V. Summary

This study was conducted in the farm of medicinal and aromatic plants research branch, barrage, Horticulture Research Institute, Agriculture Research Center, Ministry of Agriculture.

In the current study chamomile, cumin and lemongrass essential oils were chosen , three samples from each essential oil produced from chamomile, cumin and lemongrass plants produced in three different places of Egypt were taken as follows:

Chamomile essential oil	El Fayoum governorate	Bani sweif governorate	El mena governorate
Cumin essential oil	El Menya governorate	Assiut governorate	Sohag governorate
Lemongrass essential oil	El Kaluobia governorate	El fayoum governorate	Bani sweif governorate

The physical and chemical properties, chemical composition and antimicrobial activity against growth of some microorganisms for every one of essential oils under study were fully investigatel .

1- Determination of physicochemical properties of essential oil samples.

A) Chamomile essential oil samples from El Fayoum, Bani Sweif and El Menya Governorates in Egypt.

- The physicochemical properties (specific gravity at, 15° c, refractive index, solubility, acid number, ester number and ester number after acetylation) of each oil were as follows :

Specific gravity at 20° c	0.9473,	0.9704,	0.9716
Refractive index	1.4848,	1.4725	1.4950
Solubility	soluble in1.2vol of 90% alcohol		
acid number	12.3	13.1	14.4
Ester number	6.2	7.3	9.1
ester number after acetylation	65.4	70.6	84.3

B) Cumin essential oil samples from El Menya, Assiut and Sohag Governorates in Egypt

- The physicochemical properties specific gravity at 20°c, refractive index, optical rotation , solubility , acid number, ester number and total aldehydes of each oil were as follows:

- Specific gravity at 20° c	.9175,	0.9206,	0.9201
- Refractive index	1.5035,	1.5017,	1.5018
- Optical rotation	+4° 40,	+4° 95,	+5 ° 15
- Solubility	soluble in 1.8 vol of 80% alcohol		
- Acid number	1.41,	1.37,	1.50
- Ester number	25.25,	27.40,	29.20
- Total aldehydes	45.6%	48.3%	47.1%

c) Lemongrass essential oil samples from El Kaluobia, El Fayoum and Bani Sweif Governorates in Egypt

- The physicochemical properties (specific gravity at 15c,refractive index, optical rotation, solubility, acid number, ester number and ester number after acetylation) of each oil were as follows:

- Specific gravity at 15° c	0.8564,	0.8812,	0.8900
- Refractive index	1.4863,	1.4822,	1.4854

- Optical rotation	-10.58, -2.12 , -8.14
- Solubility	soluble in 0.5 vol of 80% alcohol
- Acid number	2.5, 3.1, 3.4
- Ester number	21.30, 25.14, 35.08
- Ester number after acetylation	212.16, 201.24, 217.3

2) Chemical composition of the essential oil were determined by gas liquid chromatographic analysis, components was identified as follows:

a) Chamomile oil samples

1-Farnesene, 2- Caryophelene, 3- Furfural,
4- Bisabolol Oxide A, 5- α Bisabolol, 6- Camazulene,
7- Bisabolol Oxide B

b) Cumin oil samples

1- α – Pinene, 2- Gama Terpinene, 3- Cuminic Aldehyde
4- P – Cymene, 5- b – Phellanderene, 6- P. Menthene 3-al-7
7- P - Menthadiene 1,3-al-7, 8- P-menthadiene 1,4-al-7

c) Lemongrass oil samples

1-Limonene, 2- 5 Menthyl Heptenne, 3- Linalool,
4- B. Caryophyllene, 5- Citral b, 6- Citral a,
7- α –Terpinial, 8- Geranyl Acetate, 9- Geraniol

3) Samples of essential oils were tested for antimicrobial activity by using filter paper disc diffusion and the results were as follows.

I) All tested essential oil samples had antibacterial activity against growth of gram- negative (*E.coli,S.typhi*) and gram-positive (*B.subtilis, stap.aureus*)

a) Chamomile oil samples

Chamomile oil sample produced from chamomile plant cultivated in El Fayum Governorate of Egypt had the highest effect sample in gram- negative bacteria while the sample produced from chamomile plant cultivated in El Menya Governorate in Egypt had the lowest one.

Chamomile oil sample produced from chamomile plant cultivated in Bani Sweif Governorate of Egypt had the highest effect sample in gram positive bacteria , while the sample produced from chamomile plant cultivated in El Fayoum Governorate of Egypt had the lowest one.

b) Cumin oil samples

Cumin oil samples produced from cumin plant cultivated in Assiut Governorate of Egypt had the highest effect sample in gram-positive bacteria while the sample produced from cumin plant cultivated in El Menya Governorate of Egypt had the lowest one.

Cumin oil sample produced from cumin plants cultivated in sohag Governorate in Egypt had the highest effect sample in gram-positive bacteria while the sample produced from cumin plant cultivated in Assiut Governorate of Egypt had the lowest one.

c) Lemongrass oil samples

Lemongrass oil samples produced from Lemongrass plant cultivated in El-Fayoum Governorate of Egypt had the highest effect sample in gram-negative and positive bacteria while the sample which product from Lemongrass cultivated in Bani Sweif Governorate of Egypt had the lowest one.

II) All tested essential oil samples had antifungal activity against growth of fungi (*A. flavus, A. Niger*)

All chamomile oil samples had highest effect in *A. flavus* while chamomile oil sample produced from chamomile plant cultivated in El Menya Governorate of Egypt was lowest one in *A.niger*.

Cumin oil sample produced from cumin plant cultivated in Sohag Governorate of Egypt had the highest effect sample in *A. flavus*, while the samples produced from cumin plant cultivated in Assiut and Sohog Governorate of Egypt had the lowest effect in *A. Niger*.

Lemongrass oil sample produced from Lemongrass plant cultivated in El Kaluobia Governorate of Egypt had the highest effect sample in *A. flavus* and the lowest one in *A. Niger*, while Lemongrass oil sample produced from Lemongrass plants cultivated in El Fayoum Governorate of Egypt had the highest effect in *A. Niger*.

III) All tested essential oil samples had antiyeast activity against growth of yeast (*S. Cervisiae*)

Chamomile oil sample produced from chamomile plants cultivated in Bani Sweif Governorate of Egypt had the highest effect in *S. cervisiae*, while the produced from chamomile plant cultivated in El Fayoum Governorate of Egypt had the lowest one.

Cumin oil sample produced from cumin plant cultivated in Assiut Governorate of Egypt had the highest effect e in *S.cervisiae* ,while the other Cumin oil were the lowest.

Lemongrass oil sample producted from Lemongrass plants cultivated in El Fayoum Governorate of Egypt had the highest effect sample in *S.cervisiae,* while Lemongrass oil sample produced from Lemongrass plants cultivated in Bani Sweif Governorate of Egypt had the lowest one.

IV) Table shows the differences between chamomile oil samples, cumin oil samples and Lemongrass oil samples on various microorganisms growth .

Micro-organisms	The highest effect sample	The lowest effect sample
Gram negative bacteria *E. Coli- S.Typhi*	Cumin oil II (from Assiut)	chamomile oil III (from El Menya)
Gram positive bacteria *B. Subtilis- Stap. Aureus*	Lemongrass oil II (from El Fayoum)	Cumin oil II (from Assiut)
Fungi *A. flavus*	Cumin oil III (from Sohag)	Lemongrass oil III (from Bani sweif)
A. Niger	Chamomile oil I, II (from El Fayoum and Bani sweif)	Cumin oils II, III (from Assiut and Sohag)
Yeast *S. Cervisiae*	Lemongrass oil II (from El Fayoum)	Lemongrass oil III (from Bani sweif)