

Antimicrobial Activity and Chemical Composition Screening of *Anacyclus pyrethrum* Root

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ABSTRACT

Medical herbs have many bioactive component and they are used in microbial treatment since ancient times. The resistance of pathogens to antibiotics became a critical problem, so researches for novel antimicrobial agents are required. *Anacyclus pyrethrum* (*pellitory*, *Spanish chamomile* or *Mount Atlas daisy*) is commonly used as a traditional medicine, therefore the antimicrobial activity of the root of this medicinal plant was investigated against 17 bacteria and 1 fungi by using disk diffusion method. The test strains include *Bacillus*, *Enterobacter*, *Enterococcus*, *Escherichia*, *Klebsiella*, *Listeria*, *Pseudomonas*, *Salmonella*, *Staphylococcus* and *Candida* genera. Besides, chemical composition of this sample was determined by Gas Chromatography-Mass Spectroscopy analysis. The results were presented that *A. pyrethrum* has antimicrobial activity against all tested microbial species except *E. faecalis* and *S. typhimurium*. Eighteen major chemical components were determined, but some composition of this sample is not match with library. For this reason, this medicinal plant contain unknown molecules and this molecules should be analysed NMR spectra for 3D structure determination and identification.

Keywords: *Anacyclus pyrethrum*, Medicinal Plant, Antimicrobial Activity, Chemical Composition, Disk Diffusion Method, Gc-MS.

INTRODUCTION

Plants have been used as sources for many pharmaceuticals.^{1,2} *Anacyclus pyrethrum* (*pellitory*, *Spanish chamomile* or *Mount Atlas daisy*) root and leaf are important in traditional health and herbal medicine. In particular, *A. pyrethrum* root is known to have a good effect in traditional medical uses.³ This herbal plant has many uses in different cultures as aphrodisiac, analgesic, antirheumatic, antiarthritic, antibacterial, antiviral, antibiotic, anticatarrhal, carminative, digestion, diuretic, emmenagogue, febrifuge, nervine, vermifuge, sialagogue.⁴ Several experimental studies have been carried out on *A. pyrethrum* plant and many biological activities have been identified such as antibacterial, immunostimulating and antioxidant, antidepressant.⁵⁻¹¹

The main objective of this scientific research is to determine the antimicrobial profile of *A. pyrethrum* and its ethanol extract's composition. The ethanol extract of this plant was prepared and tested against 17 bacteria and 1 fungi by disk diffusion method. In addition, GC-MS analysis was performed to identify the compounds in the ethanol extract of this plant, and the compounds were determined by comparison from Wiley Data Library.

MATERIALS AND METHODS

Plant samples

A. pyrethrum is a medicinal plant in Turkey and obtained from local market, 5.14, 10.29 and 20.57 mg *A. pyrethrum* samples were prepared with ethanol extraction process.¹²

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Table 1: Disk diffusion test result for *Anacyclus pyrethrum* (Inhibition zones in mm).

	30µL	60µL	120µL
<i>Bacillus subtilis</i> DSMZ 1971	9,00 ± 0,00	10,00 ± 0,00	12,00 ± 0,00
<i>Candida albicans</i> DSMZ 1386	7,00 ± 0,00	9,00 ± 0,58	12,00 ± 0,00
<i>Enterobacter aerogenes</i> ATCC 13048	-	-	9,00 ± 0,00
<i>Enterococcus faecalis</i> ATCC 29212	-	-	-
<i>Enterococcus faecium</i>	21,00 ± 0,00	26,00 ± 0,00	33,00 ± 0,58
<i>Enterococcus durans</i>	8,00 ± 0,00	10,00 ± 0,58	13,00 ± 0,00
<i>Escherichia coli</i> ATCC 25922	-	7,00 ± 0,00	8,00 ± 0,00
<i>Klebsiella pneumoniae</i>	-	-	7,00 ± 0,00
<i>Listeria innocua</i>	8,00 ± 0,00	8,00 ± 0,00	8,00 ± 0,00
<i>Listeria monocytogenes</i> ATCC 7644	11,00 ± 0,58	14,00 ± 0,00	16,00 ± 0,00
<i>Pseudomonas aeruginosa</i> DSMZ 50071	12,00 ± 0,00	16,00 ± 0,00	18,00 ± 0,00
<i>Pseudomonas fluorescens</i> P1	-	8,00 ± 0,00	11,00 ± 0,00
<i>Salmonella enteritidis</i> ATCC 13076	8,00 ± 0,00	9,00 ± 0,00	10,00 ± 0,58
<i>Salmonella infantis</i>	7,00 ± 0,00	8,00 ± 0,00	9,00 ± 0,00
<i>Salmonella kentucky</i>	7,00 ± 0,00	9,00 ± 0,00	10,00 ± 0,00
<i>Salmonella typhimurium</i> SL1344	-	-	-
<i>Staphylococcus aureus</i> ATCC 25923	16,00 ± 0,00	19,00 ± 0,00	21,00 ± 0,00
<i>Staphylococcus epidermidis</i> DSMZ 20044	25,00 ± 0,00	28,00 ± 0,00	32,00 ± 0,00

"-": No inhibition

Table 2: The major chemical components of *Anacyclus pyrethrum*.

No	Retention Time	Compound name	Formula	Molecular Weight (g/mol)	Area (%)
1	29.756	Benzofuran-2-carboxaldehyde	C ₉ H ₆ O ₂	146.143	5.50
2	30.057	Benzaldehyde, 2-hydroxy-6-methyl-	C ₈ H ₈ O ₂	136.148	2.68
3	37.815	Triisobutyl(3-phenylpropoxy)silane	C ₂₁ H ₃₈ OSi	334.611	1.89
4	46.971	Naphthalene, decahydro-1,1-dimethyl-	C ₁₂ H ₂₂	166.303	10.86
5	48.102	Palmitic acid	C ₁₆ H ₃₂ O ₂	256.424	13.39
6	54.324	9,12-Octadecadienoic acid (Z,Z)-	C ₁₈ H ₃₂ O ₂	280.445	10.10
7	54.510	7-Tetradecenal, (Z)-	C ₁₄ H ₂₆ O	210.356	7.08
8	54.734	N-Isobutyl-tetradeca-2,4-dienamide	C ₁₈ H ₃₃ NO	279.461	7.60
9	55.259	Octadecanoic acid	C ₁₈ H ₃₆ O ₂	284.477	1.99
10	60.566	N-Isobutyl-(2E,4Z,8Z,10E)-dodecatetraenamide	C ₁₆ H ₂₅ NO	247.376	1.15
11	61.303	N-Isobutyl-tetradeca-2,4-dienamide	C ₁₈ H ₃₃ NO	279.461	1.56
12	65.610	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	C ₁₉ H ₃₆ O ₄	330.503	1.81
13	66.398	Unknown	-	-	2.82
14	71.023	Octadecanoic acid, 2,3-dihydroxypropyl ester	C ₂₁ H ₄₂ O ₄	358.556	4.62
15	73.336	Unknown	-	-	2.98
16	73.790	Squalene	C ₃₀ H ₅₀	410.718	1.03
17	89.383	Stigmasterol	C ₂₉ H ₄₈ O	412.691	1.29
18	91.585	.gamma.-Sitosterol	C ₂₉ H ₅₀ O	414.707	5.49

The difference between our study and previous studies could depend on several reasons: (1) the microorganism strains used in these two studies may be different, (2) the location and collection season of *A. pyrethrum* may cause a change in active components, (3) the amount of extracts tested on microorganisms were different and (4) the type of extraction solvent may change the active compounds extracted from plant samples.

According to Table 2, Palmitic acid (13.39%), Naphthalene, decahydro-1,1-dimethyl- (10.86%), 9,12-Octadecadienoic acid (Z,Z)- (10.10%), N-Isobutyl-tetradeca-2,4-dienamide (7.60%), 7-Tetradecenal, (Z)- (7.08%), Benzofuran-2-carboxaldehyde (5.50%) and γ -Sitosterol (5.49%) are mainly found in the composition of *A. pyrethrum* ethanol extract.

CONCLUSION

A. pyrethrum has antimicrobial activity against large range of microorganisms. It is possible to recommend that further researches are needed to determine the mechanism of actions and antibiotic interactions due to the active compounds' pharmacokinetic profiles.

ACKNOWLEDGEMENT

None

CONFLICT OF INTEREST

None

ABBREVIATION USED

GC-MS, gas chromatography-mass spectrophotometry method; NMR, nuclear magnetic resonance; 3D, three dimensional.

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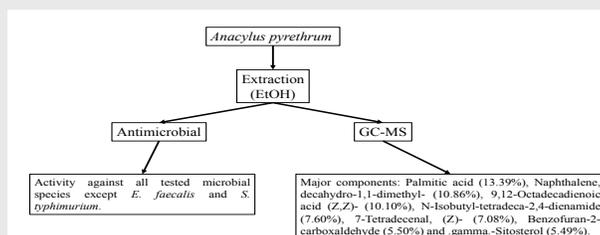
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PICTORIAL ABSTRACT



SUMMARY

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- The test microorganisms included *Bacillus*, *Enterobacter*, *Enterococcus*, *Escherichia*, *Klebsiella*, *Listeria*, *Pseudomonas*, *Salmonella*, *Staphylococcus* and *Candida* genera.
- The chemical composition of this sample was determined by Gas Chromatography-Mass Spectroscopy.
- The extract was observed to be active against all tested microbial species except *E. faecalis* and *S. typhimurium*.
- The major chemical components were observed as Palmitic acid (13.39%), Naphthalene, decahydro-1,1-dimethyl- (10.86%), 9,12-Octadecadienoic acid (Z,Z)- (10.10%), N-Isobutyl-tetradeca-2,4-dienamide (7.60%), 7-Tetradecenal, (Z)- (7.08%), Benzofuran-2- carboxaldehyde (5.50%) and .gamma.-Sitosterol (5.49%), but some components of this sample didn't match with the library.

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