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Chemical study of some species related to the Malvaceae family that growing in the Al-Diwaniya Governorate

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Abstract

The present study dealt with the chemical content of the leaves extract of six species from Malvaceae family in AL-Diwaniyah governorate, where all species are present in it. Its: *Hibiscus sabdariffa* (L.), *Abelmoschus esculentus* (L.), Moench *Althaea ludwigii* (L.), *Malva parviflora* (L.) and *Gossypium hirsutum* (L.). Chemical compounds were identified using the GC-MASS gas chromatography technique.

The results showed that these species contained several secondary metabolites, which included phenols, turbines, alkaloids, kanates, esters and steroids. The presence of some compounds involved more than one species, which helped isolate the species from each other, such as the 2-Pentenal compound, 5-phenyl, found in the extract of the leaves *Ab. esculentus* and *Al. ludwigii* and the compound Benzene, 1,2,1 - (1,2-cyclobutanediyl) bis-, cis- which was found in all species under study except *M. parviflora.*

It was observed through the study that the two genus *Hibiscus* contained the most common compounds by six compounds supported their return to the same genus, as for compound Styrene was presence in all species.

The species were also distinguished by other compounds such as 10-Undecyn-1-ol and Z-4-Dodecenol, which were found in *Al. ludwigii* and *H. rosa-sinensis*, which enhanced the taxonomic importance of this study.

Key words: Malvaceae, Chemotaxonomy, Effective chemicals.

1.Introduction

The Malvaceae family is one of the largest and most advanced families, consisting of 85 species and 1,500 species, The genus of Hibiscus is one of the largest genera of the family, consisting of 300 species (Jongbloed, 2003). Stevens (2012) has reported that the family consists of 243 genus and 4335 species. In Iraq, there are about 21 wild species and 12 cultivated species (Al-Mousawi, 1987). The science of classification often interferes with other science such as ecology, genetics, biochemistry and others, the modern science that is

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based on the identification of effective chemicals in plants to differentiate them, as well as used by the herb in the treatment of many diseases that cannot be complex and processed medicines to treat them (Al-Qubaisi, 2004).

Secondary metabolites are compounds used by humans in many aspects, both pharmaceutical and industrial, the great advances in chemistry have helped to easily separate active substances in plants for use (Morton *et al*., 2000).

These secondary compounds are produced in the plant in varying quantities because they are believed to be produced for defensive purposes, may use them to resist insects and have a role in maintaining and adapting the plants to the environment in which they are present, also some plants need to attract insects for pollination by producing volatile oils in their flowers (Kliebenstein, 2004). The broad pharmacological benefits of these compounds have increased the focus on methods of extraction, paving the way for their physiological and therapeutic effectiveness with reduced toxicity (Manna and Abalaka, 2000).

Many studies have shown the chemical composition of the Malvaceae family around the world that secondary metabolites are present in all plant parts of this family and in varying amounts, they also contain antioxidants used in various industries such as cosmetics and jams (Baum *et al*., 2004).

The plants in the Malvaceae family are characterized by many active compounds, as Sheikh (2004) refer that the extract substance of *H. sabdariffa* contains many active compounds such as phenols also Mahadevan and Kamboj (2009) also pointed to contain the *H. sabdariffa* plant phenolic acids and flavonoids as well as alkaloids, terpenes and many secondary metabolites in different plant parts. While Al-Ameer *et al*. (2010) refer that the species *H. sabdariffa*, *Al. ludwigii* and *H. rosa-sinensis* to contain the anti-oxidants such as phenols, alkaloids, and Sterols, as Ammar *et al.* (2013) the *Al. ludwigii* plant contains five phenolic compounds. Chaturvedi *et al*., (2010) also pointed it that the *Gossypium herbaceum* contained many phenolic compounds such as flavonoids, glycosides, While Petkewich (2006) refers that the *Al. ludwigii* contained starch, pectin, flavonoids, phenolic acids. As well as *Ab. esculentus* considered sucrose of amino acids, vitamins, flavonoids, phenolic acids and many other chemical compounds (Temple and Gladwin, 2003)

All of the above the aim of this study uses chemical evidence to differentiate between the Malvaceae family.

2.Materials and Methods

2.1.Preparation of extracts of raw chemical compounds

- The experiment was conducted in the Environmental Lab / Biology Department / College of Education / University of AL-Qadisiyah, the chemical compounds extracted from the powder of plant leaves according to Markham (1982) with some modification and as follows:
- Plant leaves were collected from the species under study at October 2017 until February 2018 and were then grind separately by the electric grinder to obtain a soft mixture after washing and drying at room temperature, then kept in plastic containers until use.
- Mix up 1 gm. of powder with 10 ml of methanol (99%) in a glass tube with continuous stirring for 10 minutes then left at room temperature and in a dark place for 12 hours.
- Then use a filter attached to a medical syringe with a 0.45-micrometer slot to filter the extract in a second glass tube.
- Add 1ml of hexane concentration (99%) to expel water and increase the concentration of extract.
- Chemical compounds were estimated in the extract after the withdrawal of the floating part separated from the water by hexane.

2.2.Separation and diagnosis of chemical compounds by using Gas / Chromatography / Mass Spectrometry.

- The method of technical analysis GC-MS
- The GC-MS analysis was performed using the GC Clarus 500 perkin Elmer system, which contains the gas chromatography associated with the mass spectrometer and the AOC-20i autosampler, Fig. 1, under the following conditions:
- Injector temperature 250 ° C.
- Ion source temperature 280 ° C.

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- Use of helium gas (99,999%) as a transporter gas at a continuous flow rate of 1 ml. Min -1.
- The injected liquid is 0.5 µl and works at split rates (1:10).
- The oven temperature is 110 ° C, programmed automatically at 10 ° C. Minute -1 up to 200 ° C then continue to increase in temperature until it reaches 280 ° C where it stabilizes for 9 minutes until the end.
- Mass spectra were taken on a 70 EV basis at a time interval of 0.5 seconds while the fission rate was 40 to 450 dl.
- The total time is 36 minutes of starting the GC device until it turns on.
- The separation column is an Elite-1 fused silica capillary column consisting of 100% Dimethyl Polysiloxane (100% Dimethyl Polysiloxane), which works in the 70 EV effect mode.
- The pressure inside the device 49.5 kpa and 1 ml. Min -1.
- Based on TurboMass Ver 5.2.0 for mass spectra and chromatograms, the relative amount of each component was calculated by comparing the average area of the area to Srinivasan, et al. 2013.

2.3.Identification of chemical compounds:

The components were determined according to GC-MS mass spectrometry, Figure 1 and the National Institute of Standards and Technology database was used with 62,000 or more known patterns. The resulting spectrum of the unknown component was compared with a range of known components stored in the NIST library to confirm the molecular weight and name, and the structure of the components of the test materials. This test was conducted in the GC-MAS/ Environment and Water Department / Ministry of Science and Technology Unit

3.Results and Discussion

The abundance of the chemical content of the species under study was observed in quantitative and qualitative terms, with 315 compounds, varying between phenols, terpenes, alkanes, alkaloids, esters, and steroids. The species *H. rosa-sinensis* was included in 28 compounds, *H. sabdariffa*, included 40 compounds, *Ab. esculentus* contained 25 compounds, while *Al. ludwigii* had 18 compounds, while *G. hirsutum* included 20 compounds and *M. parviflora* contained 22 compounds.

Each type is distinguished by chemical compounds, giving it a significant taxonomic significance in isolating it from other species. Record 34 compounds of phenols when the species *Al. ludwigii* included 9 phenolic compounds, while the *H. rosa-sinensis* contained 10 phenolic compounds and separated six phenolic compounds from *G. hirsutum* leaves and *H. sabdariffa* species obtained the largest share of phenolic compounds, which reached to 12 compounds, while *Ab. esculentus* included 8 phenolic compounds and *M. parviflora* contained 7 phenolic compounds. (Table 1)

As for the turbines was diagnosis 31 compounds in the leaves of species under study, also found were 3 turbine compounds in the *Al. ludwigii* and *H. rosa-sinensis* contained 6 terpenes, While 5 terpenes were identified in *G. hirsutum*, also *H. sabdariffa* which included amounted 11 compounds and 9 turbines were identified in the species *Ab. esculentus*, while 6 compounds appeared in *M. parviflora* (Table 2).

In the case of alkanes, 29 compounds were identified in the leaves of species under study, when 4 of them were identified in the species *Al. ludwigii*, while 5 compounds were separated from *H. rosa-sinensis* leaf extract, in addition, six compounds were recorded in the *G. hirsutum* and *H.sabdariffa* also included 9 compounds, while 4 compounds were diagnosed in the *Ab. esculentus*, 4 compounds were recorded also in *M. parviflora* (Table 3).

The study showed the alkaloids compounds reached to 13 compounds in the leaves of species under studied were distributed between 2 compounds in the *Al. ludwigii* and 3 compounds in *H. rosa-sinensis*, as for *G. hirsutum* there were only 2 compounds and the species *H. sabdariffa* recorded 2 compounds of alkaloids, while presence 3 compounds of alkaloids in the *Ab. esculentus* also diagnosed 3 compounds in *M. parviflora* (Table 4).

As for the Astra compounds, which were diagnosed 10 types of this compounds, 4 compounds were recorded in *H. rosa-sinensis* and 6 compounds in *H. asabdariffa* and The steroid compounds that were diagnosed 4 compounds in the leaves of species under study (Table 5).

The study also found that there were 16 compounds of the combined species between the species under study (Table 6). Some compounds were found in a species and were not found in other species or vice versa. Styrene has been present in all species under study, while the

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composite of Benzene, 1,1'- (1,2-cyclobutanediyl) bis- ,cis– founded in all species except the *M. parviflora*, and the Glycerin compound found in all species except the *Ab. esculentus* and *Al. ludwigii*. The study also found that *Hibiscus* contained the most common phenolic compounds.

The study agreed with Al-Ameer *et al.* (2010) in the presence of phenols, alkaloids, and steroids in the leaves of *Al. ludwigii*, while the study did not agree with what is referred to by Ammar *et al.* (2013) containing the same species only five phenolic compounds, while the current study recorded nine phenolic compounds and the study agreed with Gupta *et al.* (2013) in the leaf of *H. rosa-sinensis* and *G. hirsutum*. The study also agreed with the Sheikh (2004) and Mahadevan and Kamboj (2009) in the presence of most secondary metabolites in the leaves of *H. sabdariffa*.

The study was consistent with what Abobaker *et al.*, (2017) with a high percentage of phenols, terpenes, alkaloids, and esters in the leaves of the *Ab. esculentus*, while the study agreed with what indicated by Denton et al. (2004) in containing the *Ab. esculentus* on the most important turbines and vitamin E also agreed with both Ahmed and Ibrahim (2016) in the presence of phenols and alkaloids in the leaves of this type.

Mohammed and al-Obaidi (1989) pointed out that the increase in plant metabolism is related to the spread of the root mass and the absorption of substances and elements that lead to the efficiency of photosynthesis process and thus increase the chemical compounds when good conditions for growth increase the process of photosynthesis and thus increase the stored compounds In the plant.

In addition, the type of compounds shown in the GC-MAS analysis is significantly affected by the type of extract and extraction method (al-Maliki, 2016). Many organic solvents were used to extract chemical compounds from plants, including chloroform, methanol, acetone, hexane, and others. Methanol can be used as a solvent to obtain polar compounds such as phenols and canines using the polar separation column in the gas chromatography apparatus, hexane can be used to separate polar compounds such as turbines and esters using the non-polar column, while a general column is used to obtain both (Al-Tameme, 2017). Methanol and hexane were used in this study.

Table (1) Phenolic compounds in the species under study.

No.	Compound name	Species					
		Ab. esculentus	*Al. ludwigii*	*G. hirsutum*	*H. rosa-sinensis*	*H. sabdariffa*	*M. parviflora*
1	Cyclopropyl carbinol	-	+	-	-	-	-
2	Styrene	+	+	+	+	+	+
3	(3-Methyl-oxiran-2-yl)-methanol	-	+	-	-	-	-
4	1,3-Propanediol, 2-(hydroxymethyl)-2-nitro	-	+	-	-	-	+
5	Benzene, 1,1'-(1,2-cyclobutanediyl)bis-, cis-	+	+	+	+	+	-
6	10-Undecyn-1-ol	-	+	-	-	-	-
7	(2,3-Diphenylcyclopropyl)methyl phenyl sulfoxide, trans	+	+	-	+	-	-
8	2-Pentenal, 5-phenyl-	+	+	-	-	-	-
9	4-Hydroxy-8-oxo-4-phenyl-2-aza-tricyclo[3.3.1.0(3,7)]nonane-2,3-dicarboxylic acid, dibenzyl ester	-	+	-	-	-	-
10	Glycerin	-	-	+	+	+	+
11	3(2H)-Furanone, dihydro-2,2-dimethyl-5-phenyl-	-	-	-	+	-	-
12	1,14-Tetradecanediol	-	-	-	+	-	-

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13	Z-4-Dodecenol	-	-	-	+	-	-
14	3-Cyclohexene-1-ethanol	+	-	-	+	-	-
15	2.3 Epoxyhexanol	-	-	-	+	-	-
16	Benzene, 1,1'-[4-(3-phenylpropyl)-1,7- heptanediyl]bis-	-	-	-	+	-	-
17	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	-	-	+	-	+	+
18	Isopropyl phenyl ketone	-	-	+	-	-	-
19	1-Pentanol, 2,2,4-trimethyl-	-	-	+	-	-	-
20	2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	+	-	-	-	-	-
21	1,2-Benzenedicarboxylic acid, diisooctyl ester	+	-	-	-	-	-
22	Benzene, 1,1'-[3-(2-phenylethylidene)-1,5-pentanediyl]bis-	+	-	-	-	-	-
23	8-Phenyloctanoic acid	+	-	-	-	-	-
24	Pentanal	-	-	-	-	+	-
25	Phenol, p-(benzyloxy)-, benzoate	-	-	-	-	+	-
26	2-Furancarboxaldehyde, 5-methyl-	-	-	-	-	+	-
27	Benzeneacetaldehyde	-	-	-	-	+	-
28	2-(4a,8-Dimethyl-2,3,4,4a,5,6- 26 hexahydro-naphthalen-2-yl)-prop-2-en-1-ol	-	-	-	-	+	-
29	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	-	-	-	-	+	-
30	3-Dodecanol	-	-	-	-	+	-
31	1,2-Propanediol, 3-benzyloxy-1,2-diacetyl-	-	-	-	-	+	-
31	1-Undecanol	-	-	-	-	-	+
32	1-Hexadecanol	-	-	-	-	-	+
33	2-Oxabicyclo[4.3.0]non-8-en-3-one, 4,4-dimethyl-, cis	-	-	-	-	-	+

(+) The presence of a compound (-) No compound.

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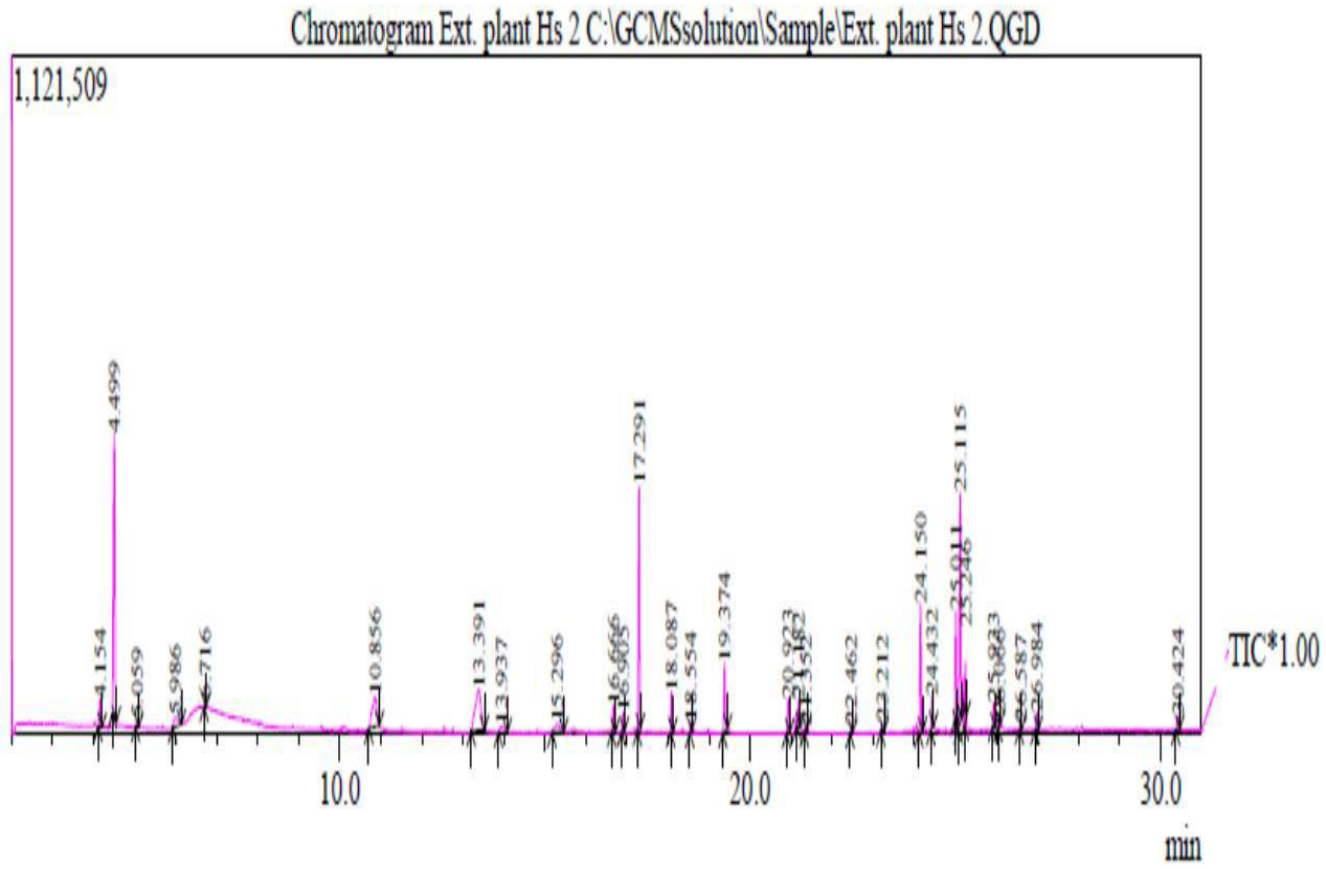

Fig.1: Chromatogram of Leaves *rosa-sinensis*

Table (2) Turbine compounds in the species under study

No.	Compound name	Species					
		Ab. esculentus	*Al. ludwigii*	*G. hirsutum*	*H. rosa-sinensis*	*H. sabdariffa*	*M. parviflora*
1	Butanenitrile, 3-methyl-	-	+	-	-	-	-
2	Butane, 2-iodo-3-methyl	-	+	-	-	-	-
3	n-Hexadecanoic acid	+	+	-	+	+	-
4	Glycidyl methyl ether	-	-	-	+	-	-
5	6-Octen-1-ol, 3,7-dimethyl-, (.+/-.)-	-	-	-	+	-	-
6	Isopropenyl methyl ether	-	-	-	+	-	-
7	Vitamin E	+	-	-	+	+	-
8	Pentadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	-	-	-	+	-	-
9	Phytol	+	-	-	-	+	+

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10	3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, acetate	-	-	+	-	-	-
11	11-Tridecenyl propionate	-	-	+	-	-	-
12	Cyclopropane, 1,1-dimethyl-2-(2,4-pentadienyl)-	-	-	+	-	-	-
13	Disulfide, (1-methylethyl) (1,1-dimethylethyl)	-	-	+	-	-	-
14	N-[Carboxymethyl]maleamic acid dimethyl ester	-	-	-	-	+	-
15	Citronellyl isobutyrate	-	-	-	-	+	-
16	Pentadecanoic acid, 14-methyl-, methyl ester	-	-	-	-	+	-
17	11,14-Eicosadienoic acid, methyl ester	-	-	-	-	+	-
18	8,11,14-Docosatrienoic acid, methyl ester	-	-	-	-	+	-
19	cis-13,16-Docasadienoic acid	-	-	-	-	+	-
20	cis,cis,cis-7,10,13-Hexadecatrienal	-	-	-	-	+	+
21	Eicosanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	-	-	-	-	+	-
22	Hexadecanoic acid, 15-methyl-, methyl ester	+	-	-	-	-	-
23	cis,cis-7,10,-Hexadecadienal	+	-	-	-	-	-
24	Eicosanoic acid	+	-	-	-	-	-
25	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	+	-	-	-	-	-
26	Octadecanoic acid, 2,3-dihydroxypropyl ester	+	-	-	-	-	-
27	gamma.-Tocopherol	+	-	-	-	-	-
28	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	-	-	-	-	-	+
29	Pentadecanoic acid	-	-	-	-	-	+
30	11,14,17-Eicosatrienoic acid, methyl ester	-	-	-	-	-	+
31	Fumaric acid, 2-dimethylaminoethyl nonyl ester	-	-	-	-	-	+

(+) The presence of a compound (-) No compound

Table (3) Spinal compounds in the species under study

No.	Compound name	Species					
		Ab. esculentus	*Al. ludwigii*	*G. hirsutum*	*H. rosa-sinensis*	*H. sabdariffa*	*M. parviflora*
1	3-Hepten-2-one	-	+	-	-	-	-
2	Eicosane	-	+	-	-	-	-
3	N-Acetylisoxazolidine	-	+	-	-	-	-
4	Formazine, 1,5-diphenyl-3-(5-nitrofuran-2-yl)-	-	+	-	-	-	-
5	p-Xylene	+	-	-	+	-	-
6	2-Cyclopenten-1-one, 2-hydroxy-	-	-	-	+	-	-
7	Oxirane, (propoxymethyl)-	-	-	-	+	-	-
8	1,3,5-Cycloheptatriene, 7-ethyl-	-	-	-	+	-	-

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9	2,6-Octadiene, 4,5-dimethyl-	-	-	-	+	-	-
10	Furfural	-	-	+	-	+	-
11	N-Ethyl-2-carbomethoxyazetidine	-	-	-	-	+	-
12	1-Tetradecene	-	-	-	-	+	-
13	Oxirane, (butoxymethyl)-	-	-	-	-	+	-
14	Octane, 1-(1-ethoxyethoxy)-	-	-	-	-	+	-
15	5,7-Octadien-3-ol, 2,4,4,7-tetramethyl-, (E)-	-	-	-	-	+	-
16	Nonyl trifluoroacetate	-	-	-	-	+	-
17	2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-hexamethyl-, (all-E)-	-	-	-	-	+	-
18	Oxetane, 3-(1-methylethyl)-	-	-	+	-	-	-
19	4-Hexen-3-one, 4,5-dimethyl-	-	-	+	-	-	-
20	5-Nonen-4-one, 6-methyl-	-	-	+	-	-	-
21	Octane, 4-bromo-	-	-	+	-	-	-
22	1,8-Nonadiyne	-	-	+	-	-	-
23	2-Decene, 8-methyl-, (Z)-	+	-	-	-	-	-
24	1-Pentadecyne	+	-	-	-	-	-
25	2-Methylbicyclo[3.2.1]octane	+	-	-	-	-	-
26	Oxetane, 2-methyl-4-propyl	-	-	-	-	-	+
27	5-Octen-1-ol, (Z)-	-	-	-	-	-	+
28	(R)-(-)-(Z)-14-Methyl-8-hexadecen-1-ol	-	-	-	-	-	+
29	Oxirane, [(dodecyloxy)methyl]-	-	-	-	-	-	+

(+) The presence of a compound (-) No compound

Table (4) alkaloids compounds in the species under study.

No.	Compound name	Species					
		Ab. esculentus	*Al. ludwigii*	*G. hirsutum*	*H. rosa-sinensis*	*H. sabdariffa*	*M. parviflora*
1	3,3-Dimethyl-4-phenylamino-butan-2-one	-	+	-	-	-	-
2	4-Benzyloxy.beta.-methyl-.beta.-nitrostyrene	-	+	-	-	-	-
3	Butanoic acid	-	-	-	+	-	-
4	4-Benzyloxy-3-methoxy-2-nitrobenzoic acid	-	-	-	+	-	-
5	Butanamide, 3,3-dimethyl-	-	-	+	+	-	-
6	3-Butenoic acid, ethyl ester	-	-	+	-	-	-
7	Butanoic acid, 2-oxo-	-	-	-	-	+	-
8	3-Eicosyne	-	-	-	-	+	-
9	9-Octadecenamide, (Z)-	+	-	-	-	-	+
10	Hydrazinecarboxamide, 2-(2-methylcyclohexylidene	+	-	-	-	-	-
11	Ethanone, 2-(2-benzothiazolylthio)-1-(3,5-dimethylpyrazolyl)- $$	+	-	-	-	-	-
12	2(1H)-Pyrimidinone, 5-methyl-	-	-	-	-	-	+
13	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	-	-	-	-	-	+

(+) The presence of a compound (-) No compound

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Table (5) Astro - compounds in the species under study

No.	Compound name	Species					
		Ab. esculentus	*Al. ludwigii*	*G. hirsutum*	*H. rosa-sinensis*	*H. sabdariffa*	*M. parviflora*
1	Oxalic acid, cyclobutyl heptyl ester	-	-	-	+	-	-
2	Oxalic acid, cyclobutyl ethyl ester	-	-	-	+	-	-
3	Oxalic acid,ethel neopentyl ester	-	-	-	+	-	-
4	Propanoic acid, 2-hydroxy-2-methyl-, methyl ester	-	-	-	-	+	-
5	3-Heptenoic acid, methyl ester	-	-	-	-	+	-
6	Cyclopentanecarboxylic acid, heptyl ester	-	-	-	-	+	-
7	Butanedioic acid, 3-hydroxy-2,2-dimethyl-, dimethyl ester, (R)-	-	-	-	-	+	-
8	n-Butyric acid 2-ethylhexyl ester	-	-	-	-	+	-
9	[1,1'-Bicyclopropyl]-2-octanoic acid, 2'-hexyl-, methyl ester	-	-	-	-	+	-

(+) The presence of a compound (-) No compound

Table (6) Steroid compounds in the species under study.

No.	Compound name	Species					
		Ab. esculentus	*Al. ludwigii*	*G. hirsutum*	*H. rosa-sinensis*	*H. sabdariffa*	*M. parviflora*
1	n-Decanoic acid	-	-	+	-	-	-
2	Fucosterol	+	-	-	-	-	-
3	Ethyl iso-allocholate	-	-	-	-	-	+
4	Cholestane, 4,5-epoxy-, (4.alpha.,5.alpha.)-	-	-	-	-	-	+

(+) The presence of a compound (-) No compound.

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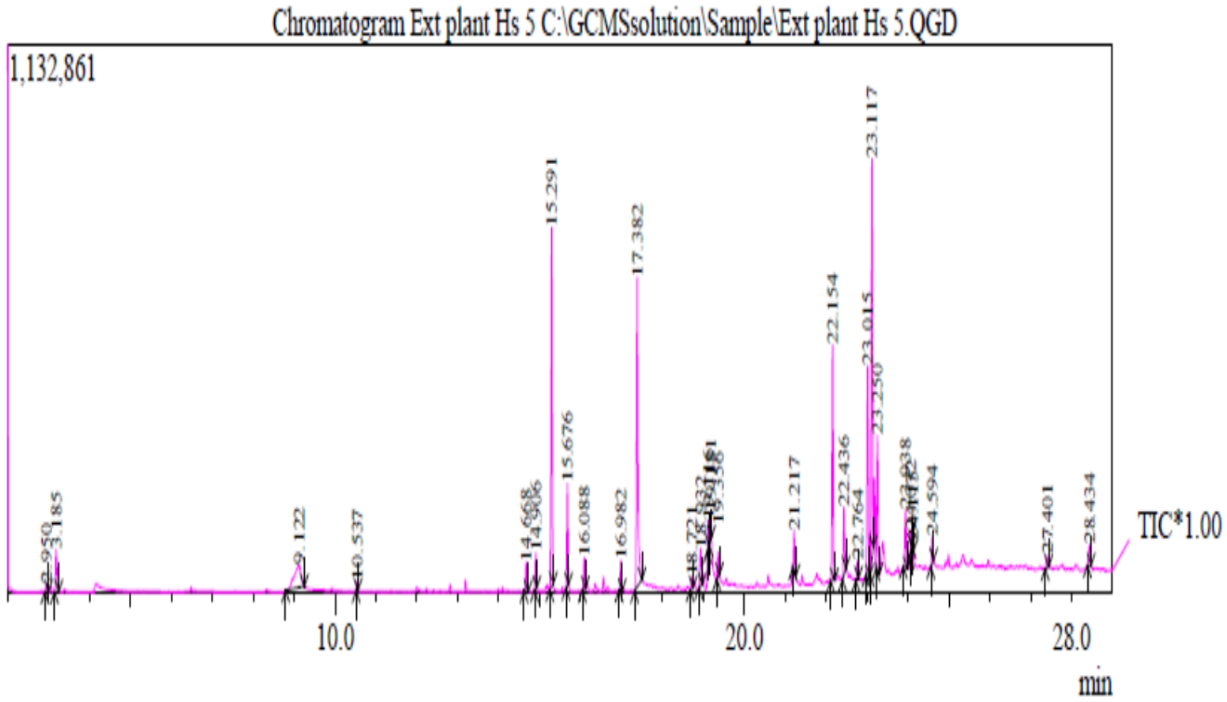

Fig.2: Chromatogram of Leaves *Ab.esculentus*

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