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CHEMICAL STUDY OF SOME *FICUS* AND *MORUS* SPECIES GROWING IN IRAQ

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Abstract

The current research was conducted the chemical study of both genus *Ficus* L. and *Morus* L. in Iraq, which included three species of the first genus *F. carica* L., *F. elastica* Roxb. and *F. religiosa* L. and two species of second genus *M. alba* L. and *M. nigra* L.

The chemical compound was studied specifically the Phenolic compounds, it was extraction and detection of the active compounds in the leaves of species under study using the reagents preliminary (Sedimentological) and it was isolation and diagnoses the active compound existing by using the Gas Chromatography/Mass Spectrometry (GC/MS) and this considered new way in Iraq and for the two genus mention considered the first chemical study in Iraq also reveal of the important the Phenolic active compound in the leaf of species under study based on the types compounds and discussing the relationship between them as well as other anatomical characteristics that we reached through research. For example, species *F. carica* contained compound 3-Furanmethanol which gave it the importance of taxonomic isolated from the rest of the species.

Key words : *Ficus, Morus*, GC-MS, phenols.

Introduction

The Moraceae family is one of the most important economic and medical families in the tropical and subtropical zone (Daoud, 1979).

The important economic and medical of it back to some genus in this such as *Morus* L.*,* family have many benefits for many diseases the fruits were taken for eat and treatment for many diseases, in addition, used the wood of them in many products on the other hand the silkworm lived on the leaves of this tree and produces natural silk, also the leaves of this species used as medical drugs (Sulaiman, 2009).

The number of genus and species of this family varied according to the researchers who were interested in studying it, some of them refer to the number of their species with about 70 genus and 1500 species (Daoud, 1979) and and the other indicated that this family consists of about 70 genera and more 1800 species are mainly found in the tropics regions, four of which are found in Iraq, two genera are endemic include *Ficus* and *Morus* and the other two genera are cultivated (Townsend and Guest, 1980). So, Vyas *et al*. (2012) appear that this family includes 73 genera and 1000 species spreader in the tropical and temperate regions of the world when the Zhou and Michael (2003) mention that the family Moraceae include 37 to 43 genera and 1100 to 1400 species widespread in the tropical and subtropical region.

Ficus belongs to the family Moraceae and is one of the oldest genera of fruit that appeared on the earth as mentioned in the books of heaven, especially in the Quran, has derived the name of this genus of ancient Latin word is Fig, and in Arabic TIN and in Kurdish HENJIR and in Turkish INJIR (Townsend and Guest, 1980), he also noted that this genus contains more than 2000 species spread in the tropical and subtropical regions and in Iraq there are eight species, but most of them are not found today. Al-Rawi (988) refers in his book geographical distribution of wild plants in Iraq to the species *F. carica* and Daoud (1979) showed that this genus comprises about 800 species This genus in Iraq consists of three species: *F. carica*, *F. religiosa* and *F. elastica*.

Morus is one of the important species belonging to the Moraceae family (Orwa *et al*., 2009). Several names

of this genus were mentioned by Townsend and Guest (1980) and refer that the word *Morus* was derived from the Latin name of TUTH, TUTH or TUT and that the name FIRSAD was mentioned by Ibn al-Bitar, and the name TU in Kurdish was also mentioned on this species and that the number of this species is about 12, two of which are spread in Iraq known *M. alba* and *M. nigra*.

Srivastava *et al*. (2006) explained that this genus has more than 15 species and that the dominant species is *M. alba*, while, Ercisli and Orhan (2007) explained that the genus *Morus* contains 24 species and Iqbal *et al*. (2012) mentioned that the genus includes about 10-16 species of falling leaf trees that spread all over the world.

Most wild and medicinal plants contain highly useful chemical compounds that are by-products of metabolism within the plant used for the purpose of their lifetime, protection and defense against other organisms, these compounds are called natural, secondary or occasional products and are often referred to as active ingredients (Harborn, 1973).

Since ancient times used of these compounds in the form of extracts as drugs, but the purification and diagnosis of many of these active substances with biological impact are still the scientists of pharmacology, chemistry, and life sciences, the attention was focused on the effect extracts of plant on a number of pathogenic bacterial and fungal strains as well as finding a method or system to extraction and purification of these active substances and these methods may vary between extracts by Methanol, ethanol or by using distilled water also the extraction and purification methods vary according to the part of the plant used to extract it (Harborn, 1973).

Secondary metabolic compounds are responsible for the metabolic activity of plants and are divided into three main groups: phenolic compounds, alkaloid compound and terpenoid compound (Harborns, 1984).

The *Morus* composed from phenolic compounds, carotenes, anthocyanin in addition B2, B3 and C vitamin also contain the high percentage of mineral like as Ni, Zn, Fe, Mg, Na and K (Okwu, 2005).

Anshul *et al*. (2012) refer of *ficus* composed from Marmesin, Umbelliferone, Coumarin and flavonoids against the cancer disease in addition composed from biochemically active like as β- carotene, β- sterols, glycosides, xanthotoxol, triterpenoids and fatty acids also the leaves of *Ficus* richness in phenols, flavonoids and essential oils.

Materials and Methods

A. Preparation the extracts of phenolic compounds

The method following by Riberean-Gayon (1972) was used to extraction the phenolic compounds from the leaves of the species under study as :

1. Weighing 20 g of Powder dry leaves and placed in a flask then added 400 ml of acetic acid 2% and extraction by using the reflex condense in a 70°C water bath for 8 hours.
2. Then let the mixture cool down, mix the mixture with filter paper (whattman no. 1) and add the same size of n-propanol and then added sodium chloride until the saturation limit reached two layers were formed isolating the upper layer (organic) containing phenolic compounds using separation funnel.

Table 1 : GC-MS analysis of phenols in leaves of *F. carica*.

No. of peak	Flow time (min.)	Area %	Compound name
1.	9.03	13.62	Methyl Hydrazine
2.	10.20	6.35	H-Thiopyran-3(6H)-one
3.	10.79	2.56	Ethanamine, N-ethyl-N-[(1-methylethoxy)methyl]
4.	11.12	11.30	3-Furanmethanol
5.	12.71	4.56	1,2-Cyclopentanedione
6.	14.06	2.61	Cyclopropane, 1-methyl-1-(2-methylpropyl)-2-nonyl
7.	16.70	3.80	Pentanal
8.	16.90	3.02	Acetoxyacetic acid, morpholide
9.	17.47	7.24	2-Hydroxy-gamma-butyrolactone
10.	17.75	3.24	1-(3,4-Dimethoxybenzylidene)-4-(4-ethoxybenzyl) thiosemicarbazide
11.	18.45	13.05	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl
12.	18.80	12.92	Glycerin
13.	20.48	15.74	2-Furancarboxaldehyde, 5-(hydroxymethyl)
	100.00		

Table 2 : GC-MS analysis of phenol in leaves of *F. elastica*.

No. of peak	Flow time (min.)	Area %	Compound name
1.	9.06	17.18	Methyl Hydrazine
2.	11.16	6.70	2,5-Dibora-1,4-dioxane, 2,3,5,6-tetraethyl
3.	14.16	5.85	dl-Erythro-1-phenyl-1,2-propanediol
4.	18.44	19.06	1,3-Dioxolane, 2,4,5-trimethyl
5.	18.80	8.11	N-Acetyl-l-methioninamide
6.	21.02	43.11	7H-Furo[3,2-g][1]benzopyran-7-one
	100.00		

Table 3 : GC-MS analysis of phenol in leaves of *F. religiosa*.

No. of peak	Flow time (min.)	Area %	Compound name
1.	9.08	16.86	Methyl Hydrazine
2.	12.73	3.09	1,2-Cyclopentanedione
3.	12.93	10.80	Benzoic acid, 2-(acetyloxy)-, methyl ester
4.	14.17	3.79	L-Arginine, N2-[(phenylmethoxy)carbonyl]
5.	16.70	12.77	Pentanal
6.	17.47	7.74	2-Hydroxy-gamma-butyrolactone
7.	18.79	18.50	Glycerin
8.	26.61	26.44	Methoxyacetic acid, 4-hexadecyl ester
		100.00	

Table 4 : GC-MS analysis of phenol in leaves of *M. alba*.

No. of peak	Flow time (min.)	Area %	Compound name
1.	9.11	6.64	Formic acid
2.	10.21	2.66	But-1-ene-3-yne, 1-ethoxy
3.	10.81	1.81	Butyrolactone
4.	11.12	7.78	2-Furanmethanol
5.	12.70	5.40	2-Cyclopenten-1-one, 2-hydroxy
6.	16.69	6.90	Pentanal
7.	17.46	5.83	2-Hydroxy-gamma-butyrolactone
8.	18.45	10.04	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6 methyl
9.	18.79	13.14	Glycerin
10.	20.51	9.22	Furancarboxaldehyde, 5-(hydroxymethyl)
11.	22.44	11.27	1,2-Benzenedicarboxylic acid, diisooctyl ester
12.	23.80	19.29	Eicosane
		100.00	

3. This layer was then concentrated in the rotary evaporator, dried and put in a closed tube glass in the refrigerator to use.

B. Phenolic compound reagents

1. Lead acetate 1% detector : to detection of Tannins when quantitative amount of the reagent is added to an equal quantity of the alcohol extract, showing a white Residuum (Al-Salami (1998) and AL-Muktar (1994).
2. $FeCl_3$ 1% detector : to detection of Tannins and simple phenols when quantitative amount of the reagent is added to an equal quantity of the alcohol extract, showing a bluish green Residuum (Harborne (1984).
3. KOH 10% detector : to detection of Flavonoids and Furanocoumarins when was added to 10% of the alcohol solution of KOH to the equal quantity of alcohol extract, showing a yellow or greenish-yellow Residuum (AL-Muktar, 1994).

C. Detected the components

The components were determined according to GC-MS using the Institute's database of National Institute for Standardization and Technology (NIST) with more than 62000 A well-known pattern and comparison of the output spectrum of the anonymous component with a range of known and stored components (NIST) to confirm the name, molecular weight and structure of the components of the test materials in Spectroscopy Laboratory, Chemistry Department, Faculty of Science, AL-Mustansiriya University.

Results and Discussion

The genera belonging to the Moraceae family considered the most important plants used in the ancient and modern medicine contains phenolic compounds, flavonoids, glucosinolates, indoles, sterols, saponins and

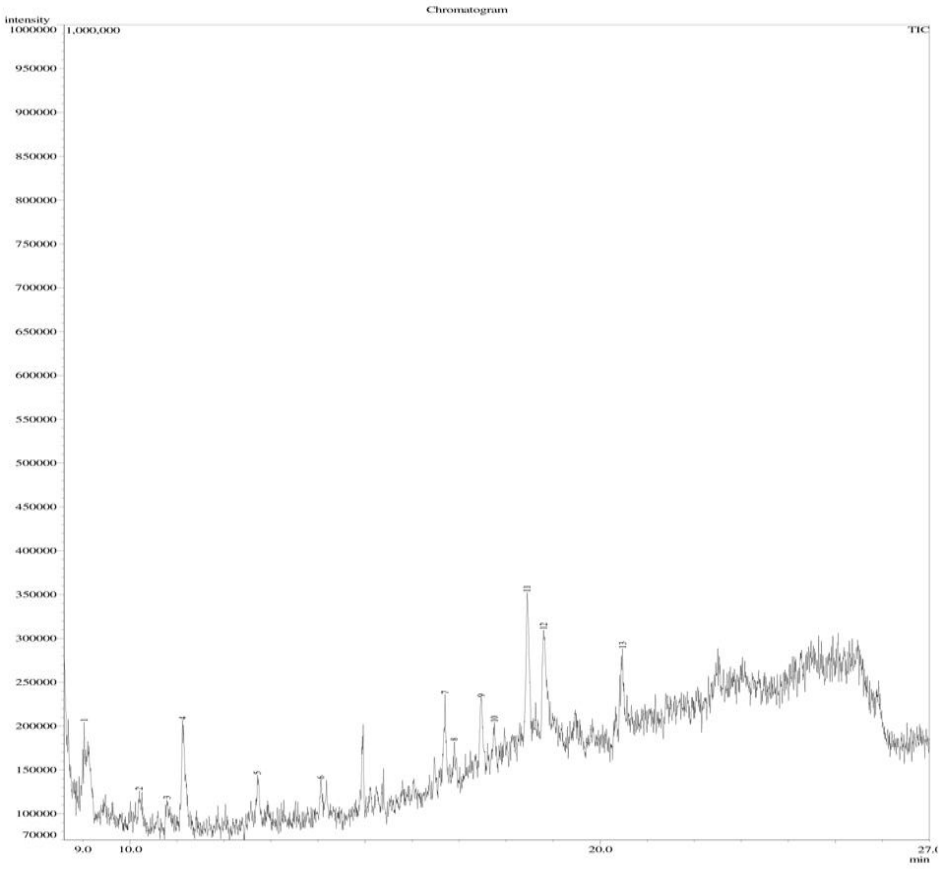

Fig. 1 : Gas chromatography of phenolic content in leaves of *F. carica.*

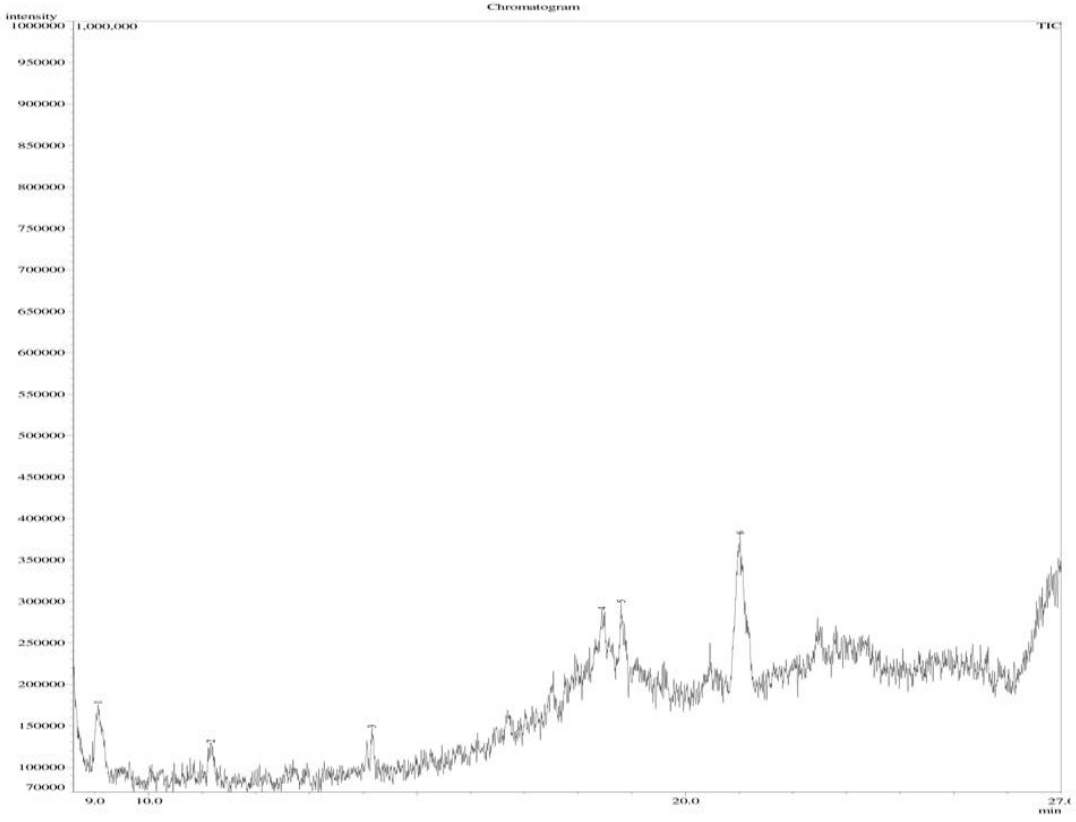

Fig. 2 : Gas chromatography of phenolic content in leaves of *F. elastica*.

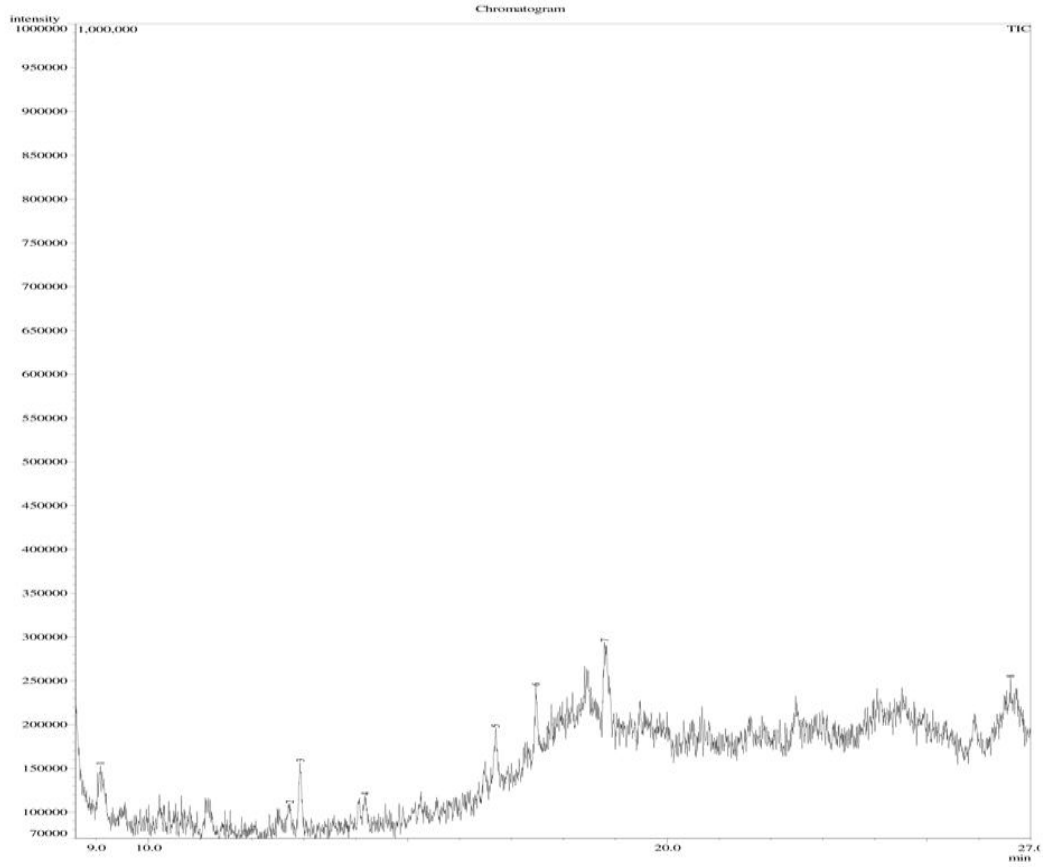

Fig. 3 : Gas chromatography of phenolic content in leaves of *F. religiosa.*

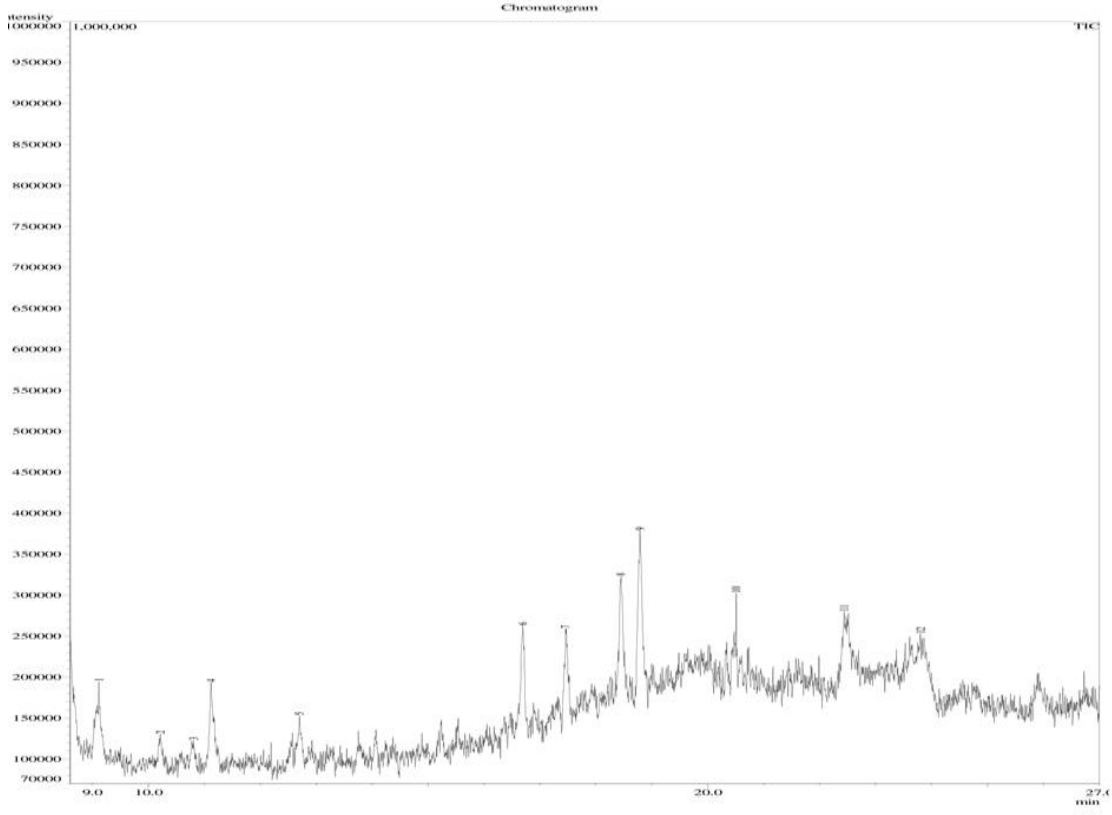

Fig. 4 : Gas chromatography of phenolic content in leaves of *M. alba.*

Table 5 : GC-MS analysis of phenol in leaves of *M. nigra*.

No. of peak	Flow time (min.)	Area %	Compound name
1.	9.09	7.21	Formic acid
2.	10.21	2.68	5-Carboxy-1,2,3-triazole
3.	11.12	7.37	2-Furanmethanol
4.	12.72	3.35	1,2-Cyclopentanedione
5.	13.79	2.56	Cycloheptyl N,N-diisopropylphosphoramidocyanidate
6.	14.06	1.44	Oxirane, [(hexadecyloxy)methyl]
7.	16.69	8.52	Pentanal
8.	16.87	3.35	Acetic acid, 3,3,6-trimethyl-4-oxo-3,4-dihydro-2H-pyran-2-yl ester
9.	17.46	6.41	2-Hydroxy-gamma-butyrolactone
10	18.45	5.88	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl
11.	18.76	9.67	Glycerin
12.	23.77	34.35	Hexatriacontane
13.	25.90	7.23	l-(+)-Ascorbic acid 2,6-dihexadecanoate
		100.00	

Table 6 : Compound Phenolics joint in leaves of *Ficus* and *Morus* species under study.

Compound name	Species				
	F. carica	***F. elastica***	***F. religiosa***	***M. alba***	***M. nigra***
Methyl Hydrazine	+	+	+	_	_
1,2-Cyclopentanedione	+	_	+	_	+
Pentanal	+	_	+	+	+
2-Hydroxy-gamma-butyrolactone	+	_	+	+	+
4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl	+	_	_	+	+
Glycerin	+	_	+	+	+
Formic acid	_	_	_	+	+
2-Furanmethanol	_	_	_	+	+

+ Presence compound - Absence compound

others active substances (El-khateeb, 2010).

From this study was diagnosis the phenolic compound from leaves of the species under study, has been diagnosed 13 different compounds in the extract of *F. carica* where recorded high percentage 13.05% of 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl in appearance time 18.45 mints followed by a compound Glycerin reached to 12.92% in 18.80 mints (table 1 and fig. 1), while separated 6 compounds from the species *F. elastica* when the 7H-Furo[3,2-g][1]benzopyran-7-one compound recorded high percentage reached to 43.11% and the time of appearance 21.02 mints and the N-Acetyl-l-methioninamide compound followed it in 18.80 mints and rate 8.11% (table 2 and figure 2) and the result agree with Doi *et al*. (2001), Yashvanth *et al*. (2015), Zeni and Molin (2010).

It was also separated 8 compounds from *F. religiosa* and the high percentage recorded by the Glycerin when appearing in 18.79 mints reached to 18.50% followed the compound Methoxyacetic acid, 4-hexadecyl ester reached to 26.44% in 26.61 mints (table 3 and fig. 3).

On the other hand from the genus *Morus* were separated 12 compounds from *Morus alba*, the high percentage recorded by Glycerin reached to 13.14% in 18.79 mints followed by the compound 4H-Pyran-4-one,2,3-dihydro-3,5-dihydroxy-6-methyl where recorded 10.04% and the time of appearance 18.45 (table 4 and fig. 4), also were separated 13 compounds from *M. nigra* and the compound Hexatriacontane recorded high percentage reached to 34.35% in appearance time 23.77 mints followed by the compound Glycerin were recorded 9.67% in 18.76 mints (table 5 and fig. 5).

The results of this study appearance there is joint compounds between the species under study as they were found in certain species and did not exist in other species or vice versa like as the compound Methyl

Table 7 : Phenolic Compounds Special in *Ficus* and *Morus* Species are under study.

Phenolic Compound	Species				
	F.carica	***F.elastica***	***F.religiosa***	***M.alba***	***M.nigra***
H-Thiopyran-3(6H)-one	+	_	_	_	_
Ethanamine, N-ethyl-N-[(1-methylethoxy)methyl]	+	_	_	_	_
3-Furanmethanol	+	_	_	_	_
Cyclopropane, 1-methyl-1-(2-methylpropyl)-2-nonyl	+	_	_	_	_
Acetoxyacetic acid, morpholide	+	_	_	_	_
Thiosemicarbazide 1-(3,4-Dimethoxybenzylidene)-4-(4-ethoxybenzyl)	+	_	_	_	_
2-Furancarboxaldehyde, 5-(hydroxymethyl)	+	_	_	_	_
2,5-Dibora-1,4-dioxane, 2,3,5,6-tetraethyl	_	+	_	_	_
dl-Erythro-1-phenyl-1,2-propanediol	_	+	_	_	_
1,3-Dioxolane, 2,4,5-trimethyl	_	+	_	_	_
N-Acetyl-l-methioninamide	_	+	_	_	_
7H-Furo[3,2-g][1]benzopyran-7-one	_	+	_	_	_
Benzoic acid, 2-(acetyloxy)-, methyl ester	_	_	+	_	_
L-Arginine, N2-[(phenylmethoxy)carbonyl]	_	_	+	_	_
Methoxyacetic acid, 4-hexadecyl ester	_	_	+	_	_
But-1-ene-3-yne, 1-ethoxy	_	_	_	+	_
Butyrolactone	_	_	_	+	_
2-Cyclopenten-1-one, 2-hydroxy	_	_	_	+	_
Furancarboxaldehyde, 5-(hydroxymethyl)	_	_	_	+	_
1,2-Benzenedicarboxylic acid, diisooctyl ester	_	_	_	+	_
Eicosane	_	_	_	+	_
5-Carboxy-1,2,3-triazole	_	_	_	_	+
Cycloheptyl N,N-diisopropylphosphoramidocyanidate	_	_	_	_	+
Oxirane, [(hexadecyloxy)methyl]	_	_	_	_	+
Acetic acid, 3,3,6-trimethyl-4-oxo-3,4-dihydro-2H-pyran-2-yl ester	_	_	_	_	+
Hexatriacontane	_	_	_	_	+
l-(+)-Ascorbic acid 2,6-dihexadecanoate	_	_	_	_	+

+ Presence Compound - Absence Compound

hydrazine appearance in all species of *Ficus* and the compound 1,2-Cyclopentanedione appearance in *F. carica, F. religiosa* and *M. nigra,* also the compound Pentanal and 2-Hydroxy-gamma-butyrolactone founded in the species *F.carica, F.religiosa, M. nigra* and *M. alba* and the compound 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl founded in the species *F. carica, M. nigra* and *M. alba* and the compound Glycerin founded in the species *F. carica*, *F. religiosa*, *M. nigra* and *M. alba*. Finally, the compound Formic acid and 2-Furanmethanol founded in the species *M. nigra* and *M. alba* and the result agree with Basnet *et al.* (1993).

From table 6 show the three species affiliate to *Ficus* participate in contains the compound Methyl hydrazine, while the two species affiliate to the genus *Morus* free of from this compound, on the other hand the species *M. nigra* and *M. alba* contain the compound Formic acid and 2- Furanmethanole and the other species free of it,

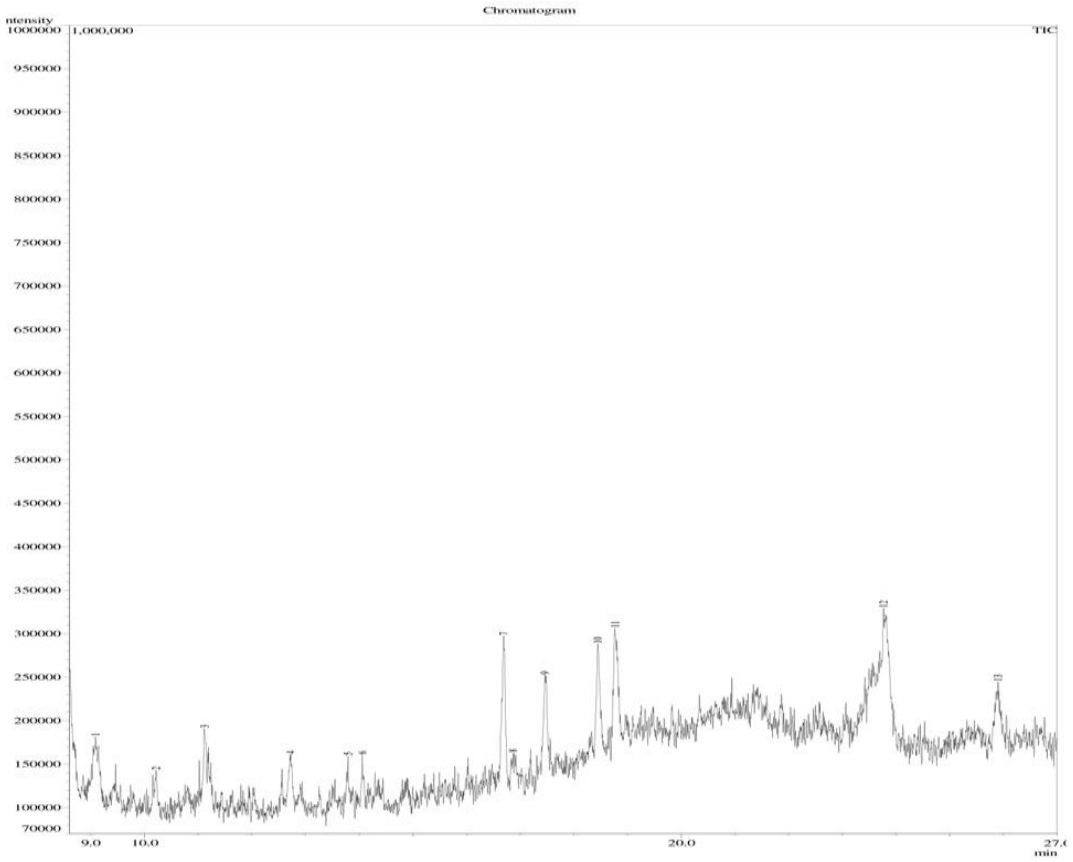

Fig. 5 : Gas chromatography of phenolic content in leaves of *M. nigra.*

also from the same table noted that the species *F. elastica* contain the compound Methyl hydrazine, so all the species under study except the species *F. elastica* contain Pentanal, 2-Hydroxy-gamma-butyrolactone and Glycerin and the result agree with Yarmolinsky (2012).

Each of the species under study was isolated by containing its leaves on certain chemical compounds phenolics, which gave it the importance of taxonomy in isolating it from other species.

F. carica was unique in containing its leaves (7) phenolic compounds and *F. elastica* was unique in containing its leaves (5) phenolic compounds and *F. religiosa* was unique in containing its leaves (3) phenolic compounds and *M. alba* was unique in containing its leaves (6) phenolic compounds and *M. nigra* was unique in containing its leaves (6) phenolic compounds (table 7) and the result agree with Yashvanth *et al*. (2015).

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