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CHEMICAL COMPONENTS OF LANTANA (*LANTANA CAMARA* L) AND LEMONGRASS (*CYMBOPOGON CITRATUS* "DC." STAPF.) PLANTS IN EGYPT

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ABSTRACT: *The aim of the present investigation is to study the chemical components of two plant species, lantana (Lantana camara) and lemongrass (Cymbopogon citratus). Plant materials were extracted successively by using four solvents of ascending polarity (Petroleum ether, chloroform, acetone and ethanol, respectively).*

The fatty acids, unsaponifiable matter, volatile oils, photochemical screening and the active components were determined.

The results of this work showed that:

1-The presence of five saturated fatty acid and seven unsaturated fatty acids in Lantana camara, while lemongrass showed seven saturated fatty acids and five unsaturated fatty acids.

2- Lantana camara unsaponifible matter showed the presence of 16 compounds, while lemongrass showed 14 compounds.

3- GC/Ms Lantana camara volatile oil showed the presence of 31 compounds, while lemongrass volatile oil showed 13 compounds.

4- Lantana camara had higher percentage of total sterols (12.23%) than that of lemongrass (6.91%). Total falvonoids were higher in Lantana camara (219.19 mg/g than that lemongrass (17.54mg/g).

Total carbohydrates, proteins and fat contents were higher in lemongrass than that Lantana camara.

Key words: *Chemical components, Extract, Lantana camara, Cymbopogon citrates, Analysis.*

INTRODUCTION

Several researchers are attempting to develop phytochemical based strategies for pest control. Compounds involved in plant pest interaction include repellents, attractants, hatching stimulatants or inhibitors and toxicants. These interactions have greater attention because of the growth of discipline of allelochemicals .

Different parts of some plants contain volatile odoriferous substances that affect the olfactory sence and are responsible for the fragrance. Volatile oils constitute the most principles odorous found in various plant parts. Volatile oils represent the essence of the active constituents of such plants.

Chitwood (2002) reported that certain plant parts extracts posses pesticidal properties. These plants have yielded a broad spectrum of active compounds toward different pests.

Many investigators have experiments on the effect of the lantana and lemongrass extracts on certain insect pests. So that, the chemical components of two plants, lemongrass (*Cymbopogon citrates*) and lantana (*Lantana camara*) was studied to determine the major constituents of these plants which are widely distributed in Egypt.

MATERIALS AND METHODS

Samples of *Lantana camara* (Fam. Verbenaceae) and *Cymbopogon citratus* (Fam. Gramineae) plants, free from insecticidal contamination were obtained. The samples were dried at room temperature for two weeks and ground in an electric mill into fine powder, sieved and kept for extraction. Plant extracts were prepared according to the method adopted by Freedman *et al.,* (1979). Hundred grams of these ground plant materials were extracted successively in a Soxhlet apparatus by using four solvents of ascending polarity as follows : Petroleum ether (40 – 60 °C), chloroform, acetone and ethanol respectively. Each extract was evaporated under vacuum pressure using a rotary evaporator. The weight and the percentage of each crude extract was calculated. The crude extract was kept in refrigerator (-4°C) till chemical studies. The volatile oils were obtained by hydro-distillation using Clevenger apparatus, as conducted by Anderson *et al.,* (1980).

Chemical investigatior:

1- Saponification of petroleum ether extract of lantana and lemon grass oils:

Saponification was carried out according to Farag *et al.,* (1986).

a– Extraction of fatty acids

The oqueous layer (Saponifiable portion) remained after the extraction of unsaponifiable compounds was acidified with HCL (10% v/v) to liberate the fatty acids, then extracted several times with petroleum ether till complete extraction. The percentage was calculated as reported by Farag *et al.,* (1986) to identify the constituents of fatty acids, the obtained residue was transformed to their corresponding methyl esters.

b- Preparation of fatty acid methyl esters

fatty acids methyl esters were prepared and purified according to the method of Kinsella (1966). Fatty acids were analyzed by GLC to identify their constituents.

c- Identification and quantitative determination of fatty acids by gas liquid chromatography (GLC).

The fatty acids methyl esters were analyzed by Variangas chromatography model 3700 equipped with flame ionization detector (FID), and a stainless steel column (12 feet x $^{1}/_{8}$ " I.D.), packed with 15% DEGS on 80-100 mesh chronosorb (W-AW). The percentage composition for each component of the fatty acids mixture was calculated by the compensated normalization method using PU 4815 computing integrator attached to the GC.

2- Gas chromatography/ Mass spectrometry analysis :

GC/MS analysis was carried out to identify and determine the unsaponifiable matters and volatile oils composition of the two plants under investigation.

3- Preliminary phytochemical screening tests :

The dried extracts were analyzed for detection of carbohydrates and/or glycosids, terpenoids, sterols, flavonoids, tannins, saponins, alkaloids and proteins.

* Test for carbohydrates and/or glycosids :

An intense violet color appeared between the junction of the two layers confirm the presence of carbohydrates or a compound containing carbohydrates moiety as reported by Lewis and Smith (1967).

* Test for unsaturated sterols and/or triterpenes :

one gram sample was extracted according to Hanson (1972).
Two tests were carried out .

a- Liebermann – Burchard test

A reddish violet ring was observed at junction of the two layers indicating the presence of unsaturated sterols and/or triterpenes.

b- Salkowski test :

A yellow color changing to orange and then red was produced, indicating the presence of sterols and/or triterpens.

* Flavonoids test :

About 10 gr. of each extract sample was used according to Geissman (1961). The presence of flavonoids appeared as follows.

a- Yellow color with sodium hydroxide.
b- Red color with concentrated hydrochloric acid and magnesium.

* Tannins test:

Shellard (1957) indicated to the presence of tannins was determine by greenish color which changes to bluish black or precipitate.

* Test for saponins :

Harborne (1998) indicated the presence of saponins if a voluminous froth was developed and persisted for almost 4hr .

* Test for alkaloids and/or nitrogenous bases:

Mayer's reagent, Wagner reagent or Dragendorff's reagent were used. If no precipitate was formed in each case, that indicate the absence of alkaloid and/or nitrogenous bases as mentioned by Farnworth *et al.,* (1964).

* Protein content :

The percentage of protein was computed by multiplying the equivalent nitrogen content by the factor 6.25 (Anonymous, 1962).

4- Quantitative determination :

1- Determine of total carbohydrate : Phenol sulphuric acid method for total carbohydrate according to (Dubois *et al.,* 1956).
2- Determine of total protein according to Lowry *et al.,* (1951) method.
3- Determination of flavonoids : flavonoids were determine according to Zhuang *et al.,* (1992).
4- Determination of total tannins : the present of tannins in the sample was calculated by the following formula:
1 gr. of copper oxide Cuo = 1.305 gr. tannins (Balbaa, 1974).

RESULTS AND DISCUSSION

The percentages of volatile oils and the different gradual extracts of *Lantana camara* and Lemon grass leaves .

Data in Table 1. indicated that the percentage of the volatile oil (fresh basis) in lemon grass leaves (1.25%) was higher than that of Lantana leaves (0.2%). The total lemon grass solvent extracts (dry basis) was in the same ratio as that of Lantana (12.83 and 12.81%, respectively).

Fatty acids composition :

The GLC chromatogram of *Lantana camara* oil indicates the presence of five saturated fatty acids and seven unsaturated fatty acids, Table (2). The saturated fatty acids represented 50.65%, while the unsaturated represented 49.35%. Also, *Lantana camara* characterized by the presence of long chain unsaturated fatty acids as erucic, docosadienoic and docosatrienoic acids, similar results were obtained by Khan *et al.,* (2003). The lemongrass GLC chromatogram indicates the presence of seven saturated fatty acids

and five unsaturated fatty acids, (Table 2). The saturated fatty acids represented 33.63% while the unsaturated fatty acids showed 66.37 %, platmitic was the major saturated acid (37.32 and 18.31%), while lenolenic was the predominant unsaturated fatty acid (21.21% and 31.25%) in both lantana and lemongrass, respectively.

Table (1): Percentage of volatile oils and different gradual extracts of lantana and lemongrass leaves.

Solvent extracts		Percentage of extracts			
		Lantana		Lemongrass	
Volatile oils (Fresh basis		0.20		1.25	
Non. Polar	Petroleum ether	1.43	6.08	3.64	5.56
	Chloroform	4.65		0.95	
Polar	Acetone	5.30	6.73	6.87	8.24
	Ethanol	1.43		1.37	
Total Dry (weight basis)			12.81		12.83

Table (2): GC of fatty acid methyl esters of *Lantana camara* and lemongrass leaves.

Fatty acids		% of fatty acids			
		Lantana camara		Lemongrass	
		Saturated	Unsaturated	Saturated	Unsaturated
Caprylic	C 8:0			0.84	
Capric	C 10:0			0.51	
Lauric	C 12:0	0.29		3.70	
Myristic	C 14:0	5.82		4.14	
Palmitic	C 16:0	37.32		18.31	
Palmitoleic	C 16:1		0.93		2.47
Stearic	C 18:0	4.77		4.22	
Oleic	C 18:1		5.05		11.11
Lindeic	C 18:2		9.96		18.72
Linolenic	C 18:3		21.21		31.25
Eicosamoic (Arachidic)	C 20:0	2.45		1.91	
Erucic acid	C 22:1		5.79		2.82
Docosadienoic	C 22:2		2.86		
Docosatrirnoic	C 22:3		3.55		
Total		50.65	49.35	33.63	66.37

GC/MS of unsaponificable matter content:

Data on GC/MS of unsaponificable matter (residue) of *Lantana camara* and lemongrass leaves are shown in Tables (3 and 4).

1- *Lantana camara*

Unsaponificable matter chromatogram shows the presence of 16 compounds. Undecae was the major hydrocarbon (35%), followed by decane (12.84%), cymene (7.26%), dodecane (6.48%), decane-2-methyl (5.21%), decane-4-methyl (5.92%), cyclohexane-butyl (3.65%) and trans caryophyllene (3.3%). Other compounds represent less than 3.00%. Sterols including campestral (2.04%), B-sitosteral (5.45%) and stigmasterol (1.59%) represent 9.08% of total unsaponifiable matter, (Table 3).

2- Lemon grass :

GC/MS of lemon grass unsaponificable matter (Table 4) indicate the presence of 14 compounds. Geranial was the major component (39.64%) followed by phytol (12.24%), Juniper camphor (8.17%), Geraniol (7.57%), 1-hexadecanol (6.25%), carpophyllene oxide (3.90%), carophyllene (3.89%), a-cis-bergamotene (3.52%), 2-pentadecanone 6,10,14 trimethyl (3.17%), Linalol (2.74%), Farnesene (2.22%) and 6 methyl-5-heptene-2 one (2.09%). Sterols as B-sitrol (2.13%) and stigmasterol (2-45%) were found in ratio of (4.58).

Table (3): GC/MS of unsaponificable matter of *Lantana camara* leaves.

Peak No.	Compound	RRT	%
1	Decane	0.73	12.84
2	Decane-4-methyl	0.79	5.92
3	Cyclohexane-butyl	0.82	3.65
4	Cymene	0.88	7.26
5	Decane-2-methyl	0.90	5.21
6	Decane-3-methyl	0.91	2.25
7	Undecane	1.00	35.00
8	Benzaldehyde-4 (methyl ethyl)	1.10	1.68
9	Nopyl acetate	1.13	2.99
10	Undecane-2-methyl	1.16	2.39
11	Naphthalene	1.22	1.85
12	Dodecane	1.25	6.48
13	Trans caryophyllene	1.78	3.30
14	Campesterol	2.42	2.04
15	B-sitosterol	2.10	5.45
16	Stigmasterol	2.70	1.59

Table (4): GC/MS of unsaponificable matter of lemongrass leaves.

Peak No.	Compound	RRT	%
1	6-methyl-5-hepten-2-one	0.51	2.09
2	Linalool	0.72	2.74
3	Geraniol	0.95	7.57
4	Geranial	1.00	39.64
5	Caryophyllene	1.29	3.89
6	a-cis-Bergamotene	1.31	3.52
7	Farnesene	1.40	2.22
8	Caryophyllene oxide	1.54	3.90
9	Juniper camphor	1.66	8.17
10	2-pentadecanone 6,10,14 trimethyl	1.90	3.17
11	1-hexadecanol	1.96	6.25
12	Phytol	2.24	12.24
13	B-sitosterol	2.42	2.13
14	Stigmasterol	2.62	2.45

GC/MS of volatile oils :

Data concerning the percentages of different volatile oil constituents of *Lantana camara* and lemon grass are showen in Tables 5 and 6 .

1- *Lantana camara*

GC/MS *Lantana camara* volatile oil detected thirty one compounds. The main components were *B. caryophellene* (10.1%), B-phellandrene (7.81%), pentane 3-methyl (7.22%), a-caryophellene (6.89%), 1,8-cineole (eucalyptol) 6.59%, nerolidol (5.25%) and germacrene D (4.42%). *Lantana camara* essectial oil was characterized by a high percentage of sesquiterpenes. The obtained results are in agreement with the results reported by Abdel Hady *et al.,* (2005).

2- Lemon grass :

GC/MS lemon grass volatile oil showed the presence of thirteen components. Geranial (49.14%), neral (37.76%) and myrcene (8.20%) were the prevalent constituents representing 95.1% of the total volatile oil. Pulegone represented 1.52%, while the other constituents were found in low percentages (less than 0.5%). These findings are line with those reported by Chisowa *et al.,* (1998), Mohd *et al.,* (2004) found that lemon grass oil contained high amounts of monoterpens (94.9%) and geraninal (52.3%).

Phytochemical screeing :

Table (7) shows preliminary phytochemical screening of different extracts of *Lantana camara* and lemon grass leaves. Saponins and alkaloids were not detected in the two plant extracts. Petroleum ether and chloroform extracts of two plants contained terpenes and sterols. Acetone extracts contained flavonoids and tannins only while ethanol extracts of the two plant leaves comprised flavonoids, tannins, carbohydrates and/or glycosides and proteins. Also, *Lantana camara* ethanol extract showed the presence of terpenoids. Similar results were obtained by Rajesh and

Verma (2006), while Osman and Radwan (2004) reported that active components of the ethanolic extract of lemon grass could be nitro, amino or terpene. Also, Mohd *et al.,* (2004) found that lemon grass contained high amounts of monoterpens.

Table (5): GC/MS of the volatile oil of *Lantana camara* leaves.

Peak No.	Compound	RRT	%
1	Hexane	0.05	1.23
2	Pentane-3-methyl	0.06	7.22
3	a-pinene	0.23	2.76
4	Camphen e	0.25	1.23
5	B-phellandrene	0.28	7.81
6	B-myrcene	0.29	1.3
7	B-pinene	0.31	1.68
8	Eucalyptol	0.37	6.59
9	1,3,6, octatriene	0.39	1.82
10	3-carene	0.40	2.96
11	Terpineol-z-beta	0.48	2.37
12	Camphor	0.55	1.24
13	Borneol	0.59	0.99
14	3-cyclohexene-1-01	0.61	1.24
15	α-Terpineol	0.63	1.04
16	γ-Pyronene	0.85	2.86
17	Cyclohexane	0.94	1.45
18	β-caryophellene	1.00	10.1
19	Germacrene D	1.01	4.42
20	α- Caryophyllene	1.05	6.89
21	γ- Elemene	1.11	3.68
22	2,6 dimethyl-3-hydroxy pridine	1.18	0.95
23	1,3-Cyclohexanedial	1.2	3.32
24	Nerolidol	1.23	5.25
25	DI hydro-Neoclovene	1.23	2.01
26	3-heptanone	1.24	4.25
27	6 methyl-2-(4-methyl-3-cyclohexene)	1.28	2.00
28	Bicylo (5.2.0) nonane	1.31	3.75
29	Naphthalene	1.32	1.84
30	1 H-Indole-3-carboxylic acid	1.34	2.34
31	Spiro (4.5) dec-8-en-7-one	1.37	3.4

Table (6): GC/MS of the volatile oil of lemongrass leaves.

Peak No.	Compound	RRT	%
1	Myrcene	0.445	8.20
2	Cis-Ocimene	0.517	0.30
3	Trans- β- Ocimene	0.536	0.25
4	Linalool	0.634	0.89
5	Trans-Chrysanthonal	0.723	0.43
6	Pulegone	0.787	1.52
7	Neral	0.931	37.76
8	Geranial	1.00	49.14
9	Geranial Acetate	1.150	0.49
10	(Z_1E) α-Bergamoine	1.235	0.34
11	2-Tridecanone	1.336	0.27
12	Caryophyllene oxide	1.479	0.24
13	α-Gurjumene	1.537	0.20

Table (7): Phytochemical screening of different extracts of lemongrass and *Lantana camara* leaves.

Constituents	*Lantana camara*				lemongrass			
	Pet. Ether extract	Chloroform extract	Acetone extract	Ethanol extract	Pet. Ether extract	Chloroform extract	Acetone extract	Ethanol extract
Carbohydrates or glycosides	--	--	--	+	--	--	--	+
Flavoniods	-	--	+	++	--	--	+	++
Saponins	-	--	--	--	-	-	--	--
Tannins	--	--	+	++	--	--	+	++
Sterols	++	++	-	--	++	++	--	--
Alkaloids	--	--	--	--	--	--	--	--
Terpenoids	+++	++	--	--	++	++	--	+
Proteins	--	--	--	+	--	--	--	+

- : Not detected ; + : Low amount ; ++ : High amount ; +++ : Highly amount

The percentages of the major constituents of *Lantana camara* and lemongrass leaves

Data in Table (8) showed that *Lantana camara* had higher percentage of total sterols (12.23%) than that of lemon grass (6.91%). Total amount of flavonoids was higher in *Lantana camara* (29.19 mg/g) than that of lemon grass (17.54 mg/g), also tannins content showed the same trend as flavonoids concerning solvent extracts, total amount of tannins was a higher in *Lantana camara* (72.88 mg/g) than lemon grass (59.73 mg/g). On contrary, total carbohydrates, proteins and fat contents were higher in lemon grass than that of *Lantana camara* .

Table (8). percentage (amount) of major constituents of *Lantana camara* and lemon grass.

Compound	Solvent extract	*Lantana camara*		Lemongrass	
		% (amonnt)	Total	% (amonnt)	Total
Sterols	Pet. Ether	9.08%	12.23%	4.58%	6.91%
	Chloroform	3.15%		2.33%	
Flavonoids	Acetone	3.00 mg/g	29.19 mg/g	17.43 mg/g	17.54 mg/g
	Ethanol	26.19 mg/g		0.11 mg/g	
Tannins	Acetone	25.39 mg/g	72.88 mg/g	48.73 mg/g	59.73 mg/g
	Ethanol	47.49 mg/g		11.00 mg/g	
Carbohydrate	Ethanol	22.36 %	_____	42.40%	_____
Protein	Ethanol	4.00%	_____	5.00%	_____
Fat	Pet. Ether	1.88%	_____	2.38%	_____

Plant tannins act as growth inhibitor due to their action in binding with protein to form insoluble digestion inhibiting complexes (Martin *et al.,* 1987). Also, tannins in the leaves play an important role as antifeedant agent.

The presence of tannins beside the low concentration of flavonoids play an important role for resistance of these plants againt the insects.

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التركيب الكيماوى لنباتات اللانتانا *Lantana camara* وحشيشة الليمون *Cymbopogon citratus* فى مصر

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الملخص العربى

الهدف من هذا البحث هو دراسة التركيب الكيماوى لكلا من نبات اللانتانا *Lantana camara* وحشيشة الليمون *Cymbopogen citratus* وذلك باستعمال أربعة مذيبات متدرجة القطبية (بتروليم إيثر . الكلوروفورم . الاسيتون . الايثانول) على التوالى.هذا وقد تم دراسة التركيب الكيماوى للاحماض الدهنية والجزء الغير متصبن والزيت الطيار حيث تم تقدير النسب المختلفة للمستخلصات النباتية والزيت والتعرف على المركبات الفعالة .

وتشير نتائج هذا العمل إلى الآتى :-

1- وجود خمسة أحماض دهنية مشبعة وسبعة أحماص دهنية غير مشبعة فى نبات الانتانا أما حشيشة الليمون فقد تميزت بوجود سبعة أحماض دهنية مشبعة وخمسة أحماض دهنية غير مشبعة.

2- أظهر محتوى الجزء المتصبن وجود 16 مركب فى نبات الانتانا ، 14 مركب فى حشيشة الليمون

3- وجود 31 مركب من الزيوت الطيارة فى نبات الانتانا و13 مركب فقط فى حشيشة الليمون

4- أظهر نبات الانتانا نسبة أعلى من السيترولات (12.23%) عن حشيشة الليمون (6.91%) وكان محتوى الفلافونويدز أعلى فى نبات الانتانا (29.19 مجم/جم) عن حشيشة الليمون (17.54 مجم/جم).

وكان محتوى الكربوهيدرات والبروتينات والدهون أعلى فى حشيشة الليمون عن نبات الانتانا.