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GC-MS Analysis and Phytotoxic and Insecticidal Properties of Anthemis Cotula L.

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Abstract

The plant extract showed modest efficacy at dosses of 10µg/ml and 100µg/ml. The phytotoxic effects of the plant rose with concentration; it was moderate (49.64%) at 10µg/ml and moderate (56.66%) at 100µg/ml, although it was higher than at 10µg/ml. However, at a concentration of 1000µg/ml, Anthemis cotula had a significant (70.82%) impact against Lemna minor. The extract exhibited modest activity against Tribolium castaneum, moderate activity against Callosobruchus analis and Sitophilus oryzae, and high activity against Trogoderma granarium.

Introduction

Mayweed is closely related to camomile, but is significantly less effective as a medicine. It was sometimes used to treat purportedly hysterical uterine disorders. It has also been used as an antispasmodic and to induce menstruation. In modern herbal treatment, it is seldom ever employed (Chevallier, 1996). According to Usher (1974) and Grieve (1984), the entire plant has antispasmodic, astringent, diaphoretic, diuretic, emetic, emmenagogue, and tonic properties. It is used internally as a tea, which can be brewed from the entire plant or just the blooms, though the flowers are more popular because they are less disagreeable (Grieve, 1984). Many ailments, including rheumatism, epilepsy, asthma, colds, and fevers, are treated using infusions (Moerman, 1998).

When administered externally, it can be poulticed on piles, used to extract splinters from the body, or added to bath water (Grieve, 1984; Moerman, 1998). Insect stings are rubbed with the leaves (Foster & Duke, 1990). Some persons are allergic to the plant and this cure could give them severe blisters (Chopra et al., 1986). Pregnant women and breastfeeding mothers should not use this herb (Chevallier, 1996). The dried and growing plant is used as a pesticide (Usher, 1974; Lust, 1983; Polunin, 1969) and is supposed to keep mice and fleas away (Grieve, 1984; Riotte, 1978).

This plant is used to treat a number of illnesses, including fever, psoriasis, gouty arthritis, diarrhea, and gastrointestinal problems (Quarenghi et al., 2000). The entire plant is used to make a gold dye (Grae, 1974; Buchanan, 2012). For many years, crops have been protected against insect herbivory by using botanical pesticides, such as extracts and essential oils of certain plant species (Isman, 2000; Belmain et al., 2012; Isman, 2008). Natural enemies are frequently killed or severely harmed by synthetic insecticides (Desneux et al., 2007). Because of their quick breakdown, selectivity, and reduced likelihood of insecticide resistance, biopesticides are thought to be reasonably safe for non-target species. Crude plant extracts, on the other hand, offer a variety of non-toxic mechanisms of action, including repellency (Amoabeng *et al*., 2013; Dubey *et al*., 2011; Isman, 2006; Koul *et al*., 2008; Tembo *et al*., 2018).

The tendency of botanical pesticides to rely on "suites" of closely related active ingredients rather than a single active ingredient is another consequential benefit; this diversity may prevent or slow

the emergence of resistance in pest populations to the majority of botanical pesticides (Koul, 2008). Because they contain compounds that prevent magnification, phytotoxic plants may be able to help solve the problems caused by synthetic herbicides. Researchers' interest in phytotoxic medicinal plants has grown recently (Fujii et al., 1991; Fujii et al., 2003; Gilani et al., 2010; Piyatida & Kato-Noguchi, 2010).

One reason for the growing interest in medical plants could be (i) the ease with which phytotoxic plants can be separated from medicinal plants, or (ii) the potential for medicinal plants to have more bioactive chemicals than other plants. These phytotoxic plants can be used to control weeds in a number of ways, such as (i) sowing or transplanting them as relay or cover crops with main crops, (ii) applying their crude extracts directly as bioherbicides, or (iii) isolating and characterizing their active ingredients and using them as a tool for the development of natural and biodegradable herbicides (Fujii et al., 2003). A phytochemical analysis of several Anthemis species revealed the presence of sesquiterpene lactones, polyacetylenes, essential oils, and flavonoids. (Gonenc *et al*., 2012; Pavlovíc *et al*., 2006; Bohlmann *et al*., 1963; Bohlmann *et al*., 1965a,b; Bohlmann & Kleine, 1966; Bulatuvic *et al*., 1997; Saroglou *et al*., 2010; Staneva *et al*., 2008; Van *et al*., 2003; Chemsa *et al*., 2018; Tuba *et al*., 2014; Williams *et al*., 2001; Dŏgan *et al*., 2015).

Materials and Methods

Phytotoxic activity

The extracts' phytotoxic activity was tested against Lemna minor in accordance with Hameed et al. (2021). The medium was made by combining different ingredients with 1000 milliliters of distilled water, then KOH pellets were added to bring the pH down to 5.5–5.6. After that, the medium was autoclaved for 15 minutes at 121 0C. The stock solution consisted of the extracts (30.0 mg) dissolved in 1.0 ml of ethanol. The final concentrations of 1000, 100, and 10 ppm were obtained by inoculating fifteen petri plates, three for each concentration, with 1000, 100, and 10 µl of the stock solution. In a sterile environment, the solvent was left to evaporate overnight.

Ten plants, each with a rosette of three Lemna minor fronds, and medium (20 ml) were placed to each dish. As a negative control, additional plates were supplemented with solvent and reference growth inhibitor (paraquate). For seven days, every plate was stored in the growth cabinet. On day seven, the number of fronds on each plate was counted and noted.

Insecticidal activity

For insecticidal action Hussain et al., (2010) technique was followed. 200 mg of the test sample and 3 ml of ethanol were combined to create the test sample. The stored grain pests are raised in plastic bottles with sterile breeding material in a lab setting with regulated humidity and temperature. The experiment uses insects that are of the same size and age. On the first day following the insects' upbringing, filter paper was cut to fit the size of the petri plate and placed within. After loading the entire sample onto the filter paper, the plates were left for a full day to allow the solvent to completely evaporate.

Using a clean brush, place ten healthy, active insects of the same size and age from each species on each plate on the second day (after the solvent had evaporated) (permethrin was used + ve and DMSO was used as – ve control, respectively). For a whole day, the plates were incubated at 27 0C. Readings were recorded on the third day, and the following formula was used to determine the percentage of inhibition or mortality:

$$\text{Percent mortality} = 100 - \frac{\text{No of insects alive in test} \times 100}{\text{No of insects alive in control}}$$

GC-MS analysis

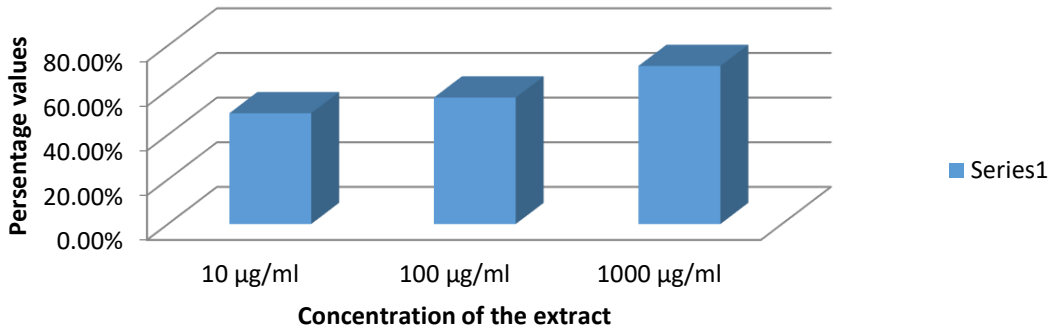
A 789 Agilent device was used to do the GC-MS analysis of the plant extract. After injecting about 1µL of the methanol extract, scanning took place for 45 minutes (Mohammed and Imad, 2013; Hameed et al., 2015a). An electrical signal proportionate to the concentration of the compounds was produced after they were separated and eluted from the column. The length of time between injection and elution is indicated by the retention time (RT), and a chromatogram graph is created that plots the signal's intensity versus RT. Compounds were broken up by electrons as they entered the mass spectrometry detector, producing charged ions whose mass/charge (M/Z) ratio was shown in the mass spectrum graph and functioned as a molecular fingerprint. Oven temperature (100°C), helium gas flow rate (1 ml/min), and electron gun energy (70 eV) were all set before analysis. Component separation was made easier using the Elite 1 column (100% dimethyl polysiloxane). By comparing retention indices and mass spectra with computer databases and published literature, chemicals were identified (Muhanned et al., 2015; Hameed et al., 2015b; Hameed et al., 2015c).

Results

Phytotoxic activity

Lemna minor was used to test Anthemis cotula's phytotoxicity. At concentrations of 10µg/ml and 100µg/ml, the plant extract exhibited moderate activity. The plant's phytotoxic effects increased with concentration; at 10µg/ml, the phytotoxic effect was moderate (49.64%), and at 100µg/ml, it was moderate (56.66%), but it was greater than at 10µg/ml. However, Anthemis cotula showed a substantial (70.82%) effect against Lemna minor at a concentration of 1000µg/ml (Table. 1; Figure. 1).

Fig. 1. Phytotoxicity of the ethanolic extract of *Anthemis cotula*



Tab. 1. Phytotoxic activity of the ethanolic extract of *Anthemis cotula*

	Positive control	**Negative control**	**10 µg/ml**	**100 µg/ml**	**1000 µg/ml**
Anthemis cotula	30	55	49.64%	56.66%	70.82%

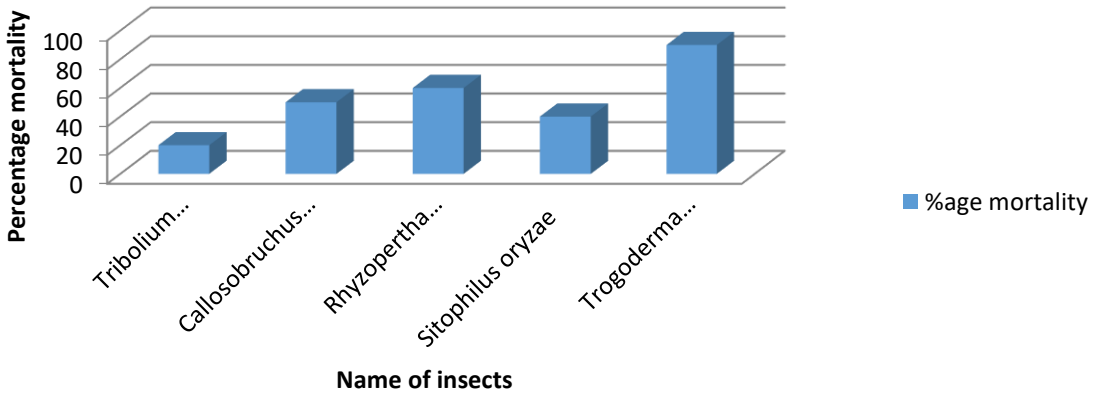
Criteria

0 – 39% inhibition Low activity
40 – 59% inhibition Moderate activity
60 – 69% inhibition Good activity
Above 70% inhibition Significant activity

Insecticidal activity

Five distinct insects were tested for Anthemis cotula's insecticidal activity: Tribolium castaneum, Callosobruchus analis, Rhyzopertha dominica, Sitophilus oryzae, and Trogoderma granarium (Tab. 2; Fig. 2). The extract showed high action against Trogoderma granarium, moderate activity against Callosobruchus analis and Sitophilus oryzae, and low activity against Tribolium castaneum.

Fig. 2. Insecticidal activity of the ethanolic extract of *Anthemis cotula*



Tab. 2. Insecticidal activity of ethanolic extract of *Anthemis cotula* of Family Asteraceae

Name of Insects	Total No of insects	+ve control	-ve control	% *Anthemis cotula*
Tribolium castaneum	10	0	100	20
Callosobruchus analis	10	0	100	50
Rhyzopertha dominica	10	0	100	60
Sitophilus oryzae	10	0	100	40
Trogoderma granarium	10	0	100	90

GC-MS data of the ethanolic extract of *Anthemus cotula* L. family Asteraceae

The ethanolic extract of *Anthemus cotula* L. showed the presence of the following sixty-five compounds which has been mention in the table 3. These compounds were **1**. Trichloromethane, **2**. Toluene, **3**. n – Butyl acetate, **4**.O – Xylene, **5**.p – Xylene, **6**.Methyl 4-hydroxyoctadecanoate, **7**.n-Octadecyl chloride, **8**. Octadecanoic acid, 2-(octadecyloxy)ethyl ester, **9.**Imipramine, **10**. Propane, 1,3-bis(octadecyloxy)-, **11.** 3-Ethyl-5-(2'-ethylbutyl)octadecane, **12**. Benzene, nitro-, **13.** Benzenepropanoic acid, à-[(2,4-dinitrophenyl)hydrazono]-4-hydroxy-, **14.** Benzocycloheptano [2,3,4-I,j]isoquinoline, 4,5,6,6a-tetrahydro-1,9-dihydroxy-2,10- dimethoxy-5-methyl, **15.** 1,2,3-Triazole-4-carboxamide, 5-amino-1-phenylsulfonyl-N-(3-methylphenyl)-, **16.** 17-Pentatriacontene, **17.** Oleic acid, 3-(octadecyloxy)propyl ester, **18.** Corynan-17-ol, 18,19-didehydro-10-methoxy-, acetate (ester), **19.** 2,5-Cyclohexadiene-1,4-dione, 2,6-bis(1,1-di methylethyl)-, **20.** 2,5-Di-tert-Butyl-1,4-benzoquinone, **21.** Butylated Hydroxytoluene, **22.** Oleic acid, 3-(octadecyloxy)propyl ester, **23.** 2-Nonadecanone 2,4-dinitrophenylhydrazine, **24.** E,E,Z-1,3,12-Nonadecatriene-5,14-diol, **25.** Dodecane,1-cyclopentyl-4-(3-cyclopentyl propyl)-, **26.** 1H-Indene, 2-butyl-4-hexyloctahydro, **27.**Cyclohexane, 1-(cyclohexylmethyl)-4-(1-methylethyl)-, **28.** 2-Naphthalenemethanol, decahydro-à,à,4a-trimethyl-8-methylene-, [2R-(2à,4aà,8aá)]-, **29.** 2-Naphthalenemethanol, 2,3,4,4a,5,6,7,8-octahydro-à,à,4a,8-tetramethyl-, [2R-(2à,4aá,8á)]-, **30.**

Pentadecanoic acid, 14-methyl-, methylester, **31.** Hexadecanoic acid, methylester, **32.**Oleic Acid, **33.** 22-Tricosenoic acid, **34.** 9-Octadecenoic acid (Z)-, methyl ester, **35.**9-Octadecenoic acid, methyl ester,(E)-, **36.** 8-Octadecenoic acid, methyl ester, **37.**Oleic acid, eicosyl ester, **38.**9,12,15-Octadecatrienoic acid,2,3-bis[(tri methylsilyl)oxy]propylester, (Z,Z,Z)-, **39.** Cholestan-3-one, cyclic 1,2-ethanediylaetal, (5á)-, **40.** Docosanoic acid, 1,2,3-propanetriylester, **41.** Oleic acid, 3-(octadecyloxy)propyl ester, **42.** 1,2-Benzenedicarboxylic acid, diisooctylester, **43.** Bis(2-ethylhexyl)phthalate, **44.** Oleic acid, 3-(octadecyloxy)propyl ester, **45.** Stearic acid, 3-(octadecyloxy)propyl ester, **46.** Docosanoic acid, 1,2,3-propanetriyl ester **47.** 9,12,15-Octadecatrienoic acid, 2,3-bis[(trimethylsilyl)oxy]propyl ester, (Z,Z,Z)-, **48.** Cholestan-3-one, cyclic 1,2-ethanediyl aetal, (5á)-, **49.** 1-Monolinoleoylglycerol trimethylsilyl ether, **50.** Stearic acid, 3-(octadecyloxy)propyl ester, **51.** Dodecanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro-5a-hydr oxy-4-(hydroxymethyl)-1, 1,7,9-tetramet hyl-6,11-dioxo-1H-2,8a-methanocyclopenta[a]cyclopropa[e]cyclo decen-5-yl ester, [1aR-(1aà,2à,5á,5aá,8aà,9à, 10aà)]-, **52.** Dasycarpidan-1-methanol, acetate (ester), **53.**Stearic acid, 3-(octadecyloxy)propyl ester, **54.** Spirost-8-en-11-one, 3-hydroxy-, (3á,5à,14á,20á,22á,25R)-, **55.** Dodecanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro-5a-hydr oxy-4-(hydroxymethyl)-1, 1,7,9-tetramet hyl-6,11-dioxo-1H-2,8a-methanocyclopenta[a]cyclopropa[e]cyclodecen-5-yl ester, [1aR-(1aà,2à,5á,5aá,8aà,9à, 10aà)]-, **56.** Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13, 15,15-hexadecamethyl, **57.** Dasycarpidan-1-methanol, acetate (ester), **58.** Hexasiloxane,1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl, **59.** Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl, **60.** Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11, 13,13-tetradecamethyl, **61.** 1h-Pyrrole-3,4-diacetic acid, 2-acetoxymethyl-5-methoxycarbonyl-, dimethyl ester, **62.** 1,2-Cinnolinedicarboxylic acid, 1,2,3,5,6,7,8,8a-octahydro-4-trimethylsilyloxy-, diethyl ester, **63.** Hexadecanoic acid, 2-(octadecyloxy)ethyl ester, **64.** Tetradecanoic acid, 9a-(acetyloxy)-1a,1b,4,4a,5,7a,7b,8,9,9 a-decahydro-4a,7b-dihydroxy-3-(hydro-xymethyl)-1,1,6,8-tetramethyl-5-oxo-1H-cyclopropa[3,4]benz[1,2-e]azulen-9-yl ester, [1aR-(1aà,1bá,4aá,7aà,7bà,8à,9á,9aà)]-, **65.** 5á-Ergost-24-en-26-oic acid, 5,6á-epoxy-4á,18,22-trihydroxy-3-meth oxy-1-oxo-, ë-lactone, diacetate, (20S,22R)-.

Tab. 4. GC-MS data of the ethanolic extract of *Anthemis cotula* L. family Asteraceae

S. No	Compound name	MF	RT	Area %	MW
1	Trichloromethane	$CHCl_3$	0.71	93.23	118
2	Toluene	C_7H_8	1.28	1.09	92
3	n – butyl acetate	$C_6H_{12}0_2$	1.61	0.58	116
4	O – xylene	C_8H_{10}	2.06	2.20	106
5	p – xylene	C_8H_{10}	2.06	2.20	106
6	Methyl 4-hydroxyoctadecanoate	$C_{19}H_{38}O_3$	2.93	0.01	314
7	n-Octadecyl chloride	$C_{18}H_{37}Cl$	2.93	0.01	288
8	Octadecanoic acid, 2-(octadecyloxy)ethyl ester	$C_{38}H_{76}O_3$	2.93	0.01	580
9	Imipramine	$C_{19}H_{24}N_2$	3.24	0.02	280
10	Propane, 1,3-bis(octadecyloxy)-	$C_{39}H_{80}O_2$	3.24	0.02	580
11	3-Ethyl-5-(2'-ethylbutyl)octadecane	$C_{26}H_{54}$	3.24	0.02	366
12	Benzene, nitro-	$C_6H_5NO_2$	4.24	0.69	123
13	Benzenepropanoic acid, à-[(2,4-dinitrophenyl) hydrazono]-4-hydroxy-	$C_{15}H_{12}N_4O_7$	6.42	0.01	360

14	Benzocycloheptano[2,3,4-I,j]isoquinoline, 4,5,6,6a-tetrahydro-1,9-dihydroxy-2,10- dimethoxy-5-methyl	$C_{20}H_{23}NO_4$	6.42	0.01	341
15	1,2,3-Triazole-4-carboxamide, 5-amino-1-phenylsulfonyl-N-(3-methylphenyl)-	$C_{16}H_{15}N_5O_3S$	6.42	0.01	357
16	17-Pentatriacontene	$C_{35}H_{70}$	7.07	0.00	490
17	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	7.07	0.00	592
18	Corynan-17-ol, 18,19-didehydro-10-methoxy-, acetate (ester)	$C_{22}H_{28}N_2O_3$	7.07	0.00	368
19	2,5-Cyclohexadiene-1,4-dione, 2,6-bis(1,1-dimethylethyl)-	$C_{14}H_{20}O_2$	7.64	0.10	220
20	2,5-di-tert-Butyl-1,4-benzoquinone	$C_{14}H_{20}O_2$	7.64	0.10	220
21	Butylated Hydroxytoluene	$C_{15}H_{24}O$	7.99	0.13	220
22	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	8.68	0.00	592
23	17-Pentatriacontene	$C_{35}H_{70}$	8.68	0.00	490
24	2-Nonadecanone 2,4-dinitrophenylhydrazine	$C_{25}H_{42}N_4O_4$	8.68	0.00	462
25	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	8.92	0.00	592
26	E,E,Z-1,3,12-Nonadecatriene-5,14-diol	$C_{19}H_{34}O_2$	8.92	0.00	294
27	17-Pentatriacontene	$C_{35}H_{70}$	8.92	0.00	490
28	Dodecane, 1-cyclopentyl-4-(3-cyclopentylpropyl)-	$C_{25}H_{48}$	9.39	0.11	348
29	1H-Indene, 2-butyl-4-hexyloctahydro	$C_{19}H_{36}$	9.39	0.11	264
30	Cyclohexane, 1-(cyclohexylmethyl)-4-(1-methylethyl)-	$C_{16}H_{30}$	9.39	0.11	222
31	2-Naphthalenemethanol, decahydro-à,à,4a-trimethyl-8-methylene-, [2R-(2à,4aà,8aá)]-	$C_{15}H_{26}O$	10.25	0.12	222
32	2-Naphthalenemethanol, 2,3,4,4a,5,6,7,8-octahydro-à,à,4a,8-tetramethyl-, [2R-(2à,4aá,8á)]-	$C_{15}H_{26}O$	10.25	0.12	222
33	Pentadecanoic acid, 14-methyl-, methyl ester	$C_{17}H_{34}O_2$	11.00	0.07	270
34	Hexadecanoic acid, methyl ester	$C_{17}H_{34}O_2$	11.00	0.07	270
35	17-Pentatriacontene	$C_{35}H_{70}$	11.39	0.02	490
36	Oleic Acid	$C_{18}H_{34}O_2$	11.39	0.02	282
37	22-Tricosenoic acid	$C_{23}H_{44}O_2$	11.39	0.02	352
38	9-Octadecenoic acid (Z)-, methyl ester	$C_{19}H_{36}O_2$	12.08	0.37	296
39	9-Octadecenoic acid, methyl ester, (E)-	$C_{19}H_{36}O_2$	12.08	0.37	296
40	8-Octadecenoic acid, methyl ester	$C_{19}H_{36}O_2$	12.08	0.37	296
41	Oleic acid, eicosyl ester	$C_{38}H_{74}O_2$	13.22	0.01	562
42	9,12,15-Octadecatrienoic acid, 2,3-bis[(trimethylsilyl)oxy]propyl ester, (Z,Z,Z)-	$C_{27}H_{52}O_4Si_2$	13.22	0.01	496
43	17-Pentatriacontene	$C_{35}H_{70}$	13.22	0.01	490
44	Cholestan-3-one, cyclic 1,2-ethanediyl aetal, (5á)-	$C_{29}H_{50}O_2$	13.87	0.03	430
45	Docosanoic acid, 1,2,3-propanetriyl ester	$C_{69}H_{134}O_6$	13.87	0.03	1058

46	Oleic acid, 3-(octadecyloxy)propylester	$C_{39}H_{76}O_3$	13.87	0.03	592
47	1,2-Benzenedicarboxylic acid, diisooctylester	$C_{24}H_{38}O_4$	14.48	0.28	390
48	Bis(2-ethylhexyl) phthalate	$C_{24}H_{38}O_4$	14.48	0.28	390
49	Oleic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{76}O_3$	15.44	0.01	592
50	Stearic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{78}O_3$	15.44	0.01	594
51	Docosanoic acid, 1,2,3-propanetriyl ester	$C_{69}H_{134}O_6$	15.44	0.01	1058
52	9,12,15-Octadecatrienoic acid, 2,3-bis[(trimethylsilyl)oxy]propyl ester, (Z,Z,Z)-	$C_{27}H_{52}O_4Si_2$	15.81	0.02	496
53	Cholestan-3-one, cyclic 1,2-ethanediyl aetal, (5á)-	$C_{29}H_{50}O_2$	15.81	0.02	430
54	1-Monolinoleoylglycerol trimethylsilyl ether	$C_{27}H_{54}O_4Si_2$	15.81	0.02	498
55	Stearic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{78}O_3$	16.46	0.01	594
56	Dodecanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro-5a-hydr oxy-4-(hydroxymethyl)-1, 1,7,9-tetramet hyl-6,11-dioxo-1H-2,8a-methanocyclopenta[a]cyclopropa[e]cyclodecen-5-yl ester, [1aR-(1aà,2à,5á,5aá,8aà,9à,10aà)]-	$C_{32}H_{48}O_6$	16.46	0.01	528
57	Dasycarpidan-1-methanol, acetate (ester)	$C_{20}H_{26}N_2O_2$	16.46	0.01	326
58	Stearic acid, 3-(octadecyloxy)propyl ester	$C_{39}H_{78}O_3$	16.87	0.00	594
59	Spirost-8-en-11-one, 3-hydroxy-, (3á,5à,14á,20á,22á,25R)-	$C_{27}H_{40}O_4$	16.87	0.00	428
60	Dodecanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro-5a-hydr oxy-4-(hydroxymethyl)-1,1,7,9-tetramet hyl-6,11-dioxo-1H-2,8a-methanocyclope nta[a]cyclopropa[e]cyclodecen-5-yl ester, [1aR-(1aà,2à,5á,5aá,8aà,9à,10aà)]-	$C_{32}H_{48}O_6$	16.87	0.00	528
61	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl	$C_{16}H_{50}O_7Si_8$	17.28	0.00	578
62	Dasycarpidan-1-methanol, acetate (ester)	$C_{20}H_{26}N_2O_2$	17.28	0.00	326
63	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl	$C_{12}H_{38}O_5Si_6$	17.28	0.00	430
64	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl	$C_{12}H_{38}O_5Si_6$	20.64	0.75	430
65	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11, 13,13,15,15-hexadecamethyl	$C_{16}H_{50}O_7Si_8$	20.64	0.75	578
66	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11, 13,13-tetradecamethyl	$C_{14}H_{44}O_6Si_7$	20.64	0.75	504
67	1h-Pyrrole-3,4-diacetic acid, 2-acetoxymethyl-5-methoxycarbonyl-, dimethyl ester	$C_{15}H_{19}NO_8$	21.95	0.02	341

68	1,2-Cinnolinedicarboxylic acid, 1,2,3,5,6,7,8,8a-octahydro-4-trimethylsilyloxy-, diethyl ester	$C_{17}H_{30}N_2O_5Si$	21.95	0.02	370
69	Hexadecanoic acid, 2-(octadecyloxy)ethyl ester	$C_{36}H_{72}O_3$	21.95	0.02	552
70	Tetradecanoic acid, 9a-(acetyloxy)-1a,1b,4,4a,5,7a,7b,8,9,9 a-decahydro-4a,7b-dihydroxy-3-(hydro xymethyl)-1,1,6,8-tetramethyl-5-oxo-1H -cyclopropa[3,4]benz[1,2-e]azulen-9-yl ester, [1aR-(1aà,1bá,4aá,7aà,7bà,8à,9á,9aà)]-	$C_{36}H_{56}O_8$	22.34	0.03	616
71	5á-Ergost-24-en-26-oic acid, 5,6á-epoxy-4á,18,22-trihydroxy-3-meth oxy-1-oxo-, ë-lactone, diacetate, (20S,22R)-	$C_{33}H_{46}O_9$	22.34	0.03	586
72	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl	$C_{16}H_{50}O_7Si_8$	23.28	0.04	578
73	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl	$C_{12}H_{38}O_5Si_6$	23.28	0.04	430
74	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13 – tetradecamethyl	$C_{14}H_{44}O_6Si_7$	23.28	0.04	504
75	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13, 15,15-hexadecamethyl	$C_{16}H_{50}O_7Si_8$	23.76	0.02	578
76	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl	$C_{12}H_{38}O_5Si_6$	23.76	0.02	430
77	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13 – tetradecamethyl	$C_{14}H_{44}O_6Si_7$	23.76	0.02	504
78	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl	$C_{16}H_{50}O_7Si_8$	24.57	0.00	578
79	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl	$C_{12}H_{38}O_5Si_6$	24.57	0.00	430
80	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl	$C_{14}H_{44}O_6Si_7$	24.57	0.00	504
81	Octasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyl	$C_{16}H_{50}O_7Si_8$	24.85	0.01	578
82	Hexasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11-dodecamethyl	$C_{12}H_{38}O_5Si_6$	24.85	0.01	430
83	Heptasiloxane, 1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl	$C_{14}H_{44}O_6Si_7$	24.85	0.01	504

Discussion

Allelopathy is an interference process whereby plants or their dead parts emit biochemicals known as allelochemicals that cause phytotoxicity, or unpropitious effects, on the related plants (Pan et al., 2015; Duke, 2003). Prosopis glandulosa, Indigofera hochstetteri, Capparis cartilaginea, and Parkinsonia aculeata were found to have high levels of phytotoxicity by Qasim et al. (2019). They claimed that flavonoids, tannins, phenols, quercetin, pyrocatechol, and gallic acid were present in these plants. Plants exhibited phytotoxicity for this reason. Rheum austral, Polygonum plebejum, Persiacaria maculosa, Rumex nepalensis, and Rumex dentatus demonstrated notable phytotoxicity against Lemna minor, according to Hussain et al. (2010).

The substances they contain are the cause of the plant's growth inhibition. Similar to the current study, Schumannianthus dichotomus contained syringic acid and methyl syringate, which reduced the root and shoot growth of two monocot species, Italian ryegrass and barnyard grass, as well as dicot alfalfa and cress (Rob et al., 2020).

Significant insecticidal action was demonstrated by crude extracts of Persicaria maculosa and Polygonum plebejum against Tribolium castaneum, Rumex dentatus, and Rumex nepalensis against Sitophilus oryzae (Hussain et al., 2010). Ageratum conyzoides, Achillea fragrantissima, and Tagetes minuta oils were found to have poor to moderate insecticidal action against Callosobruchus maculatus by Nenaah et al. (2015). Rhaponticum acaule and Mantisalca duriaei can be utilized to guard stored grains from Tribolium confusum since plants contain several active chemical compounds that may either repel or kill insects (Boussaada et al., 2008).

Similar to the current study, Ahmed et al. (2020) examined the insecticidal properties of Citrullus colocynthus, Cannabis indica, and Artemesia argyi against Brevicoryne brassicae and found that these plants shown notable activity against the test pathogen.

Ziada et al. (2014) reported polyphenols and flavonoids from their phytochemical analysis of Anthemis cotula. 14 identified components, including α-Bisabolol oxide A, α-Bisabolol, Bisabolol oxide, β-farnesene, (+) spathulenol, chamazulene, and germacrene, were found in the volatile oil extracted from A. cotula flowers capitula. Flavonoids, polyphenols, and volatile oils were the principal constituents.

Turgumbayeva et al. (2014) reported flavonoids, phenylethanoid glycosides, coumarines, fatty acids, and steroids in their initial phytochemical screening of Carthamus tinctorius. Crude protein, total sugar, and extractable lipids were found in the seeds. The seeds contained terpenoids, cardiac glycosides, linoleic acid, oleic acid, and linoleic acid steroids. According to Munir et al. (2014), Suaeda monoica, Salsola imbricata, Salsola fruticosa, and Salsola tragus include anthraquinones, carbohydrates, flavonoids, saponins, phenolic compounds, and terpenoids. Similar to the current study, Shelar et al. (2017) conducted phytochemical investigations and found that Urena lobata leaf extracts contained alkaloids, glycosides, steroids, flavonoids, and tannins.

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