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# Comparative Chemical Study For Species Of The Family Poaceae

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## ABSTRACT

Background: The species P. incurva, S. arabica, C. pakeri, A. donax, A. palaestina, S. barbatus, S. divaricatus and L. hirsutus belongs to the grass family, which is a herbaceous plant that is widespread in Iraqi lands were selected These plants are known as forage plants. The chemical compounds of leaves of these species which belong to different tribes of the Poaceae family were detected 510 compounds were observed, the fewest number of chemical compounds (35) recorded in the leaves of the species P. incurva, while the highest number (90) compounds in the species S. arabica, and the lowest retention time (2.852) minutes recorded with Propane, 2,2-diethoxy-, while the highest detention time (28.272) minutes with the compound Citronellol epoxide (R or S) in the species S. arabica, It was observed that the lowest number of repeated chemical compounds reached two chemical compounds in the P. incurva, as each chemical compound was repeated twice, while the highest number of repeated chemical compounds, (13) compound in the species A. palaestina and by comparing the chemical content, it was noticed the similarity of all studied species by containing the two compounds Propane, 2, 2-diethoxy- and Propan amide, 2-methoxy-N-methyl- while the compound 1,2-Butanediol, appeared in all species except for species A. donax, as well as for the two compounds 2- pentanone, 4-hydroxy-4-methyl and Acetoxyiso butyrylchloride , which were found in all species except P. incurva. The species P. incurva, A. donax and S. arabica shared the compound propanic acid, 2-methoxy-2-methyl-, ethyl ester, and on the other hand, A. palaestina, S. divaricatus, S. barbatus, and L. hirsutus shared In the compounds 1,3-Dioxolane, 2-methanol, 2,4-dimethyl, and 2,3-Butanedione, monooxime was found in all the studied species except for the species P. incurva, A. donax, and S. arabica. This study also noticed the existence of peaks, as the diagnose with the lowest number of peaks reached (7) in the type P. incurva, while the highest number of peaks (18) in the type S. arabica. The results showed that the studied species can be separated easily using chemical analysis techniques. Conclusion: The present study proved that the studied species can be classing by means of chemical analysis techniques, especially GC-MS technique, which represents a direct and rapid analytical approach to identify the plant components As it reached the maximum genetic distance between L. hirsutus and S. arabica (1016.2), while the euclidean distance between S. divaricatus and A. palaestina (353.74) was the lowest distance that was calculated .In molecular study, cluster analysis (phylogenetic tree) by unweighted pair-group method of arithmetic means (UPGMA) based dendrogram revealed that they were two main genetic groups: one small cluster A containing 3 varieties and a large cluster B containing 5 varieties.Cluster analysis (phylogenetic tree) by unweighted pair-group method of arithmetic means (UPGMA) based dendrogram revealed that they were two main genetic groups: one small cluster A containing 3 varieties and a large cluster B containing 5 varieties.

**Keywords:** family Poaceae , Iraq , , tribe , PCA analysis, phylogenetic tree . Gas chromatography–mass spectrometry (GC-MS) .

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proteins, carbohydrates, fibers, and ash which represent the primary metabolites [2].

Gas chromatography–mass spectrometry (GC-MS) is a powerful analytical technique that not only separate but also record a mass spectrum of components of complex mixtures which represent not only primary but also secondary metabolites[11]. It has been used to identify and elucidate the chemical composition of a wide range of grasses such as *Triticum* sp., *Hordeum vulgare*, *Avena sativa* and *Secale cereal* [6] The aim of this study is to determine the chemical composition of eight species by GC-MS technique .

## MATERIALS AND METHODS

**1- Dry Powder Preparation**

(1) gram of dry plant leaves is grind into fine powder at room temperature.

**2- Sample Preparation for GCMS Analysis**

## INTRODUCTION

The Poaceae family is one of the economically important plant families because of its fundamental role as the main source of human and animal food, In general, the plants are composed of a wide array of compounds.Phytochemicals are defined as bioactive non-nutrient compounds in fruits, vegetables, grains, and other plant foods that have been linked to reducing the risk of major chronic diseases[5,7,8,10].

The biosynthetic pathways to construct these compounds differ, and consequently, the chemical constituents within a plant can roughly differentiated, and hence, useful in classification [3,4]. Scant attention has been given to the chemical composition of wild plants that have less nutrition value, and most of the scientific researches emphasized on cultivated or wild edible plants[2] egarding the chemical composition of grasses, it contain

The GC-MS analysis is conducted at the laboratories of the Ministry of Science and Technology, the (99.999% purity) is at a constant flow of 1 ml/min temperature of 270°C. Ion source temperature is at 200°C. The oven temperature is programmed from 50°C, with an increase of 8°C/min, to 250°C hold from 5 min.

(1) gram is extracted with 100 ml of absolute ethanol and acetone (1:1), the solution is shaken for 24 h and then dried in an oven. The whole mixture then filtered through Whatman filter paper. The filtrate obtained is evaporated under room temperature .

**3- GC-MS Analysis**

**Table (1) chemical compounds in *A. palaestina (Part 1)***

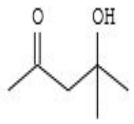
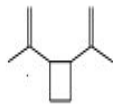
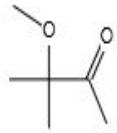
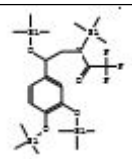
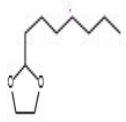
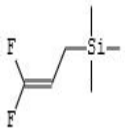
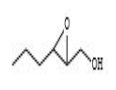
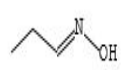
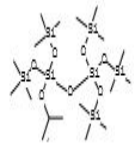
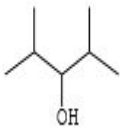
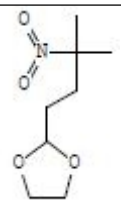
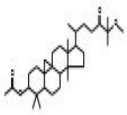
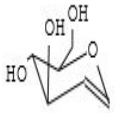
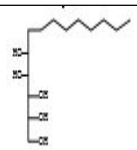
| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |
|---|---|---|---|---|---|---|
|  | C7H16O2 | 2.851 | 1660485 | 132 | Propane, 2,2-diethoxy- | 1- |
|  | C6H12O2 | 4.134 | 292083 | 116 | 2-Pentanone, 4-hydroxy-4-methyl- | -2 |
|  | C10H16 | 7.035 | 40353 | 136 | Cyclobutane, 1,2-bis(1-methylethenyl)-, trans- | -3 |
|  | C6H12O2 | 11.548 | 6632 | 116 | 2-Butanone, 3-methoxy-3-methyl- | 4- |
|  | C17H50O7Si7 | 13.941 | 29587 | 562 | 3-Ethoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane | -5 |
|  | C22H42F3NO4Si4 | 16.072 | 29138 | 553 | N-(Trifluoroacetyl)-N,O,O',O''-tetrakis(trimethylsilyl)norepinephrine | 6- |
|  | C10H20O2 | 17.903 | 22575 | 172 | 1,3-Dioxolane, 2-heptyl- | 7- |
|  | C6H12F2Si | 19.531 | 16237 | 150 | Trimethyl(3,3-difluoro-2-propenyl)silane | 8- |

**Table (1) chemical compounds in *A. palaestina (Part 2)***

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C6H12O2 | 19.762 | 12620 | 116 | 2,3-Epoxyhexanol | 9- |
|  | C3H7NO | 21.017 | 13025 | 73 | Propanal, oxime | -10 |

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C18H52O7 Si7 | 22.357 | 15255 | 576 | 3-Isopropoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane | 11- |
|  | C7H16O | 23.589 | 17608 | 116 | 3-Pentanol, 2,4-dimethyl- | 12- |
|  | C8H15NO4 | 24.738 | 20538 | 189 | 2-(3-Methyl-3-nitrobutyl)-1,3-dioxolane | -13 |
|  | C33H54O4 | 25.816 | 24604 | 514 | 9,19-Cyclolanostan-24-one, 3-acetoxy-25-methoxy- | 14- |
|  | C6H10O4 | 26.890 | 24550 | 146 | D-arabino-Hex-1-enitol, 1,5-anhydro-2-deoxy- | 15- |
|  | C14H30O5 | 28.108 | 22280 | :278 | D-Mannotetradecane-1,2,3,4,5-pentaol | -16 |
|  | C9H20O | 29.549 | 17356 | 144 | Pentane, 2-methoxy-2,4,4-trimethyl- | 17- |

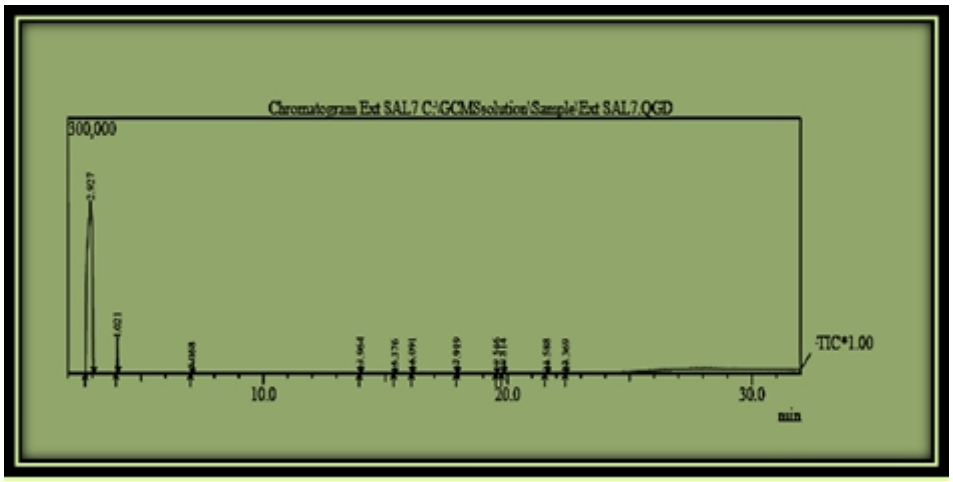
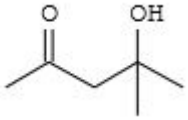
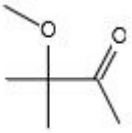
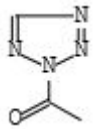
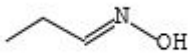
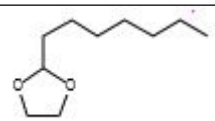
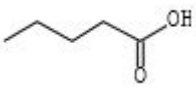
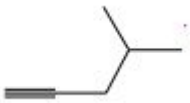
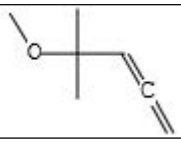



**Figure (1) an outline of chemical compounds in leaves of *A. palaestina***

| **Table (2) chemical compounds in *S. divaricatus (Part 1)*** | | | | | | |
|---|---|---|---|---|---|---|
| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C7H16O2 | 2.927 | 2809894 | 132 | Propane, 2,2-diethoxy- | 1- |
|  | C6H12O2 | 4.021 | 82256 | 116 | 2-Pentanone, 4-hydroxy-4-methyl- | 2- |
|  | C9H14 | 7.068 | 10883 | 122 | 1,7-Octadiene, 3-methylene- | 3- |
|  | C6H12O2 | 13.964 | 5972 | 116 | 2-Butanone, 3-methoxy-3-methyl- | 4- |
|  | C3H4N4O | 15.376 | 1150 | 112 | 1-Tetrazol-2-ylethanone | 5- |

| **Table (2) chemical compounds in *S. divaricatus (Part 2)*** | | | | | | |
|---|---|---|---|---|---|---|
|  | C3H7NO | 16.091 | 5629 | 73 | Propanal, oxime | 6- |
|  | C10H20O2 | 17.919 | 4652 | 172 | 1,3-Dioxolane, 2-heptyl- | 7- |
|  | C6H12O2 | 19.546 | 3605 | 116 | 2-Butanone, 3-methoxy-3-methyl- | 8- |
|  | C5H10O2 | 19.814 | 6275 | 102 | Pentanoic acid | 9- |
|  | C6H10 | 21.588 | 4112 | 82 | 1-Pentyne, 4-methyl- | 10- |
|  | C7H12O | 22.369 | 1621 | 112 | 1,2-Pentadiene, 4-methoxy-4-methyl- | 11- |

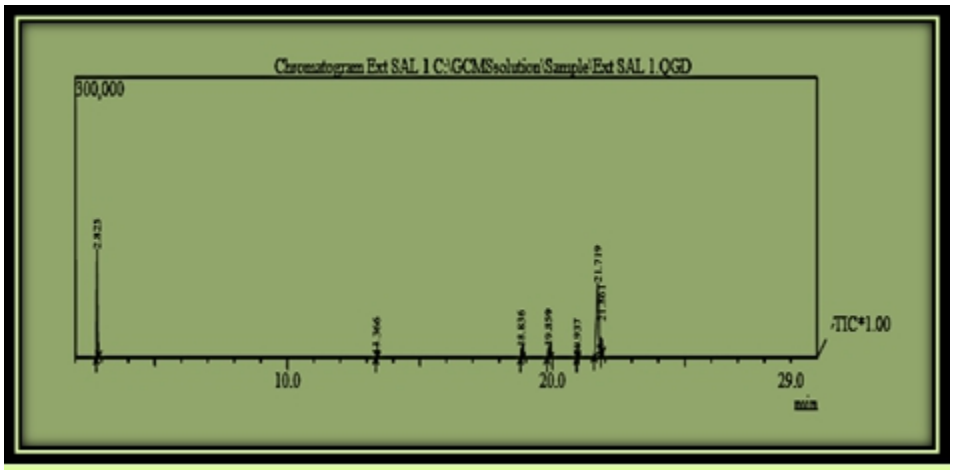
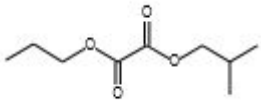
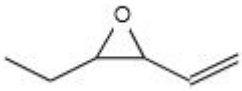
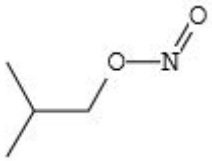
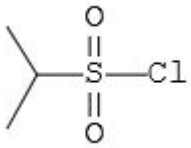



**Figure (2) an outline of chemical compounds in leaves of *S. divaricatus***

**Table (3) chemical compounds in *P. incurva***

| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |
|---|---|---|---|---|---|---|
|  | C7H16O2 | 2.825 | 206746 | 132 | Propane, 2,2-diethoxy- | 1- |
|  | C9H16O4 | 13.366 | 6811 | 188 | Oxalic acid, isobutyl propyl ester | 2- |
|  | C6H10O | 18.836 | 35521 | 98 | 2-Ethyl-3-vinyloxirane | 3- |
|  | C4H9NO2 | 19.859 | 53255 | 103 | Isobutyl nitrite | 4- |
|  | C3H7ClO2S | 20.937 | 3856 | 142 | Isopropylsulfonyl chloride | 5- |
|  | C15H30O | 21.719 | 439479 | 226 | Z-10-Pentadecen-1-ol | 6- |
|  | C4H9NO2 | 21.861 | 6173 | 103 | Nitrous acid, butyl ester | 7- |

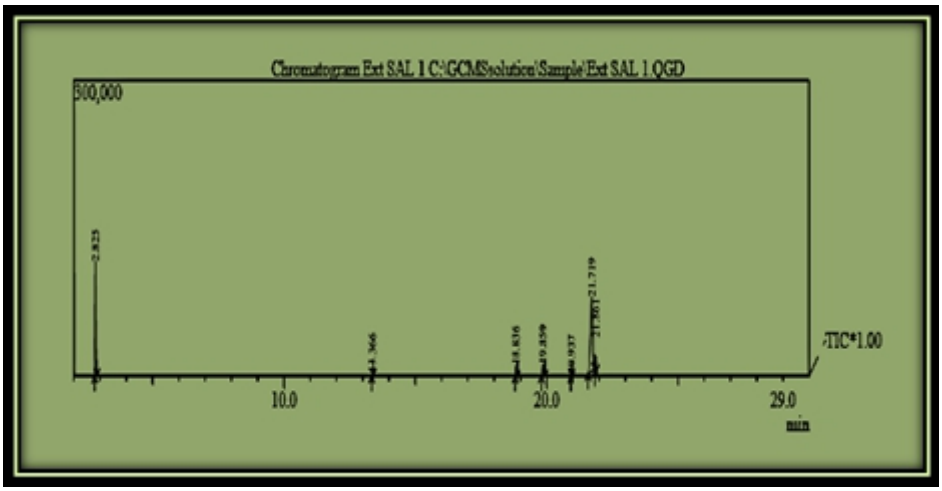
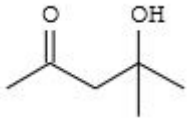
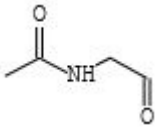
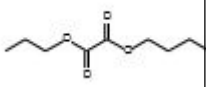
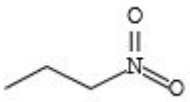



**Figure (3) an outline of chemical compounds in leaves of *P. incurva***

| **Table (4) chemical compounds in *A. donax (part 1)*** | | | | | | |
|---|---|---|---|---|---|---|
| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |
|  | C7H16O2 | 2.895 | 1099488 | 132 | Propane, 2,2- diethoxy- | 1- |
|  | C6H12O2 | 3.973 | 52762 | 116 | 2-Pentanone, 4-hydroxy-4-methyl- | 2- |
|  | C4H7NO2 | 11.575 | 1670 | 101 | Acetamidoacetaldehyde | 3- |
|  | C9H16O4 | 13.372 | 31690 | 188 | Oxalic acid, butyl propyl ester | 4- |
|  | C3H7NO2 | 18.837 | 16445 | 89 | Propane, 1-nitro- | 5- |

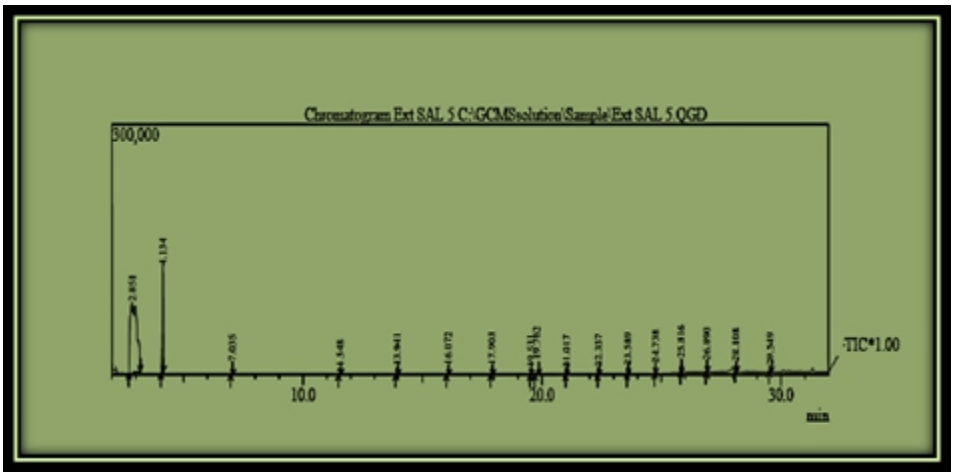
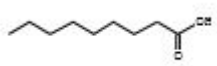
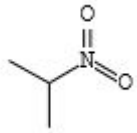
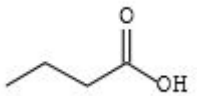
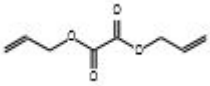
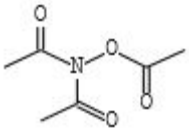



**Figure (4) an outline of chemical compounds in leaves of *A. donax***

| **Table (4) chemical compounds in *A. donax (part 2)*** | | | | | | |
|---|---|---|---|---|---|---|
|  | C9H18O2 | 19.864 | 81605 | 158 | Nonanoic acid | 6- |
|  | C3H7NO2 | 20.940 | 8658 | 89 | Propane, 2-nitro- | 7- |
|  | C15H30O | 21.733 | 594407 | 226 | Z-10-Pentadecen-1-ol | 8- |
|  | C4H8O2 | 21.870 | 15956 | 88 | Butanoic acid | 9- |
|  | C8H10O4 | 24.721 | 6807 | 170 | Oxalic acid, diallyl ester | 10- |
|  | C6H9NO4 | 26.314 | 7730 | 159 | N,N,O-Triacetylhydroxylamine | -11 |

| **Table (5) chemical compounds in *S. Arabica (Part 1)*** | | | | | | |
|---|---|---|---|---|---|---|
| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |
|  | C7H16O2 | 2.852 | 1131818 | 132 | Propane, 2,2-diethoxy- | 1- |

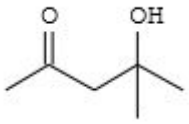
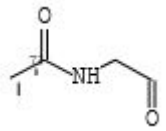
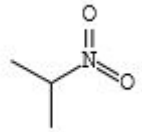
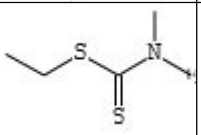
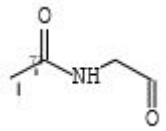
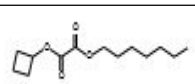
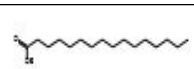
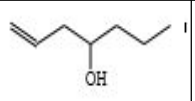
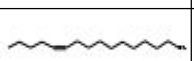
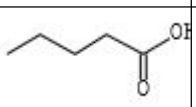
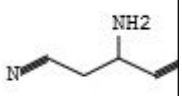
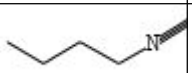
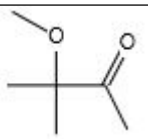
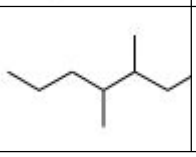
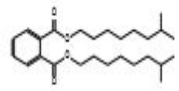
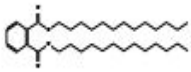
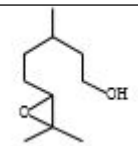
| | | | | | | |
|---|---|---|---|---|---|---|
|  | C6H12O2 | 3.915 | 23563 | 116 | 2-Pentanone, 4-hydroxy-4-methyl- | 2- |
|  | C4H7NO2 | 13.967 | 1670 | 101 | Acetamidoacetaldehyde | 3- |
|  | C5H9NO2S | 15.326 | 4468 | 147 | Propanesulfonylacetonitrile | 4- |
|  | C5H11NS2 | 15.406 | 1837 | 149 | Carbamodithioic acid, dimethyl-, ethyl ester | 5- |
|  | C4H7NO2 | 16.096 | 2612 | 101 | Acetamidoacetaldehyde | 6- |
|  | C13H22O4 | 18.825 | 14808 | 242 | Oxalic acid, cyclobutyl heptyl ester | 7- |
|  | C16H32O2 | 19.876 | 81558 | 256 | n-Hexadecanoic acid | 8- |

**Table (5) chemical compounds in *S. Arabica (Part 2)***

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C7H12O | 20.942 | 37555 | 112 | 1-Heptyn-4-ol | 9- |
|  | C15H30O | 21.705 | 300099 | 226 | Z-10-Pentadecen-1-ol | 10- |
|  | C5H10O2 | 21.860 | 15829 | 102 | Pentanoic acid | 11- |
|  | C4H5N3 | 22.776 | 19747 | 95 | 2-Aminosuccinonitrile | 12- |
|  | C5H9N | 22.913 | 8336 | 83 | Butane, 1-isocyano- | 13- |
|  | C6H12O2 | 23.608 | 5201 | 116 | 2-Butanone, 3-methoxy-3-methyl- | 14- |
|  | C9H20 | 27.096 | 28877 | 128 | Heptane, 3,4-dimethyl- | 15- |

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C26H42O4 | 27.453 | 227789 | 418 | Phthalic acid, bis(7-methyloctyl) ester | 16- |
|  | C34H58O4 | 27.879 | 154885 | 530 | 1,2-Benzenedicarboxylic acid, ditridecyl ester | 17- |
|  | C10H20O2 | 28.272 | 501458 | 172 | Citronellol epoxide (R or S) | 18- |

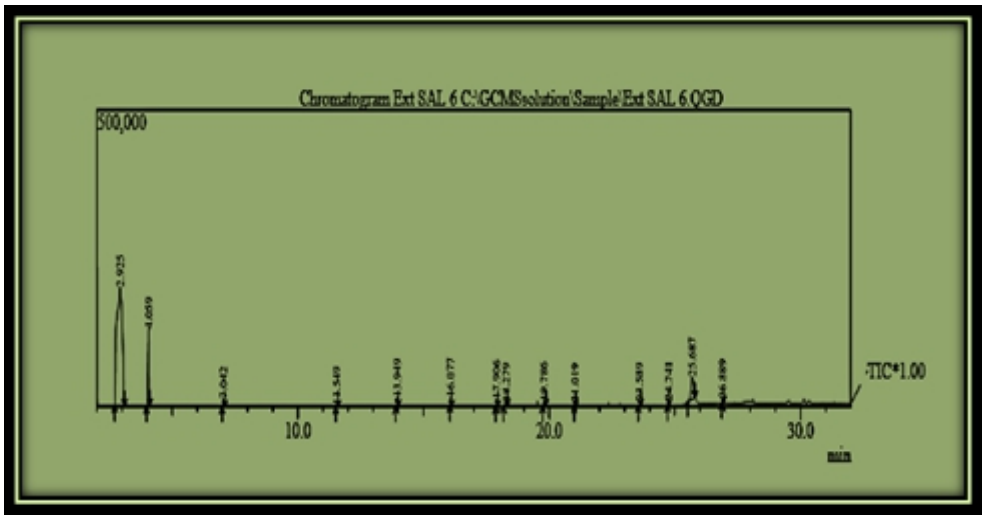
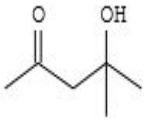
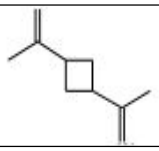
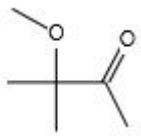
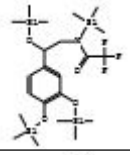
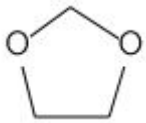
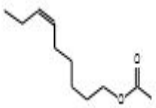
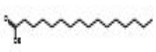
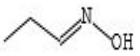
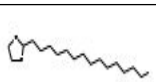
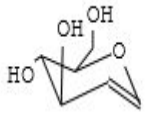
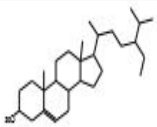



**Figure (5) an outline of chemical compounds in leaves of *S. arabica***

**Table (6) chemical compounds in *S. barbatus (Part 1)***

| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |
|---|---|---|---|---|---|---|
|  | C7H16O2 | 2.925 | 3023393 | 132 | Propane, 2,2-diethoxy- | 1- |
|  | C6H12O2 | 4.059 | 330049 | 116 | 2-Pentanone, 4-hydroxy-4-methyl- | 2- |
|  | C10H16 | 7.042 | 29047 | 136 | Cyclobutane, 1,3-diisopropenyl-, trans | 3- |
|  | C6H12O2 | 11.549 | 5514 | 116 | 2-Butanone, 3-methoxy-3-methyl- | 4- |
|  | C17H50O7Si7 | 13.949 | 32586 | 562 | 3-Ethoxy-1,1,1,7,7,7-hexamethyl-3,5,5-tris(trimethylsiloxy)tetrasiloxane | 5- |

| Table (6) chemical compounds in *S. barbatus (Part 2)* | | | | | | |
|---|---|---|---|---|---|---|
|  | C22H42F3NO4Si4 | 16.077 | 27474 | 553 | N-(Trifluoroacetyl)-N,O,O',O''-tetrakis(trimethylsilyl)norepinephrine | 6- |
|  | C3H6O2 | 17.906 | 25161 | 74 | 1,3-Dioxolane | 7- |
|  | C11H20O2 | 18.279 | 28822 | 184 | 6-Nonen-1-ol, acetate, (Z)- | -8 |
|  | C16H32O2 | 19.786 | 27769 | 256 | n-Hexadecanoic acid | 9- |
|  | C3H7NO | 21.019 | 10191 | 73 | Propanal, oxime | 10- |
|  | C18H36O2 | 23.589 | 12625 | 284 | 1,3-Dioxolane, 2-pentadecyl- | 11- |
|  | C6H10O4 | 24.741 | 12226 | 146 | D-arabino-Hex-1-enitol, 1,5-anhydro-2-deoxy- | 12- |
|  | C29H50O | 25.687 | 252814 | 414 | beta.-Sitosterol | 13- |

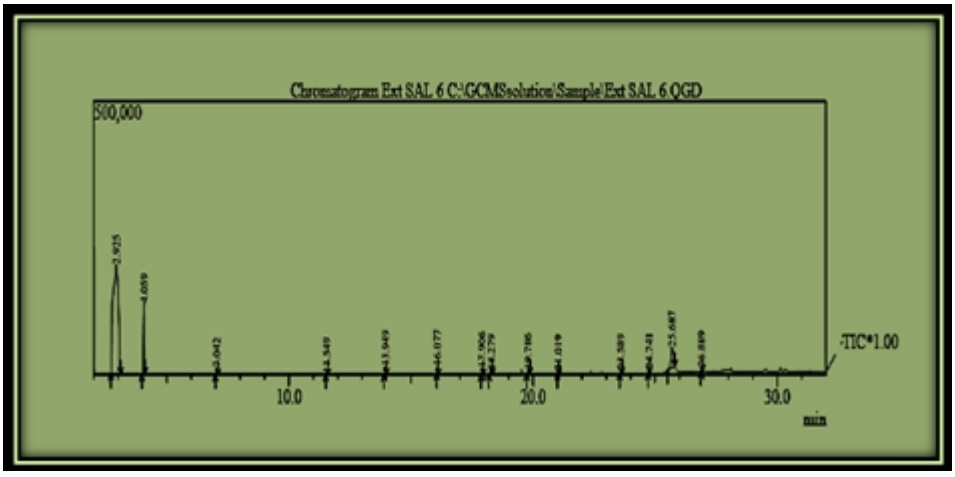
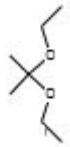
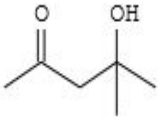
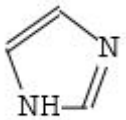
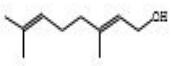
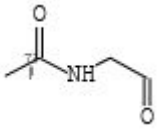
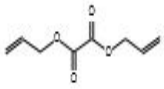
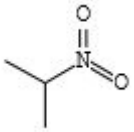
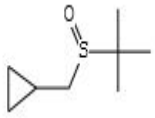
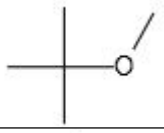
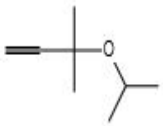
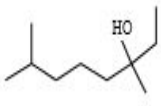



**Figure (6) an outline of chemical compounds in leaves of *S. barbatus***

| Table (7) chemical compounds in *C. pakeri (Part 1)* | | | | | | |
|---|---|---|---|---|---|---|
| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C7H16O2 | 2.834 | 1177622 | 132 | Propane, 2,2-diethoxy | 1- |
|  | C6H12O2 | 3.895 | 44578 | 116 | 2-Pentanone, 4-hydroxy-4-methyl | 2- |
|  | C3H4N2 | 7.035 | 3869 | 68 | 1H-Imidazole | 3- |
|  | C10H18O | 10.459 | 170822 | 154 | 2,6-Octadien-1-ol, 3,7-dimethyl-, (E)- | 4- |
|  | C4H7NO2 | 13.967 | 3104 | 101 | Acetamidoacetaldehyde | 5- |
|  | C4H7N | 19.240 | 3460 | 69 | Utanenitrile | 6- |

| **Table (7) chemical compounds in *C. pakeri (Part 2)*** | | | | | | |
|---|---|---|---|---|---|---|
|  | C8H10O4 | 21.637 | 6752 | 170 | Oxalic acid, diallyl ester | 7- |
|  | C3H7NO2 | 24.668 | 1787 | 89 | Propane, 2-nitro | -8 |
|  | C8H16OS | 24.956 | 9714 | 160 | tert-Butyl cyclopropylmethyl sulfoxide | 9- |
|  | C9H20O | 26.818 | 7823 | 144 | Pentane, 2-methoxy-2,4,4-trimethyl- | 10- |
|  | C8H14O | 28.136 | 6022 | 126 | 1-Butyne, 3-methyl-3-(1-methylethoxy)- | 11- |
|  | C10H22O | 29.431 | 7287 | 158 | 3-Octanol, 3,7-dimethyl-, | 12- |

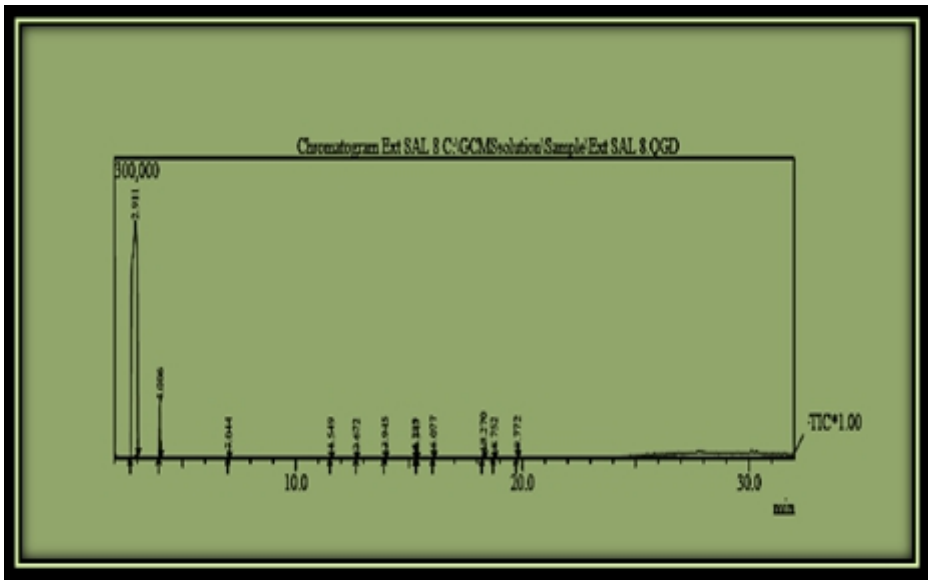
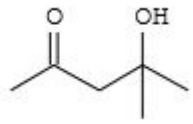
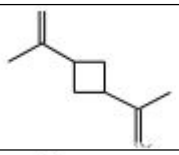
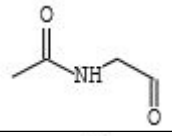
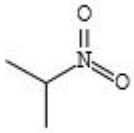
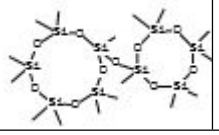
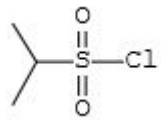
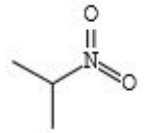
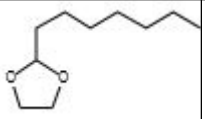
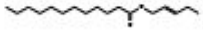
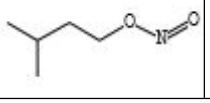



**Figure (7) an outline of chemical compounds in leaves of *C. pakeri***

| **Table (8) chemical compounds in *L. hirsutus (Part 1)*** | | | | | | |
|---|---|---|---|---|---|---|
| Structural formula | Molecular formula | holding time | Area | Molecular weight | Name of compound | NO. |
|  | C7H16O2 | 2.911 | 3645289 | 132 | Propane, 2,2-diethoxy- | 1- |
|  | C6H12O2 | 4.006 | 116863 | 116 | 2-Pentanone, 4-hydroxy-4-methyl- | 2- |
|  | C10H16 | 7.044 | 18003 | 136 | Cyclobutane, 1,3-diisopropenyl-, trans | 3- |
|  | C4H7NO2 | 11.549 | 2327 | 101 | Acetamidoacetaldehyde | 4- |
|  | C3H7NO2 | 12.672 | 764 | 89 | Propane, 2-nitro- | 5- |
|  | C16H48O10Si9 | 13.945 | 5589 | 652 | 2-(2',4',4',6',6',8',8'-Heptamethyltetrasiloxan-2'-yloxy)-2,4,4,6,6,8,8,10,10-nonamethylcyclopentasiloxane | 6- |

| **Table (8) chemical compounds in *L. hirsutus (Part 2)*** | | | | | | |
|---|---|---|---|---|---|---|
|  | C3H7ClO2S | 15.285 | 318 | 142 | Isopropylsulfonyl chloride | 7- |

| | | | | | | |
|---|---|---|---|---|---|---|
|  | C3H7NO2 | 15.347 | 528 | 89 | Propane, 2-nitro- | -8 |
|  | C10H20O2 | 16.077 | 5038 | 172 | 1,3-Dioxolane, 2-heptyl- | 9- |
|  | C17H32O2 | 18.270 | 22427 | 268 | Dodecanoic acid, 2-penten-1-yl ester | 10- |
|  | C6H11N | 18.752 | 3668 | 97 | Pentanenitrile, 4-methyl- | 11- |
|  | C5H11NO2 | 19.772 | 5776 | 117 | Isoamyl nitrite | 12- |

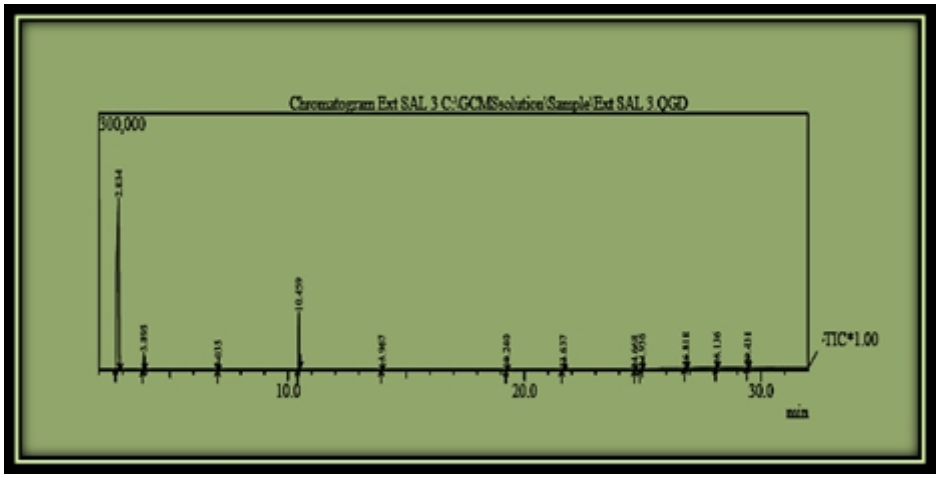



**Figure (8) an outline of chemical compounds in leaves of *L. hirsutus***

**Tables (9) chemical compounds with highest and lowest retention time**

| the highest retention time | the name of the compound | the shortest retention time | the name of the compound | The species |
|---|---|---|---|---|
| 29.549 | Pentanem2-methoxy-2,4,4-trimethyl | 2.851 | Propane, 2,2-diethoxy- | *A. palaestina* |
| 22.369 | 1,2-pentadiene,4-methoxy-4-methyl | 2.927 | Propane, 2,2-diethoxy- | *S. divaricatus* |
| 21.861 | Nitrous acid butyl ester | 2.825 | Propane, 2,2-diethoxy- | *P. incurva* |
| 26.314 | N,N,O-Triacetylhydroxylamin | 2.895 | Propane, 2,2-diethoxy- | *A. donax* |
| 28.272 | Citronellol epoxide (R or S) | 2.852 | Propane, 2,2-diethoxy- | *S. arabica* |
| 26.889 | D-Mannoteradecane-1,2,3,4,5pentaol | 2.925 | Propane, 2,2-diethoxy- | *S. barbatus* |
| 29.431 | 3- Octanol1,3,7-dimethyl-, | 2.834 | Propane, 2,2-diethoxy- | *C. pakeri* |
| 19.772 | Isoamyl nitrite | 2.911 | Propane, 2,2-diethoxy- | *L. hirsutus* |

*hirsutes* .

The emergence of repetition of some chemical compounds was recorded in all studied species and through the extraction and calculation of the number of chemical compounds that occur repeatedly in all types of the studied species, it was observed that the lowest number of repeated chemical compounds reached two chemical compounds in the *P. incurva*, while the highest number of repeated chemical compounds, (13) compound appeared in the *A. palaestina*. The lowest

## RESULTS AND DISCUSSION

The results of our study showed the presence of prominent changes in the distribution of chemical compounds between the species under study, (510) chemical compounds clustered in the studied species were detected, as (35) compounds were identified in the *P. incurva* and (90) compounds in the *S. arabica* , (60) compounds in *C. pakeri*, (55) compounds in *A. donax*, (85) compound in *A. palaestina*, (70) compound in *S. barbatus*, (55) compound in *S. divaricatus* and (60) compounds in *L.*

*divaricatus, S. barbatus*, and *L. hirsutus* species shared the compound 1,3-Dioxolane, 2-methanol, 2,4-dimethyl , The compound 2,3-Butanedione, monooxime was found in all species except for *P. incurva, A. donax*, and *S. arabica*. By comparing the number of peaks in each chemical diagram, it was observed that *A. pakeri* and *L. hirsutus*, having (12) peaks, while the lowest number (7) was in *P.incurva*, and the highest peaks in *S.arabica*, with (18) peaks .

Some of the identified compounds possess antimicrobial and biological activities such ashexadecanoic acid which has anti-inflammatory activity [9] octadecanoic acid had the property of anti-inflammatory and antiarthritic; tetracosane showed cytotoxicity against AGS, MDA-MB-231, HT29, and NIH3T3 cells (28); and triacontane possesses antibacterial, antidiabetic, and antitumor activities [1] The identification of these compounds serves as the basis in determining the possible health benefits of the wild plants, leading to further biological and pharmacological studies.

The results of the study presented in Table (10) show the euclidean distance between the studied species. As it reached the maximum genetic distance between *L. hirsutus* and *S. arabica* (1016.2), while the Euclidean distance between *S. divaricatus* and *A. palaestina* (353.74) was the lowest distance that was calculated .

Figure (9) shows division species into two main groups or two major clades. The first clad included *S. A.donax* and *C.pakeri* species, while *L. hirsutus* was characterized by the subgroup alone.The secondary subgroup was divided into 3 subgroups,( 3subclades). Incline species *S.barbatus* apart sub-sub by himself and brothered him with the second subclade 2 subclade that combines the two species *S. divaricatus* and *A. palaestina*, while the *P. incurva* species is unique to the secondary subclade alone.The isolation of the species in groups or clusters from each other indicates the reliability of the chemical characteristics in separating the species. As for the similarity that some species came with, this results from the fact that they have a common ancestral origin.

retention time (2.852) minutes was recorded with the compound Propane, 2,2-diethoxy- while the highest retention time was (28.272) minutes with Citronellol epoxide (R or S) in species *S. arabica*, while species *A. palaestina* had a minimum retention time (2,851) minutes for Propane, 2,2-diethoxy-, and a highest (29,549) minutes for a compound Pentane, 2-methoxy-2,4,4-trimethyl-. While the species *S. barbatus*, had aminimum retention time of (2,925) minutes at the compound Propane, 2,2-diethoxy- and the highest retention time (26,889) minutes at the compound. pentaol D-Mannotetradecane-, and the two types *A. donax* and *S. divaricatus* were similar in that they contain (55) chemical compounds, in *A. donax* with a minimum retention time (2.895) minutes for diethoxy. - Propane, 2,2- and the highest retention time (26,314) minutes at compound N, N, O-Triacetylhydroxylamine, while the species *S. divaricatus* recorded the lowest retention time (2,227) minutes at the compound Propane, 2,2-diethoxy- and the highest retention time (22.369) minutes with the compound 1,2-Pentadiene, 4-methoxy-4-methyl-, and the species *C. pakeri* and *L. hirsutus* were similar in that they contained (60) chemical compounds. The first one had its lowest retention time of (2.834) minutes at the compound Propane, 2,2-diethoxy, and the highest retention time (29.431) minutes for the compound 3-Octanol, 3,7-dimethyl-, while *L. hirsutus* recorded the lowest retention time (2,911) minutes at the compound Propane, 2, 2-diethoxy - while its highest retention time reached (19.772) minutes with Isoamyl nitrite as indicated in Table (9). By comparing the chemical content, it was observed that all the studied species were similar in that they contained the two compounds Propane, 2,2-diethoxy- and Propan amide, 2-methoxy-N-methyl-. while the compound 1,2-Butanediol, appeared in all species except for speciese *A. donax*, as well as for 2-pentanone, 4-hydroxy-4-methyl and Acetoxyiso butyrylchloride, which were found in all species except for *P. incurva*, *A. donax* and *S. arabica* while co-present with the compound propanic acid, 2-methoxy-2-methyl-, ethyl ester. On the other hand, *A. palaestina, S.*

**Table (10): The values of the genetic dimension depending on the chemical characteristics**

| *L.hirsutus* | *C.pakeri* | *S.barbatus* | *S.arabica* | *A.donax* | *P.incurva* | *S.divericatus* | *A.palaestina* | 0 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0 | *A.palaestina* |
| | | | | | | 0 | 353.74 | *S.divericatus* |
| | | | | | 0 | 492.24 | 534.08 | *P.incurva* |
| | | | | 0 | 558.36 | 446.94 | 627.51 | *A.donax* |
| | | | 0 | 856.49 | 999.06 | 977.9 | 958.5 | *S.arabica* |
| | | 0 | 962.34 | 671.57 | 771.52 | 605.97 | 620.9 | *S.barbatus* |
| | 0 | 891.81 | 919.81 | 537.7 | 894.01 | 836.98 | 982.88 | *C.pakeri* |
| 0 | 652.13 | 831.97 | 1016.2 | 579.57 | 934.47 | 685.44 | 864.34 | *L.hirsutus* |

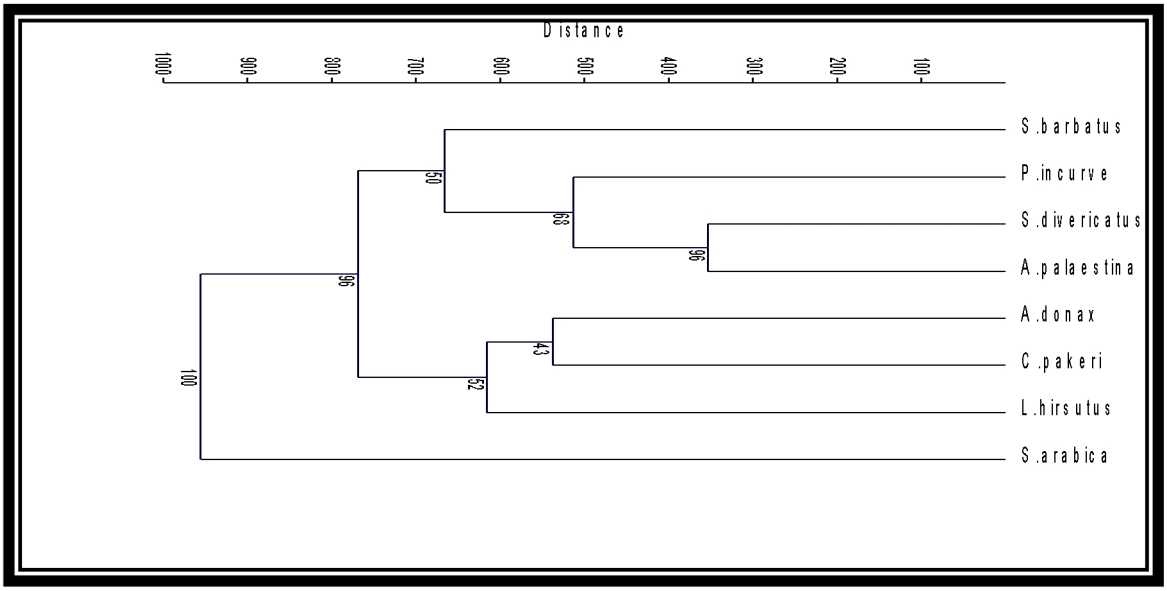



**Figure (9) a tree diagram that shows the similarity between the species studied using the UPGMA analysis method. The numbers of clusters represent Bootstraping, which is a measure of the accuracy and strength of the cluster.**

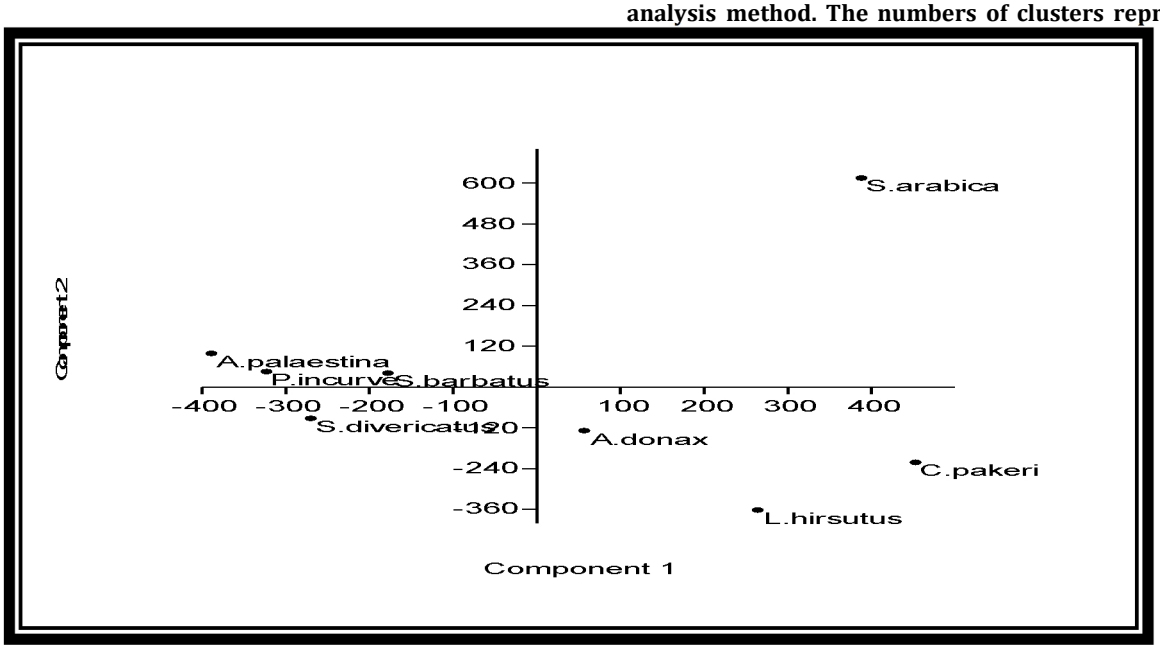



**Figure (10) The distribution of species on the orthogonal level according to PCA analysis.**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## CONCLUSIONS

The present study has proven its assisting in the classification of species studied using chemotaxonomic techniques, especially the GC-MS technique, which represents a direct and fast analytical approach for the identification of phytoconstituents.

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