxylic acid, bis(2-methylpropyl) ester, **G.** n-Hexadecanoic acid, **H.** Oleic Acid



Discussion

Glycerin, Methyl Salicylate, Oleic Acid, Dodecanoic acid, n-Hexadecanoic acid, 2-Furancarboxaldehyde and 5-(hydroxymethyl)- have more bioactivities while Propane, 1,1,3-triethoxy, 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-, 1,2-Benzenedicarboxylic acid, bis (2-methylpropyl) ester, 1,2-Benzenedicarboxylic acid and diisooctyl ester had no activity which was confirmed from Dr. Duke's phytochemical and Ethanobotanical databases (Table 4).

The present study revealed that the above chemical compounds exhibits high bioactivity. The potential antinoceptive effect by methanolic extract of *A. leptopus* root could be due to different nociceptive stimuli[13]. Biochemicals and phytochemicals such as saponins, terpenoids, flavonoids, tannins, steroids, and alkaloids have anti-inflammatory effects[14-20]. Some polycyclic glycosides, flavonoids, tannins, and alkaloids have hypoglycemic [21]. The anti-edematogenic mechanism of action of *A. leptopus* may also be due to prostaglandin synthesis inhibition as described for the anti-inflammatory mechanism of aspirin-like drugs[22]. Primary metabolites, for example, sugars, proteins, lipids, and starch are of prime importance and essentially required for growth of plants. The studies of primary metabolites have been carried out in some plants in the past such as *Balanites aegyptiaca*, *Cissus quadrangularis*, *Eclipta alba* and *Nerium indicum*[23]. The identified compounds from *A. leptopus* were found to have unique bioactivity from earlier reports (Table 5).

The phytochemical screening of *A. leptopus* showed that the leaves and tuber were rich in alkaloids, saponin, steroid/triterpenoid, phenolic compounds, fatty acid, flavonoids and volatile oils. The present investigation on biochemical compounds of *A. leptopus* (Glycerin, Methyl Salicylate, Oleic Acid, Dodecanoic acid, n-Hexadecanoic acid, 2-Furancarboxaldehyde and 5-(hydroxymethyl)) show medicinal activity as well as physiological activity [24]. The evaluated *A. leptopus* being used as traditional medicine must be taken forward to complete phytochemical analysis so as to study in depth the individual potential compounds which will pave way to clinical leads.

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