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Detection of medicinally Effective Compounds in Two Genera of Ornamental Palm Leaves and Roots (*washingtonia filifera* and *Phoenix* sp.)

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Abstract. Many plants are economically important as they are an irreplaceable source of essential alkaloids, saponins, tannins, glycosides, resins, coumarins and other biologically active compounds, For this purpose, the current study was conducted in the Medicinal and Aromatic Plants Unit- College of Agriculture, University of Basrah. To detect medicinally active compounds (alkaloids, saponins, tannins, glycosides, resins, and coumarins) in the roots and leaves of two genera of the ornamental palm, *Washingtonia filifera* and four species from the genus *Phoenix*; *P. canariensis*, *P. pusilla*, *P. roebelenii* and *P. humilis*. The qualitative analysis of chemical compounds in the leaves was also carried out using the GC-MS technique. The results demonstrated that the leaves of *Washingtonian filifera* tree recorded high concentrations of all the mentioned compounds, while the roots contained these compounds in much smaller quantities. Alkaloids and coumarins were not recorded in the roots of *Phoenix Canariensis*. However, in the leaves of *Phoenix Pusilla*, a low concentration of resins was observed, with the absence of glycosides and coumarins. Meanwhile, the proportions of glycosides and coumarins increased. whereas alkaloids and saponins were not detected in the roots. *Phoenix robellinelli* did not show a positive presence of coumarins compounds. Similarly, its roots did not show presences presence of most of the mentioned compounds. The results indicated that *Phoenix humilus* leaves contain all of these compounds in high proportions, with the exception of resins, which were not clearly positive.

Keywords. Medically effective compounds, Ornamental Palm, *Washingtonia filifera*, *Phoenix* sp.

1. Introduction

The palm tree belongs to a family of monocotyledons plants known as Areacacea. It is a flowering plant family including 181 genera and about 2600 species, Washingtonia is a genus of palms belonging to the Coryphoideae subfamily (Coryphieae tribe and Livistoninae subtribe) and including two species; *Washingtonia filifera* and *Washingtonia robusta*. The Washingtonia palm known as the

California palm is a hybrid between two species *Washingtonia robusta* (Mexican fan palm), and *Washingtonia* x *filabusta*, the Washingtonia genus is a widespread palm tree all over the world as well as in Iraq. It is planted as an ornamental tree for its beautiful appearance on public streets [1,2 and 3]. *Phoenix canariensis*, *Phoenix pusilla*, *Phoenix ruebellini* and *Phoenix humilis* belong to the palm family Arecaceae under the genus *Phoenix*, cultivated in the worlds' hot and semi-hot regions [4]. In their specific or several organs, the medicinal plants contain chemical substances called active ingredients, Plants are rich sources of a wide varieties of bioactive secondary metabolites such as tannins, terpenoids, saponins, alkaloids, flavonoids, and other compounds that have the ability to treat a specific disease or reduce its incidence. Many active compounds are formed as their own defense mechanism against predators like insects, herbivores and even microorganisms, resulting in changes to root and leaf exudates[5,6 and 7]. The family of Arecaceae has been reported to contain compounds which are characterized by the prevalence of lipoids (triterpenoids and steroids), polyphenols (flavonoids and phenolic acids), alkaloids, tannins, saponins as major bioactive secondary metabolites, this family have been shown to have many biological activities such as anti-diabetic, anti-oxidant, anti-parasitic, renal protective, cardio protective, cytotoxic, anti-microbial (antibacterial, antifungal and antiviral), anti-pyretic, anti-inflammatory, anti-mutagenic, antihypertensive, analgesic, anti-ulcer, neuropharmacological, and anti-Alzheimer [8 and9]. Many previous studies have shown the great medicinal use of different parts of the genus *Phoenix*, as antioxidant [10], anti-inflammatory, antitumor [11], antibacterial [12], antifungal, neuroprotective [13] and hepatoprotective agents [14]. Plant bioactive compounds are being studied for its applications in medicinal field, agricultural, cosmetics preparations and other fields. The major aim of this work is the research of the bioactive compounds isolated from the roots and leaves of two genera of the ornamental palm, *Washingtonia filifera* and four species frome ornamental palm belonging to the genus *Phoenix p. canariensis, p. pusilla,p. roebelenii,p. humilis* and to validate their ethnomedicinal uses.

2. Materials and methods

This study was conducted in the Medical and Aromatic Plant Unit-college of Agriculture,University of Basrah on two genera of ornamental palm; *Washingtonia filifera* and *Phoenix*,namely *P. Canariensis, P. pusilla, P. roebelen*i, *and P. humilis*, to study the contents of leaves and roots of medicinally effective compounds. Leaf and root samples of trees were collected, cleaned, and dried in an oven at a temperature of 45 °C until dehydration.Dried pant parts were Crushed by an electric mill, the milled samples were kept in sealed glass containers at laboratory temperature (20–22 °C) until use.

2.1. Chemical Detection of Medicinally Effective Compounds

2.1.1. Alkaloids Detection

The method of [15] was followed by boiling 10 grams of vegetative portion in 50 mL of hydrochloric acid-acidified distilled water at a concentration of 4%. The detection process was carried out using a Dragendrov detector to detect alkaloids.

2.1.2. Saponins Detection

The saponin compound test was based on the method of [16]. A total of 0.5 g of extract was put into a test tube containing 10 mL chloroform, heated for 5 mins on a water bath while shaking. Then a few drops of Lieberman Bouchard reagent were added. If a brown or violet ring is formed, it indicates the presence of triterpene saponins, while green or blue colors indicate the presence of steroidal saponins [17].

2.1.3. Tannins Holding Material Disclosure

The method mentioned in [18] was used to determine the tannin contents of the leaves and roots, where 10 drops of the solution were added to distilled water until the color fades, and 1-2 drops of iron chloride reagent were added, and when a blackish blue color was formed. The greenish-black color indicates the presence of tannin compounds in the sample.

2.1.4. Glycosides Detection
The method of [19] was followed to detect glycosides, a sample of 5 g of crude sample was taken and placed in a conical flask with the addition of 85% aqueous methanol. A total of 10% lead acetate solution was added to the methanolic extract, which was then centrifuged for 5 mins.
For 5 mins to remove precipitated materials. Then it was placed in a conical flask with a 10% sodium phosphate solution, The supernatant was then partitioned with chloroform: methanol (3:1) solution to extract the whole glycosides.

2.1.5. Resin Detection
Resins detection was relied upon [20] to estimate the resinous materials of leaves and roots.

2.1.6. Disclosure of Coumarins
The method described in [21] was used to take 1 mL of alcohol extract of leaves in a test tube and using UV radiation to detect coumarins.
Note, the semantics of the signs in Tables 1,2,3,4 and 5 show the followings: The (+) sign indicates positive detection, and the (-) sign indicates negative detection, while the (±) indicates that the positive result does not appear clearly. The intensity of the compound was determined by increasing the number of positive marks.

2.2. GC-MS Analyses
The leaves were collected from the palm trees of the two genera and washed with ordinary water, then with distilled water and air dried, then ground by an electric grinder for the purpose of obtaining foliage powder. 50 g of the dried vegetation powder was weighed and blended with 500mL ethyl alcohol 70% in a 1000mL glass deck, sealed by cotton and aluminum paper, and placed in a vibrating incubator. It was left for 24 hours at room temperature after spraying the mixture using several layers of medical gauze to get rid of the plankton, centrifuged at 3000 rounds per minute for 10 minutes, and then spraying the extract using filtration sheets type Whatman No. 1 . For a brilliant solution to use in GC-MS technology (Gas-Chromatography-Mass Spectrometry). Leaves containers containing active substances were assessed using a gas chromatograph device coupled with mass spectrometry. The components were identified using the National Institute of Measurement and Technology (NIST) database by comparing the output spectrum of the unknown component with the well-known stored components of the NIST library.

3. Results and Discussion

3.1. Results of Chemical Detection of Effective Compounds in Leaves and Roots
The results of (Table 1) show the chemical detection of the active substances in the Washingtonia filifera leaves and roots to compare the quantity of effective compounds in different plant parts. The results indicated that the leaves contained all such compounds in high proportions, except coumarins, which were in lower proportions at the roots, and glycosides did not appear at the roots.

Table 1. Results of chemical detection of effective compounds in *Washingtonia filifera* leaves and roots.

Effective compounds	Part of plant	
	Leaves	Roots
Alkaloids	+++	±
Saponins	+++	±
Tannins	+++	+
Glycosides	++	-
Resins	+++	+
Coumarins	++	+

The results of table (2) show the chemical detection of the active substances of *Phoenix Canariensis* leaves and roots to compare the quantity of effective compounds in leaves and roots, with the results indicating that the leaves contained all such compounds in proportions similar to those found in the

Washingtonia filifera leaves, while in very small proportions they were in the roots, and the alkaloids and coumarins did not appear in the roots.

Table 2. Results of chemical detection of effective compounds in *Phoenix canariensis* leaves and roots.

Effective compounds	Part of plant	
	Leaves	Roots
Alkaloids	+++	-
Saponins	++	±
Tannins	+++	+
Glycosides	++	+
Resins	+++	+
Coumarins	++	-

The results of (Table 3) also showed the chemical detection of the active substances in the leaves and roots of the *Phoenix Pusilla* to compare the quantity of effective compounds in the leaves and roots. The results indicated a decrease in the amount of resin compounds in the leaves. Glycosides and coumarins did not appear positively.

Table 3. Results of chemical detection of effective compounds in *Phoenix pusilla* leaves and roots.

Effective compounds	Part of plant	
	Leaves	Roots
Alkaloids	++	±
Saponins	++	±
Tannins	+++	+
Glycosides	-	++
Resins	+	+
Coumarins	+++	++

The results of (Table 4) showed the chemical detection of the active substances in *Phoenix Roebelenii* leaves and roots to compare the quantity of effective compounds in leaves and roots. The results indicated that the leaves contained all of those compounds, relative to which coumarins did not appear positively, but for the roots, most compounds did not appear positively.

Table 4. Results of chemical detection of effective compounds in *Phoenix roebelenii* leaves and roots.

Effective compounds	Part of plant	
	Leaves	Roots
Alkaloids	+++	±
Saponins	+++	±
Tannins	+++	+
Glycosides	++	±
Resins	+	+
Coumarins	±	+

(Table 5) results illustrate the chemical detection of the active substances in *Phoenix Humilis* leaves and roots to compare the quantity of effective compounds in different plant parts. In general, the results indicated that the papers contained all such compounds in high proportions, with the exception of resins' compounds that did not appear in a clear positive manner. As for the roots, all the vehicles studied except alkaloids and saponins did not appear in a clear positive manner.

Table 5. Results of chemical detection of effective compounds in Phoenix *humilis* leaves and roots.

Effective compounds	Part of plant	
	Leaves	Roots
Alkaloids	+++	±
Saponins	+++	±
Tannins	+++	+++
Glycosides	++	++
Resins	±	+
Coumarins	+	++

The (+) sign indicates positive detection, and the (-) sign indicates negative detection, while the (±) indicates that the positive result does not appear clearly. The intensity of the compound was determined by increasing the number of positive marks.

Studies have shown Arecaceae family, to which Washingtonia filifera belongs, is known for its medicinal plants. The active compounds identified in the roots, leaves, fruits, and seeds of Washingtonia species have been linked to digestive health and other therapeutic applications, enhancing the medical value of this plant family [22].

The phytochemical composition of leaves and roots of *Washingtonia filifera* and four species of ornamental palm belonging to the genus Phoenix, showed the presence of the saponins, Saponins are glycosides that lower the surface tension of water and used as cleansing agents andas an expectorant, The acidic nature of saponins is characterized by the presence of one or two carbonyl groups in aglycone or sugar molecules, The significant pharmacological activities of appear that saponins exhibit a biological role and medicinal properties such as hemolytic factor anti-inflammatory, antibacterial, antifungal, antiviral and as anticancer [23,24].

Glycosides play numerous important roles in living organisms, For example Phenolic glycosides possess antiseptic properties that are useful for the health of the urinary tract, Flavonoid glycosides include naringin, hesperidin, quercitrin and rutin, These glycosides have antioxidant properties, Cardiac glycosides are steroidal constituents which relieve symptoms due to a congestive heart failure and reduce some atrial arrhythmias, Where the interactions between glycosides and other phytochemicals found in medicinal plants may improve therapeutic results and minimize negative effects [25,26].

Coumarins show characteristic pharmacological properties such as ant bacteriostatic antimytotic effects and *anti*-HIV activity, As they are secondary metabolites of bacteria, plants, and fungi, Although these natural compounds exist in various parts of different plants, their highest concentration can be found in fruits, roots, stems, and leaves [27]. alkaloids are one of the most important bioactive components in natural herbs, their wide use in medicine for development of drugs [28].

Tannins is a group of phenolic compounds found to form irreversible complexes with proline rich protein leaves that have tannins as their main components are astringent in nature and are used for treating intestinal disorders such as diarrhea and dysentery [29]. resins of plant origin have got several therapeutic uses In addition to its medical uses, resins contain various types of terpenes, saponins, flavonoids, steroids, and their derivatives as their main aromatic compounds [30]. The plant roots tested negative for the presence of alkaloids and coumarins to the *phoenix canariensis*, the results of the analysis of *Phoenix humilis* palm leaves and roots showed positive activity for all components under study These results are consistent with [31]. The plant roots tested negative for the presence of Glycosides to the *Washingtonia filifera*, While the leaves test results showed positive effectiveness for the rest of the compounds under study, were the compounds identified in roots, leaf, which were correlated with their biological activities as anti-microbial, anti-fungal, anti-parasitic, anti-allergic, ant diabetic, antineoplastic, anti-inflammatory or antioxidant agents [22]. tested results negative plant leaves glycosides to the *phoenix pusilla*, While the roots showed positive effects for both alkaloids, saponins, tannins, glycosides, resins, coumarins , If studies show root extract abilitythe to act against free radicals and poses hypoglycemic and anti-inflammatory activity as determined by membrane stabilization and proteinase inhibitory activity, *Phoenix pusilla* is well-known for its traditional medicinal value, root extracts contains saponins that have a role ant diabetic and anti-inflammatory [32,33]. Test results for *Phoenix roebelenii* leaves and roots showed positive results for the compounds under study, The identified compounds possess various biological properties, their potential antioxidant and anti- inflammatory activities play important roles in the antioxidant and hepatoprotective activity of the leaves extracts [14]. The presence of these bioactive substances in the extracts, which may act synergistically, could be responsible for the pharmacological properties of the leaves, are actually reported to show antimicrobial activities [34]. Various species of Phoenix also have very good antioxidant properties and good amount of phytochemicals. And these compounds are known to possess potent antimicrobial, antitumor, hepatoprotective properties and good therapeutic potential which may help in drug development. The study results indicate these phenolic are among the predominant sources of antioxidant activity among the species of Phoenix [35]. The two genus

under study are distinguished With their medicinal properties, so that better economic and therapeutic utilization can be achieved.

3.2. Results of Qualitative Analysis of Chemical Compounds in Leaves with GC-MS Technology

The results of the paper analysis by GC-MS shown in the tables (6,7,8,9,10) and Fig. (1) showed the chemical ingredients in the genus leaves of the ornamental palm by time and space as well as the concentration of the compound in the sample used. The results showed the existence of several effective compounds that were the most important and abundant: Alkaloids, Saponins, Tannins, Glycosides, Resins, Coumarins, Cinnamics, lignano and callic acid. These compounds differed in their concentration and abundance by genera and species. Data from this study also showed that the genera of palm leaves contain biologically active compounds that vary by genera. The Palm family is one of the most useful families Plants are used widely used as food, as fertilizers and in folk medicine. Many effective compounds have been isolated from the genus *Washingtonia filifera* active compounds of pharmaceutical and economical importance [36]. Species of family Arecaceae have been used as medicine across the globe as it is a rich source of isoflavonoids, rotenoids, sterols, phenolic compounds, tannins, coumarin, terpenoids, resin, saponins [22]. This study shed light on leaves of *Phoenix canariensis*, The leaves are rich in Alkaloids, saponins, tannins, glycosides, resins, coumarins ,cinnamic, lignin, callic acid , The main components identified by GC-MS might suggest their incorporation in antioxidant and anti-inflammatory preparations, We need many studies are required to evaluate the plant biological activities and to isolate the bioactive compounds[37]. The results of the analyzes by GC-MS on *phoenix pusilla* showed that they contain active compounds, the most important of which is saponin, Saponins are a high molecular weight polar compound proved to have various biological activities, crude saponins are used against diabetes and associated complications Because of his ability of saponin to reduce elevated plasma blood glucose makes saponin an excellent candidate in the treatment of diabetes mellitus. The active compounds under study were found in *Phoenix roebelenii* When analyzing in GC-MS, The potential for creating new and powerful therapeutic interventions is underlined by the synergy between Active compounds and other bioactive substances found in medicinal plants. leaves *Phoenix humilis* contain When analyzed in GC-MS on different phytochemicals with biological activity, Different phytochemicals have been found to possessa wide range of activities, which may helpin protection against chronic diseases, Genera palm leaves can be an important drug source for maintaining health, and with these compounds, these leaves can be used in cosmetics. The presence of some of these compounds gives them the ability to be used as antibacterial and viral. The presence of different types of comarines and alkaloids is an important source of flavonides and Comarinates. Perhaps the presence of types of compounds similar to the medical drug used to treat skin diseases can be an indicator of the effectiveness of these leaves in the treatment of dermatological diseases, as well as evidence of the validity of their use in folk medicine as a treatment for dermatology. This allows for the investment of these plants in pharmacology in addition to their chemical protective importance Pharmacological properties of this genus in the treatment of conditions such as cardiovascular disorder, inflammatory ailments including liver and kidney disorders, microbial and viral infections, cancer The observed pharmacological properties may be attributed to the presence of a high concentration of minerals and various other phytochemicals of diverse chemical structure [38].

Table 6. Chemical ingredients identified by GC-MS in *Washingtonia filifera* leaves.

Compound Name	Reten.tim (min)	Area (mV.s)	Height (mV)	Area (%)	Height (%)	W05 (min)
Alkaloids	10.978	265.234	178.231	0.3	0.3	0.12
Saponins	14.983	186.453	287.231	0.3	1.4	0.03
Tannins	13.976	261.432	398.234	0.2	0.1	0.03
Glycosides	8.234	297.786	148.284	0.3	2.2	0.04
Resins	5.654	445.765	235.125	0.4	2.5	0.22
Coumarins	9.235	265.927	389.341	0.1	0.1	0.03
Cinnamic acid	4.563	564.876	163.345	0.3	0.2	0.23

Lignin	3.987	243.257	250.234	0.2	1.2	0.03
Gallic acid	7.873	375.987	333.476	0.1	1.4	0.06

Table 7. Chemical ingredients identified by GC-MS in *Phoenix canariensis.*

Compound Name	Reten.tim (min)	Area (mV.s)	Height (mV)	Area (%)	Height (%)	W05 (min)
Alkaloids	11.978	365.234	278.231	0.4	0.3	0.12
Saponins	12.983	286.453	287.231	0.3	1.4	0.03
Tannins	11.976	261.432	398.234	0.1	0.1	0.03
Glycosides	8.234	397.786	158.284	0.3	3.4	0.04
Resins	6.654	145.765	235.125	0.2	1.5	0.22
Coumarins	8.235	265.927	289.341	0.1	1.1	0.03
Cinnamic acid	3.563	564.876	263.345	0.3	0.2	0.23
Lignin	2.987	343.257	250.234	0.2	1.2	0.03
Gallic acid	7.873	375.987	333.476	0.1	0.4	0.06

Table 8. Chemical ingredients identified by GC-MS in *Phoenix pusilla* leaves.

Compound Name	Reten.tim (min)	Area (mV.s)	Height (mV)	Area (%)	Height (%)	W05 (min)
Alkaloids	11.978	265.234	278.231	0.3	1.3	0.12
Saponins	16.983	186.453	187.231	0.3	2.4	0.03
Tannins	13.976	261.432	398.234	0.2	0.1	0.03
Glycosides	9.234	297.786	148.284	0.3	2.2	0.04
Resins	5.654	445.765	335.125	0.4	2.5	0.22
Coumarins	7.235	265.927	389.341	0.1	0.1	0.03
Cinnamic acid	4.563	564.876	163.345	0.3	0.2	0.23
Lignin	3.987	243.257	250.234	0.2	1.2	0.03
Gallic acid	8.873	375.987	333.476	0.1	1.4	0.06

Table 9. Chemical ingredients identified by GC-MS in *Phoenix roebelenii* leaves.

Compound Name	Reten.tim (min)	Area (mV.s)	Height (mV)	Area (%)	Height (%)	W05 (min)
Alkaloids	11.978	365.234	265.231	0.5	3.3	0.12
Saponins	12.983	186.453	189.231	0.2	1.4	0.03
Tannins	14.976	161.432	256.234	0.2	1.1	0.03
Glycosides	6.234	197.786	148.284	0.1	2.2	0.04
Resins	5.654	345.765	235.125	0.3	1.5	0.22
Coumarins	8.235	265.927	289.341	0.1	0.1	0.03
Cinnamic acid	7.563	564.876	263.345	0.3	1.2	0.23
Lignin	3.987	243.257	150.234	0.2	1.2	0.03
Gallic acid	7.873	375.987	333.476	0.1	1.4	0.06

Table 10. Chemical ingredients identified by GC-MS in *Phoenix humilis* leaves.

Compound Name	Reten.tim (min)	Area (mV.s)	Height (mV)	Area (%)	Height (%)	W05 (min)
Alkaloids	13.978	265.234	178.231	0.3	0.3	0.12
Saponins	13.983	186.453	287.231	0.3	1.4	0.03
Tannins	11.976	261.432	398.234	0.2	0.1	0.03
Glycosides	6.234	297.786	148.284	0.3	2.2	0.04
Resins	6.654	445.765	235.125	0.4	2.5	0.22
Coumarins	9.235	265.927	389.341	0.1	0.1	0.03
Cinnamic acid	5.563	564.876	163.345	0.3	0.2	0.23
Lignin	3.987	243.257	250.234	0.2	1.2	0.03

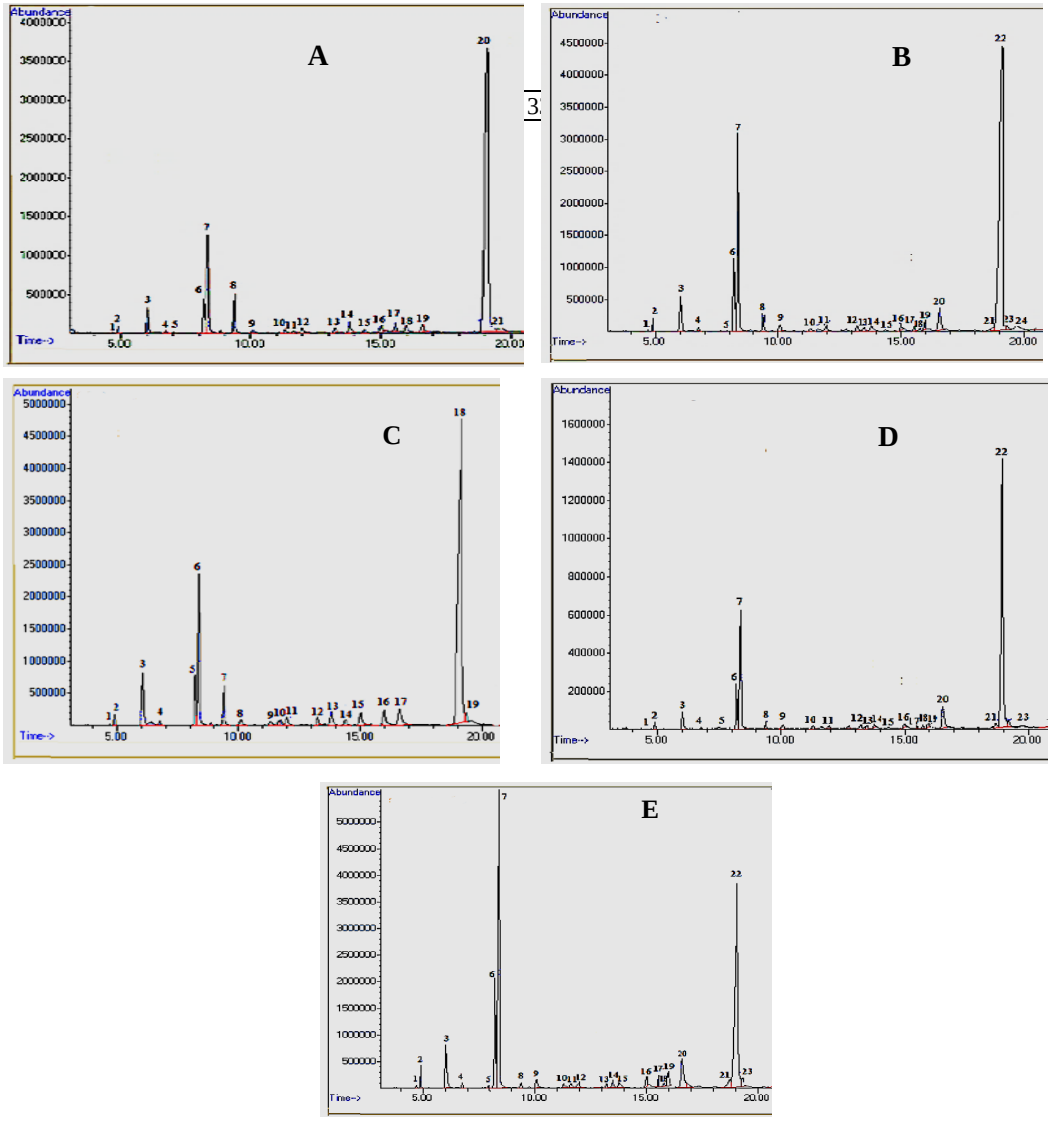

Figure 1. (A) Chemical ingredients identified by GC-MS in *Washingtonia filifera* leaves, (B) Chemical ingredients identified by GC-MS in *Phoenix canariensis* leave, (C) Chemical ingredients identified by GC-MS in *Phoenix Pusilla* leaves, (D) Chemical ingredients identified by GC-MS in *Phoenix Roebelenii* leaves. (E) Chemical ingredients identified by GC-MS in *Phoenix humilis* leaves.

Conclusions

Phytochemical analyzes of extracts of the leaves and roots of both genera of decorative palm trees showed that they are rich in secondary metabolites; Alkaloids, Saponins, tannins, glycosides, resins, coumarins, cinnamic acid, lignin, and gallic acid, Furthermore, palm leaves and roots of both genera possess biologically active substances that differ based on their genus and species. are known for their industrial and medicinal importance, exhibit similar efficacies and effects. They could serve as a potent source of medicinal activity. However, it is essential to conduct numerous studies to isolate, characterize, and purify these compounds responsible for the therapeutic activity, We suggest that *Washingtonia filifera* and four species from ornamental palm belonging to the genus *Phoenix* can be used in the medicinal field. It can therefore be concluded the possibility of characterizing compounds and exploring their bioactive potentials.

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