J. Agric. Sci. Mansoura Univ., 34 (10):, 2009

EFFECT OF TYPE OF PACKAGE AND STORAGE ON INSECT POPULATION OF *Gibbium psylloids* (ZEMP.), ON THE QUALITY AND QUANTITY OF DRY CHAMOMILE.

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ABSTRACT

The effect of post harvest treatment and the hump beetle , *Gibbium psylloids* (Zemp.), on the quality and quantity of dry chamomile flower heads was studied. Results, after storage period of two years, revealed that the glass jar packing received the lowest insect population, followed by plastic net then card box, while the highest insect population was observed in polyethylene bag. The highest weight loss of dry chamomile flower heads occurred in plastic net and the lowest in glass jar, at the end of the second year of storage. The essential oil percentage decreased by increasing the storage period in all experimental packages. Acid number decreased in all package except in polyethelene bag, which recorded an increase in acid number after two years storage.

INTRODUCTION

Chamomile (*Matricaria chamomilla* L.) belongs to family Asteraceae and is one of the medicinal plants known for the longest time. Egyptian and Greeks knew the healing effects of the plant since thousands years. Its inflorescence and essential oil are also indispeusable in modern medicinal practice, it is an official drug in all the pharmacopoeias of the worlds. The infusion of the flower heads is an anti-infamniatory, antispasmodic and antiseptic as is well known. Its essential oil is used by the pharmaceutical industry to prepare. Anti- infamniatory medicines, and by cosmetic industry to prepare skin-care products. The use of this plant is significant all over the world. Egypt is one of the countries with the most extended production of chamomile. Most of the drugs appearing in the world market originates from Egypt and Argentine (Hornok, 1992).

Chamomile, *Matricaria chamomilla* L. is one of the most economic medicinal plants. Its flower heads are the main source of highly aromatic essential oil. Both the storage conditions and insect infestation are important in keeping the product in a good marketable quality (Rakova, 1961; Chinenova *et al.,* 1969; Reffaat, 1988; Carle *et al.* 1989 and Waffa, 2001.

The hump beetle, *Gibbium psylloids* (Zemp.) is oftenly a minor insect and receives little attention as a storage products pest (Belles and Holstead, 1985; Lee *et al*. 1992; Salama and Ahmed 1995; Bosman and Jonge, 1998 and Waffaa, 2001). Therefore, the current investigation was conducted to study the influence of type package and storage on population density of *G. psylloids* on the quality and quantity of dry chamomile.

MATERIALS AND METHODS

Effect of type of package and storage period on insect population:-

After the harvest, the yield of chamomile flower heads were collected from the filed (Abo Gonsho – El Fayoum) and transferred to the laboratory.

Under the laboratory conditions the yield was divided into two parts. After that it was stored in different containers which were made of glass, cloth, plastic or cellophane. The infestation by *G. psylloides* was carried out by using three pairs of adult stage for the first level and five pairs for the second level.

All containers (plastic, glass, cloth and cellophane) were kept under laboratory conditions throughout the storage period extending one year.

Three replicates (25gm) for each level of insect infestation of each package were done.

Samples were taken every three months of chamomile flower to follow up the development of insect population in each container.

Effect of storage condition on the volatile oil of chamomile:

In this experiments the flower heads of chamomile were air dried in the shads. Then stored in four different conditions; plastic, glass, cloth and cellophane with different three infestation level; not infestation, semi infestation and infestation. The different conditions were stored at room temperature for one year, each treatment was represented by three replicates.

The samples were taken every three months from chamomile. Chamomile flowers were taken from each treatment to extract and determine volatile oil .

volatile oil percentage:

Volatile oil percentage in flower head of chamomile sample from each treatment was determined using Clevenger apparatus as described by Guenther (1973). Twenty five grams of chamomile flowers were separately mixed with 500ml of water in a rounded one-liter flask and subjected for hydrolistillation for three hours. The resulted volatile oil was dried over unhydrous sodium sulphate and then stored in dark bottles at a refrigerator until used for analysis. The quantity of volatile oil was determined for each treatment to study the relation between the quantity of volatile oil containers and insect population.

GC/MS: Analysis were performed on a Hewlett-Packard Capillary Column 50 ml carbowax, 20 mm. Internal diameter 0.2 mm, film thickness 0.33 m., over temperature (40to 200^{o} c), program rate (2^{o} c/min), Injection port temperature (150^{o} c), Detetor (TLC), carrier gas (Helium/ and Carried flow ml/min).

The components of the oil were identifified by comparison of their mass spectra with those of the camper library (Wiley) or with matching their retention times with those of autheutic samples injected with the same conditions or with data published in the literature (Stenhagen *et al.* 1974 and Adams,2001)

Data were subjected for statistical analysis to calculate F test at the 0.05 level of probability according to Snedecor and Cochran (1990).

RESULTS AND DISCUSSION

Hump beetle *Gibbium psylloids* (Zemp.):

The data given in Table (1) indicated that essential oil of chamomile decreased in all packages due to the long period of storage such as after three months.

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The percentage of oil reduction reached 11.1 % and 27.8 % for 1st and 2nd level of infestation, in cellophane bag respectively and 16.7 % and 33.5 % for the first and the second level of infestation, in glass bag respectively. While in cloth bag the percentage of reduction was 27.8 % and 45.0 % for 1st and 2nd level of infestation, respectively.

After six months, the decrease of essential oil continued with different degrees according to type of package. It ranged between 18.9 % and 33.5 % for 1st and 2nd level of infestation, respectively in cellophane bag and 27.8 % and 44.4 % for 1st and 2nd level of infestation, respectively in glass jar, while in both plastic and cloth bags it was 33.3 % and 50.00 % for 1st and 2nd level of infestation, in plastic and respectively 40.9 % and 55.6 % for 1st and 2nd level of infestation, respectively.

After nine months, the decrease of essential oil continued with different degrees according to type of package it ranged between 27.0 % and 44.1 % for 1st and 2nd level of infestation, respectively, in cellophane bag and 38.9 % and 50.0 % for 1st and 2nd level of infestation, respectively in glass jar while, in plastic jar it was 50.0 % and 61.1 % for 1st and 2nd level of infestation, respectively and in cloth bag it was 55.6 % and 66.5 % for 1st and 2nd level of infestation, respectively.The volatile oil percent in the flower heads of the different treatments as shown in Table (2). It is clear that the volatile oil percent decreased gradually in all kind of containers Table (2).

Table (2): Essential oil % of *Matricaria chamomilla* as affected by storage containers.

Containers months	Plastic			Glass			clothes			Cellophane		
	control	Semi inf.	Inf.	Con.	Semi Inf.	Inf.	Control	Semi Inf.	Inf.	control	Semi Inf.	Inf.
0	0.18	0.18	0.18	0.018	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
3	0.15	0.13	0.11	0.15	0.12	0.10	0.13	0.10	0.08	0.16	0.11	0.12
6	0.14	0.11	0.09	0.13	0.10	0.08	0.10	0.09	0.07	0.14	0.13	0.11
9	0.12	0.09	0.07	0.12			0.11	0.09	0.07	0.13	0.11	0.10
12	0.10	0.08	0.06	0.10			0.09	0.08	0.06	0.13	0.10	0.09
Mean	0.138	0.118	0.102	0.132			0.114	0.10	0.088	0.146	0.132	0.12

Semi inf. = Semi infection
Inf. = infection

The containers varied in their decrements, cloth containers showed the highest decrement which may be explained in the view of that clothes have good aireation which increased the loss of volatile oil. Glass, cellophane and plastic containers showed the same rate of decrement with increasing storage period . infection with Gibbium psylloids decreased the content of volatile oil. Increasing the level of infection increased the loss of volatile oil from 0.08 % to 0.11 %. This trend was clear in all kind of containers. Cellophane containers showed the lowest value of volatile oil decrement.There is a good correlation between numbers of insects and volatile oil content. It is clear that the number of insects increased with increasing the period of storage in all containers meanwhile it increased with decreasing the volatile oil on the number of insects. The results agree with those results obtained by Salama and Ahmed (1995); and Misra (1997) and Waffaa and Yousef(2001) on Chamomile.

The main constituents of volatile oils of chamomile:

The main constituents of chamomile as separated and identified by GC / MS are shown in Table (3) accounted for more than 87.5% their molecular weights, formula and chemical structures are shown in the same table. Bisabodol Oxide- A was found to be the main compound and accounted for 57.8% followed by bisanolol oxide–B (8.6%), azulene, 7-ethyl-1,4 dimethyl (8.6%), dicycloethers (8.7%) and a-bisabolol which accounted for 1.6%.

The main hydrocarbon was found to be farnesene and accounted for 0.8% the hydrocarbon monoterpens were identified as α-pinene (0.1%) ß-pinene (0.04%) and p-cymene (0.3) , while anethole (0.2%) is oxygenated monoterpine. The sesquterpeinic hydrocarbons are farnesene , a zulene- 7-ethyle-1,4-dimethyl,y-candinene, while the oxygenated sesqterpines are bisabolol oxide-A & B and α- bisabolol, and chamazlene, 7,ethyl-1,4dimethyl1.

These results are in agreement with those of Youssef and Moussa (1998) who found that bisabolol oxide A ranged from 53.9 to 80.4 % followed by bisabolol oxide B which ranged from 33.5 to 50.9 %. On the other hand, chamazulene, bisabolol and farnesene were found as in low concentration or trace amounts. Felkova *et al.* (1981) Honcarive and Repcak (1979), and Wafaa and Yousef (2001).

Effect of storage treatments on the main constituents of volatile oils of chamomile:

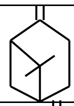
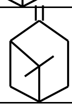
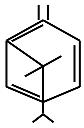
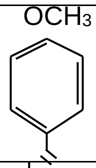
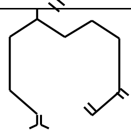
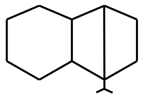
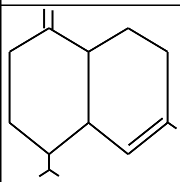
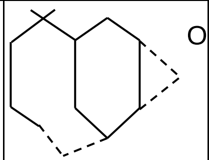
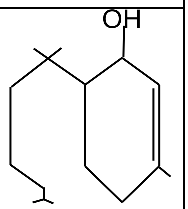
Volatile oil of Chamomile showed the main component as bisabolol oxide A in all treatment. Its relative percent reached 64% while other treatments showed its content with 40% Cis-Dicyclaether increased from 8.7 to 10.5 % bisabolol oxide B showed the same trend as that of bisabolol oxide A in which it decreased from 8.6 to 6.1 %.

The mean values of bisabolol oxide A as affected by storage conditions and the storage period are shown in table (4). Generally in glass containers, The data showed no considerable differences according to storage period in glass containers.

In cloth containers bisabolol oxide A contenton flower head landed to decrease up to 9 months.

Bisabolol oxide-A of The mean valued as affected by storage containers and the storage period are showed in table (4). Flower heads content of bisabolol oxide-A tended to decrease up to nine months then increased to be more or less The same value of three months sample.

Table (3): Molecular weights, chemical formulas and chemical of the volatile oil *Matricaria chamomilla*

7Compound	%	Molecular weights	chemical formulas	Structure
α-pinene	0.11	136	$C_{10} H_{16}$	
ß- pinene	0.04	136	$C_{10} H_{16}$	
p-cymene	0.29	134	$C_{10} H_{14}$	
Anethole	0.23	148	$C_{10} H_{18} O$	
Farnesene	0.80	204	$C_{15} H_{24}$	
ß-cubebene	0.17	204	$C_{15} H_{24}$	
y-cadinene	0.21	204	$C_{15} H_{24}$	
Bisabolol oxide-B	8.61	238	$C_{15} H_{26} O_2$	
α-Bisabolol	1.55	222	$C_{15} H_{26} O$	

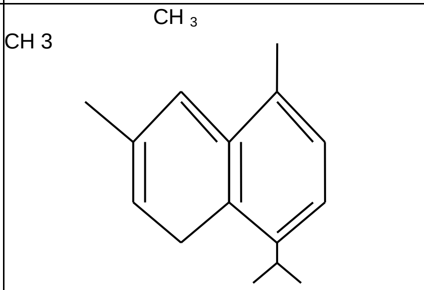
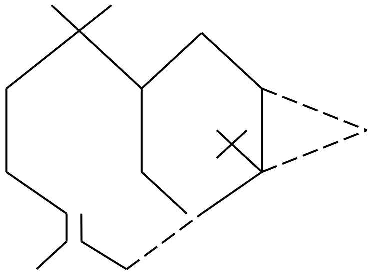
Compound	%	Molecular weights	Chemical formulas	Structure
Azulene, 7-ethyl-1,4 dimethyl	8.58	198	$C_{15}H_{18}$	
Bisabolol oxide-A	57.78	238	$C_{15}H_{26}O_2$	
Dicycloether (Cis)	8.67			
Dicycloether (trans)	0.03			
Eicosanoic acid, methyl ester.	0.75	326	$C_{21}H_{42}O_2$	$CH_3(CH_2)_{12}C\text{-}OCH_3$

Table (4): Bisabolol oxide-A content in the volatile oil of *Matricaria chamomila* as affected by storage conditions .

Containers / Month	Plastic	Glass	Cloth	Cellophane
3	58	55.3	54.5	53.5
6	55.6	57.1	55.2	54.1
9	47.8	55.8	47.5	36.4
12	57.9	58.0	53.0	50.6

In glass containers, flower heads showed on considerable differences according to storage period in glass containers. In cloth containers, bisabolol oxide-A in flower heads tended to decrease in their content up to nine months.

There results agree with of Waffaa (2001). In cellophane containers, bisabolol oxide-A content in the sample of nine months flower heads showed the minimum content of bisabolol oxide-A (36.4 %).

Effect of infestation on the content of bisabolol oxide-A:

The effect of infestation on the content of bisabolol oxide-A in the flower heads stored in different containers is shown in Table (5). It is clear that infestation and semi infestation flower heads contained higher percentage of bisabolol oxide-A comparing to control treatment in most containers.

Table (5): Effected of infestation with insects in different containers on bisabolol oxide - B content of *Matricaria chamomila* volatile oil.

Containers / Infection	Plastic	Glass	Cloth	Cellophane
Control	12.8	15.5	15.3	14.0
Semi infected	13.7	14.5	14.2	14.7
Infected	13.3	14.2	11.4	15.31

The flower heads stored at cloth showed the minimum content of bisabolol oxide-A I semi infested flower heads. bisabolol oxide-B contents in flower heads of chamomile as affected by storage containers as shown in Table (7).

Increasing storage period decreased bisabolol oxide-B contents flower heads stored in all kind of containers.

These may attributed to the conversion of bisabolol oxide –B to other compounds.

The reduction of bisabolol oxide-B after 12 months reached more than 50 % in flower heads stored at clothes as shown in Table (6).

Table (6): Bisabolol oxide-B contents in the volatile oil of *Matricaria chamomila* as affected by storage conditions .

Containers / Month	Plastic	Glass	Cloth	Cellophane
3	17.3	17.2	18.4	18.6
6	14.3	15.1	13.6	13.7
9	12.2	13.8	13.9	16.0
12	9.3	12.9	8.7	10.4

The contents of bisabolol oxide-B in the volatile oil of flower heads of chamomile stored in different containers are showed in Table (7). In plastic containers, flower heads showed gradual increase in their contents of bisabolol oxide-B up to 12 months.

Table (7): Effected of infestation with insects in different containers on bisabolol oxide - A contents of *Matricaria chamomila* volatile oil.

Containers / Infection	Plastic	Glass	Cloth	Cellophane
Control	75.2	55.9	57.5	53.6
Semi infected	54.6	54.9	50.0	51.8
Infected	61.2	57.0	54.9	51.4

In glass and cloth containers, flower heads showed gradual decrease in their contents of bisabolol oxide-B up to 12 months. The same trend was observed with cellophane containers, in which the six months sample showed lower content of bisabolol oxide-B comparing to nine months sample.

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تــاثير انــواع العبــوات والتخــزين علــى الكثافــة العدديــة للخنفســاء العنكبوتيــة *Gibbium psylloids (Zemp.)* على كمية ونوعية ازهار الكاموميل.

شريف احمد ابودنيا[1] ، منى احمد مجدالدين [2] ، منير متولى [1] و زكريا عبدالحليم عطية[2]
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تاثير معاملات ما بعد الحصاد وكذلك الخنفساء العنكبوتية *Gibbium psylloids (Zemp.)* على كم ونوع ازهار الكاموميل. اظهرت النتائج بعد فترات التخزين لمدة عامين ان التخزين فى اوعية زجاجية يكون به اقل عدد فى تعداد الحشرات يتبعه الشكارة البلاستيكية بالمقارنة بالصناديق الورقية بينما لوحظ اكبر تعداد للحشرات كان فى شنط البولى إيثلين. وكان اعلى فقد فى وزن ازهار الكاموميل فى حالة الاوعية البلاستك والاقل مان فى الاوعية الزجاجية فى نهاية السنة الثانية للتخزين، ويقل رقم الحمض فى جميع العبوات فيما عدا عبوات البولى ايثلين الذى سجل زيادة فى رقم الحمض بعد عامين للزيت الطيار.

Table (1): Mean insect numbers of *Gibbium psylloids* , and reduction percentage of oil at different type of package throughout one year of chamomile .

Storage period	Level of infestation	Mean insect number				Mean	General mean	Oil reduction			
		Plastic	Glass	Cloth	Cellophane			Plastic	Glass	Cloth	Cellophane
3	I	74.7±1.00	65.0±1.15	85.7±1.73	43.0±2.30	67.1	87.1	22.2	16.7	27.8	11.1
	II	114.3± 2.51	105.0±2.88	138.0±2.90	71.0±3.05	107.1	(d)	38.9	33.5	45.0	27.8
6	I	115.3± 8.66	90.3±2.89	164.3±2.29	66.7±5.77	109.2	145.7	33.3	27.8	40.9	18.9
	II	225 ± 1.15	145.0±6.24	246±4.61	113±7.63	182.3	(c)	50.0	44.4	55.6	33.5
9	I	201.3± 8.66	110.3±6.22	222.7±3.06	84.5±2.30	154.6	220.1	50.0	38.9	55.6	27.0
	II	331.0± 2.00	194.3±2.88	460.0±4.61	157±7.50	185.6	(b)	61.1	50.0	66.5	44.1
12	I	321.0± 5.00	145.3±4.6	337.7±14.43	112.3±8.81	229.1	313.7	55.6	44.4	61.1	33.8
	II	504.3 3.05	252±3.46	639±13.22	198±8.66	390.3	(a)	66.7	58.6	72.2	50.0
General mean Group		235.9 (a)	138.4 (C)	286.7 (b)	105.6 (d)	F (period)	1779.84				
F		1313.49									
L. S. D.		6.6				0.5	6.6				
T test (1 & 11) 9.44*											

I first level of infestation
II Second level of infestation
T test (I8II) 9.44*