J. Agric. Sci. Mansoura Univ., 33 (11): 8057 - 8070, 2008

EFFECT OF SOME NATURAL ESSEENITAL OILS ON COWPEA PRODUCTIVITY AND STORABILITY

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ABSTRACT

Field and storage experiments were conducted on cowpea cv. El- Balady during 2004/2005 and 2005/2006 seasons, to study the influence of some hybr-distillated essential oils and or their aromatic major components as natural antioxidants and safe botanical insecticides on the agronomical performance of it's plants under high temperature condition of late summer season and on the subsequent storability and insect damage of it 's 5 month stored dry seeds on ambient temperature . In this work , seven natural essential oils of thyme, eucalyptus ,clove , pepper mint, marjoram, lemonine and onion were applied in the field as emulsion foliar sprays. Also, three aromatic major components, i.e. thymol, camphor and menthon (crystal volatiles) and three essential oils, of garlic, majoram and MS were applied during storage as natural fumigants in comparison with Al – phosphide synthetic one.

The obtained results of field exp. and it's storage one revealed that, all the applied essential oils greatly improved the agronomical performance of their plants and storability of their 5 months stored seeds in the two seasons.

The most significantly effective ones were thyme, lemonine and pepper mint, respectively, those increased dry wt. of their plants by 32.5,31.4 and 27.1%, total fresh pod yield by 50.7, 46.6 and 28.00% , total seed yield by 198.3, 145.5 and110.0% over those of the control. Also, greatly improved storability and viability of their seeds reduced damage from 100% (control) to 2.2, 3.5 and 4.8%, inf. perforated seeds from 100% (control) to 2.7, 6.6 and 8.2% and wt. losses from 60% (control) to 2.0, 4.2 and 5.8% respectively .Regarding the effect of the fumigants during storage, Al-hposphide was the most effective treatment followed by MS. and thymol (natural ones) those respectively reduced seed damage from 100% to 0%, 0% and 7.5%, inf . perforated seeds from 100% to 1.0% , 2.0% and 8.0% , wt. losses from 60% to 0.4%, 1.5 % and 3.0% respectively.

For the best yield and storability of cowpea , foliar sprays of theyme or lemonine oils (2m1/L) 4 times during the growing seasons , also for the best storability of 5 month stored seeds , methyl salicylate (MS) oil 0.5 ml/kg seed applied twice as a storage fumigant were the most recommended natural and safe applications.

INTRODUCTION

Under Egyptian conditions growth, yields of fresh green pod or dry seed and it's storability of cowpea known to be dramatically depressed and damaged due to high temperature extremes (Fathy and Faried 2000 , Fathy and El- Hamady 2007) and / or the intensive infestation with cowpea weevil a bruched that infests both pods in the field and seeds in storage (Stoll 1989, El-shamma and Doss, 2002). These abiotic and biotic stressful conditions are prevailing during long period extended from May to October (growing season) and from November to April (storage). Agronomicaly, these conditions progressively causes, weak growth, poor fruit setting, abscission of the

reproductive sinks and low productivity (Wien and Zhang ,1991; Fathy and El-Hamady, 2007). More pronounced losses and damages are occurring during seed storage 90-100% perforated seeds and 60-80% weight losses due to insect infestation (Tanbzubil 1991; Keita *et al*., 2000). Biochemically , it was reported that, many biotic and biotic stresses includes heat and disease or insect infestation known to induce serious oxidative stress , enhance the production of reactive oxygene species (ROS) in high toxic and destructive levels (Bowler *et al*., 1992; Dat *et al.*, 2000) .Over accumulation of ROS during heat and biotic stress can results in cell membrane lipid peroxidation, protein oxidation,enzyme inhibition , DNA and RNA damage (Mittler, 2002; Dat *et al*., 2000 ; Richter and Schweizer, 1997).

Recently many workers illustrated that , suppression the extreme enhanced production of ROS during such conditions is of great importance to protect and ameliorate their injurious effects (Dat *et al*., 2000). This will be established by using ROS scavengers (anti–oxidants) to allow detoxification of the excess ROS , protect the plant against their destructive effects (Dat *et al*., 2000) . Also to allow the low ROS level to participate and act in signaling events to sense the stress defense responses (Dat *et al*.,2000 ; Mittler, 2002). Both synthetic and natural anti–oxidants such as VE, VC. phenols, carotenoids, glutathione, essential oils (Bowler *et al*., 1992 and Pratt , 1992), known to catalyze group of enzymes (anti – oxidant enzymes), i.e. peroxidases, catalases, and dismutoses that scavenging and lowering the levels of ROS (Bowler *et al*., 1992 ; Willekens *et al*., 1997). Wide group of phenolics and mono–terpenoids rich essential oils and/or their basic components such as thyme, eucalyptus, clove, mint marjoram basil, onion, garlic and others are characterized as strong natural anti–oxidants (Graven *et al*.,1992; Pratt, 1992; Dorman *et al*.,1995). Also, as effective botanical insecticides applied for safe control of best infestation (Yadava and Bhatnagar, 1987; Keita *et al*., 2000 ; Byunsho *et al*., 2001). For improving the agronomical behavior of many crops specially under stressful conditions Akhauri and Yadova (1999) used some botanical, i.e. castorbean and neem powder on pigeon pea, this results in satisfactory growth and yield increments as well as insect protection.

Root application of thyme, eucalyptus, clove and onion oils into sweet pepper, improved it's growth, fruit yield and reduce the severity of root rot disease (Fathy *et al*.,2003). On tomatoes, spraying combination of essential oils includes thyme, mint, lemonine, clove, garlic and MS oils was greatly ameliorate the severity of biotic TYLCV infection, increase growth and fruit productivity (Fathy and Kheder,2005). Also, using mint oil applied as fumigant and marjoram as spray during storage of seed potato, improved it's storability and the subsequent growth and yield of their plants , this explained based on the anti–oxidantal responses during heat stress (Fathy *et al*., 2005). On the other hand, these essential oils also applied for their safe insecticidal effects especially to improve storability of the stored seeds and grains; Yadava and Bhatnagar, (1987) use botanical materials for protection of cowpea against pulse beetle during 5 months storage, they found that neem and garlic gave better control , storability and viability of the stored seeds , also , those

superiored malathion (thynthetic insecticide). Keita *et al.,* (2000) found that, using some essential oils as fumigants during storage of cowpea seeds was fully effective and safe method in controlling cowpea weevil, improving seed storability and maintaing it's viability.

Byunsho *et a*l., (2001) applied some essential oils and their major constituents to control rice weevil during storage . They found that , eucalyptus oil (fumigant) was effective and superiored the chemical agents .

In addition, it was known that these oils and botanicals via their phenolics and monoterpenoids and due to their strong volatility and lipophilicty penetrate into the insect cell impaired it's membranes ,toxified it's organelles and, inhibited the mitochondrial respiration also acting as toxic fumigants, antifeedants, ovicide, inhibit oviposition and adult emergence (El – Baroty, 1997; Keit *et al*.,2000). The present work was conducted for using some essential oils and/or their major components either as emulsion foliar sprays or storage fumigants to improve cowpea yield and storability in safe way.

MATERIALS AND METHODS

Field and storage experiments were performed on cowpea plant, EL-Balady CV at EL-Baramon Exp. Farm, EL-Dakahllia governorate, Hort. Research institute during 2004 /2005 and 2005/2006 seasons . This work aimed to study the influence of some natural essential oils (EO) and/or their major components (known with their anti-oxidant and insecticidal effects), on the agronomical performance of high temperature. affected cowpea plants grown during late summer season and on viability, weight. losses, damages and insect infestation (cowpea weevil) of their seeds that stored for 5 months after harvesting.

The seeds were sowing on the beginning of May (both seasons) in hills on one side ridge 3m long and 0.6 m wide and 0.25 m in between. After emergence the plants thinned into one plant per hill . All plots contained 6 ridges with planting density of nearly 25333 plants per feddan. Half of the plot area and plants regarded for the yield of fresh pods, whereas, the reminder used for dry seeds yield.

The essential oils and major components:

The dried herb of thyme,eucalyptus,pepper mint and marjoram also,the dried flower buds of clove and seeds of onion were obtain from Hort. Res. Inst. and siecum comp.

Essential oils of these medicanal and aromatic plants extracted by hydro – distillation according to method of Charles and Simon, (1990),the other ones,i.e.methyl salicylat (MS) ,lemonine and garlic also , cystals of thymol,camphor and menthone (the basic components of thyme,eucalyptus, pepper mint oils)respectively obtained from El- Gammhoria Comp.

The exp.Procedure, treatments and parameters

1- Field and it's subsequent storage experiments:-

In this exp. a randomized complete block design with three replications and nine treatments was adopted. During the growing season, the plants were foliar sprayed 4 times, the first, one was at the beginning of flowering and the others applied every 15 days.

All oils sprayed at concentration of (2 ml/l) in emulsion from, the experimental treatments were as follows: thyme oil, eucalyptus, clove oil, pepper mint oil, marjoram oil, lemonine oil and garlic oil added to the treatment of synthetic besticide (selecron) that, sprayed also at the same times and consentraion and the control one (sprayed only with water) .

After the last spraying, five plants from each plot were taken then plant length (cm) number of leaves per plant and dry weight (gm) / plant recorded.

As for yield and it 's components , number and weight of the fresh green pods were recorded from the cumulative harvestings for each plot (half area) then , number pf pods / plant , fresh pods yield (gm) / plant and total fresh pods yield (ton) / fed.were calculated. whilst the pods of the reminder plants of each plot were harvested In late stage (fully ripe nearly dry seeds) , allowed for suitable drying after harvesting . Samples of thirty pods were taken for recording the number and weight of seeds / pod , weight (gm) of 1000 seeds . The obtained dry seeds of each plot (half plot area weighted, then seed yield (gm) / plant and (kg) / fed. were calculated . Also the relative dry weight, total fresh pods yield and total seeds yield for all treatments, were calculated as% of the control values(mean of two seasons).

As for the seed storage followed and affected by the prior field treatments 0.5 kg seeds obtained from each plot stored for 5 months under laboratory cond. within 1000 cm^3 plastic bottles covered with very fine permeable silk tissue. The bottles arranged in complete randomize design, includes nine treatments each one replicated three times, one bottle for each exp. unit. The experiment terminated after 5 months, the seeds of each treatment weighted again , then weigh loosing % was calculated . Also, samples of50 g seeds taken from each bottle , carefully examined then the perforated seeds (due to penetration of cowpea weevil / adult) were separated and weighted ; the same was doing for the damaged seeds due to rotting , decaying and etc. Then wt. loosing, inf. perforated seeds and damage percentages calculated . In addition other seeds from each treatment expose to germination test , then germination percentages and rate as well as seedling length were determining .

2-Storing seeds for five months using fumigation method for applying some essential oils and aromatic basic constituents as natural botanical insecticides (fumigants) .At harvesting time during the two seasons of this work seeds collected from untreated area (received no protection applications) were used .Similar storage procedure and design were followed, whatman paper saturated with the oils or enclosed the solid fumigants then put inside the bottle containing the seeds , the bottles were strongly closed with their caps for one week to allow the headspace and the seeds within to be fully saturated with the fumigant vapor .This

procedure performed twice at the beginning and after 2.5 months of storage .

The applied fumigants were as follows : -

Crystal major components includes thymol , camphor and menthone were used at concentration of 150 mg / 0.5 kg seeds / 1L headspace .Whereas , essential oils of garlic , marjoram and methyl salicylate oil (MS) applied at concentration of 0.25 ml / 0.5 kg seeds / 1L headspace .

The synthetic fumigant Al- phosphide applied at concentration of 25 mg / 0.5 kg seeds / 1L headspace . The control received no fumigant. At the end of the experiment , weight loosing (%) , perforated infested seeds (%) and damage (%) were determined . All the obtained date were statistically computer analyzed using ANOVA analysis and Duncen Multiple Range Test .Also, means of maximum and minimum temperatures, prevailing during the two seasons of 2004 and 2005 are presented here in Table(1) :

RESULTS AND DISCUSSION

1- **Field experiments** :

1.1- Vegetative growth :

Cowpea plants cv. El-balady grown during late summer seasons of 2004 and 2005, naturaly exposed to high temperature extremes prevailing in these seasons ,Table (1) .

under this a biotic stressful condition,antioxidants and monoterpenoids rich natural essential oils ((Graven *et al*.,1992; Pratt , 1992 ; Dorman *et al*.,1995) (thyme, eucalyptus, pepper mint, marjoram, lemonine and onion oils)were applying to improve different performances of cowpea under such condition.

The presented data in Table (2) proved that, most oils were significantly increased growth parameters (plant length , number of leaves and dry weight) of their plants over those of the control treatment in the two seasons of this work.

Among them the most effective and considerably growth enhancable ones were thyme oil followed by lemonine one, those increased dry weight of their plants by32.5% and 31.4 % respectively over the control. The other essential oils,i.e.pepper mint followed by clove,eucalyptus, onion and at least marjoram oil also,evolved considerable growth enhancement, increased dry weight of their plants over the control by 27.1%,21.2%,17.6%,15.6%and 5.1% respectively.

.On the other hand, it was clear from the same data that the synthetic inseticide selecron, also ,showed considerable growth encouraging effect , increased dry weight of it's plants by 25.6 % over the control .

This may prove that, these natural oils gave, their growth enhancable effect not only due to their antioxidantal ameliorative effect but also due to their insecticidal protective effect (El – Baroty ,1997 ; Akhauri and Yadova

,1999 ; Keit *et al*., (2000). Similar results about the beneficial effect of the essential oils on growth and reproductive performance of some vegetables during a biotic and biotic stress conditions obtained by Akhauri and Yadova ,(1999), Fathy *et al* ,(2003) ; Fathy and Kheder,(2005); Fathy *et al*.,(2005). Recently,also, under similar stress condition, it was found that growth, mineral content and productivity of cowpea were severely depressed(Fathy and El- Hamady , 2007).Regardless the direct adverse effects of high temperature extremes, recently it was known that this condition and others. Induce serious internal physiological oxidantive stress, enhanced the accumulation of reactive oxygen species ROS in high toxic and destructive level (Bowler *et al* 1992; Dat *et a*l .,2000).

Table (1): Means of maximum and minimum temperatures prevailing during 2004 and 2005

Months	2004				2005			
	Ten days mean (°c)		Months mean (°c)		Ten days mean (°c)		Months mean (°c)	
	Max.	Min.	Max	Min.	Max	Min.	Max	Min.
April	23.5	10.6	26.1	11.9	22.3	11.1	25.9	13.2
	27.6	12.2			27.7	14.1		
	27.2	12.9			27.6	14.3		
May	31.0	16.5	30.0	16.3	28.1	13.7	30.4	15.9
	29.1	15.2			32.0	16.3		
	29.8	17.2			31.1	17.7		
June	30.8	17.8	31.9	19.3	30.9	18.2	31.3	19.9
	33.0	19.3			31.8	20.4		
	31.8	20.9			32.4	21.1		
Julie	34.9	22.8	34.5	22.6	32.6	21.9	33.6	24.1
	34.8	22.8			33.5	24.9		
	33.9	22.3			34.6	25.4		
August	33.7	22.0	33.7	22.9	34.5	23.8	35.7	25.2
	34.3	21.7			35.7	24.2		
	33.0	23.2			36.8	27.7		
Sept.	32.5	21.6	32.1	19.7	35.9	24.3	34.5	20.8
	30.6	18.3			32.7	19.5		
	33.2	18.8			31.8	18.6		
. Oct	31.1	17.6	30.5	17.7	29.3	17.2	27.5	15.8
	30.0	17.4			30.0	17.2		
	30.4	18.0			23.2	12.9		

Mean having the same letter (s) in the same column do not significantly differ using Duncan's Multiple Range Test at 5% level

This followed by serious destructive internal events of cell membrane peroxidation , protein oxidation , enzymes inhibition, DNA, and RNA damage ((Mittler ,2002 Dat *et al*., 2000 ; Richter and Schweizer, 1997).

Such probable heat enchancable oxidative destructive internal events may be to far extent explain the depressed weak growth case of the control

plants in comparison with the plants of other treatments grown under the same condition .

Parameters	**Plant length(cm)**		**NO .of. leaves / plant**		**Dry weight/ plant (g)**		**Relative D .W. % of control**
seasons Treatments	**2004**	**2005**	**2004**	**2005**	**2004**	**2005**	**Mean of two seasons**
Thyme oil	119.4 A	116.20 A	53.33 A	50.33 A	80.13 A	78.15 A	132.50
Eucalyptus oil	93.87CD	92.85 C	46.00 CDE	43.00BCDF	68.23BCD	72.30 B	117.60
Clove oil	98.70 C	97.63 C	46.67 BCD	45.00ABCD	71.87ABC	72.87 B	121.20
Pepper mint oil	108.50 B	107.90 B	49.67 ABC	46.33ABC	76.83AB	75.00 AB	127.10
Marjoram oil	85.17 EF	83.00 D	40.67 EF	38.67 DE	63.43CD	62.10CD	105.10
Lemonine oil	115.70 A	113.50AB	51.67 AB	48.33 AB	79.70 A	77.26 AB	131.4
Onion oil	90.00DE	91.23 C	43.33 DEF	41.00CDE	71.97CD	66.12 C	115.60
Selecron (synth.insecticid)	108.3 B	107.20 B	49.60 ABC	46.30ABC	76.00AB	74.10 AB	125.60
Control	83.17 F	80.66 D	40.00 F	37.67 E	60.00 D	59.45 D	100.00

Table (2): Growth performance of cowpea plants as affected by foliar spray of natural essential oils during late summer seasons of 2004 and 2005.

Mean having the same letter (s) in the same column do not significantly differ using Duncan's Multiple Range Test at 5% level

Supperession of the accumulated ROS is greatly protect against heat extremes (Keit *et al*., (2000).The applied essential oils as natural anti-oxidants (their phenolics, glycosides and others) (Graven *et al*., 1992, Pratt, 1992, Dorman *et al*., 1995)may suppress the level and action of heat – oxidative effects. Again, the anti- oxidants including essential oils(El – Awady , 2006) known to catalyze internal anti-oxidant enzymes (peroxidases , catalases, dismutases and some oxidases)suppressed(scavining and detoxifying) the accumulated ROS into low level,protect against heat oxidative injurious effects also,may allowing the low ROS level to signaled (gene level) the internal anti- oxidative defensive responses (Mittler ,2002 ; Dat *et al* .,2000 ,.

In addition ,it was generally observed that the oil treated plants in comparison with the control one, were to certain extent free from insect infestation specially leaf and pod borers, this also proved that these oils in safe way may be evolved insecticidal effects (Akhauri and Yadova, 1999) protect their plants, maintain their growth size and area in healthy case.

This may be due to their action as insect repellents, antifeedants , oviposition inhibitors (El – Baroty ,1997 ; Keit *et al* .,2000)

1.2.Yeild of fresh green pods:

The data illustrated in Table (3) revealed that,in similar way, most oils greatly improved the reproductive performance of their heat stressed plants, increased significantly number and weight of pods/plant and total pods yield / fed .over those of the control in the two seasons. These thermal extremes known to be consequented by severe abscission of reproductive sinks, poor fruit setting and low productivity (Wien and Zhang, 1991; Fathy and EL-Hamady ; 2007) . On the other hand , the enhancable effect of the essential oil treatments could be explained based on their beneficial effect in similar trend on all growth parameters (Table 2) .Also, may be due to their antioxidantal protective role in preventing the thermal oxidative damage of the genetical materials, signaling certain genetical defensive responses,avoiding the thermal oxidative inhibition of the transporter and biosynthesis enzymes, maintaining cell membrane stability and functions(Mittler, 2002 ; Dat *et al*., 2000)

Table (3): Yield of fresh pods of cowpea plants as effected by foliar spray of natural essential oils during late summer seasons of 2004 and 2005.

Mean having the same letter (s) in the same column do not significantly differ using Duncan's Multiple Range Test at 5% level

In turn may be preserved the heat sensitive reproductive sinks, ensuring sufficient metabolites supply from photosynthetic sources into reproductive sinks for pod setting and filling . Moreover, their insecticidal protective action (El – Baroty, 1997 ; Akhauri and Yadava ,1999) may also be participated.

1-3- Yield of dry seeds:

Data in Table (4) showed that , most of the essential oil treatments in similar to their previous effect on growth and pod yield Tables (2) and (3) , were greatly increased number and weight of seeds / pod , seed yield / plant and total seed yield / fed. as well as weight of 1000 seed over those of the control at both seasons .

Table (4): Dry seed yield of cowpea plant as affected by foliar spray of

Param-eters	N0.ofseeds / pod		Weight of seeds/pod (gm)		W eight of 1000 seeds (gm)		seed yield /plant (gm)		Total seed yield/fed (kg) fed.		Relative yield % of control
seasons											
Treatm-ent Parameters	2004	2005	2004	2005	2004	2005	2004	2005	2004	Relative .% of control	Means of Two Season
	No. of pods /plant				Yield of fresh pods/plant(g)		Total yield of fresh pods /fed. (Ton)				
Thyme oil	14.60 A	13.5 A	2.12 A	2.00 A	145.21 BC	142.15 B	50.88 A	48.0 A	1286.9 A	1215.9 A	219.0
Eucalyptus oil	12.o ABC	11.0 BC	1.64 AB	1.54 BCDE	136.66 DE	140.0 B	26.24 BC	24.64 BCD	664.7 CD	628.2 B	153.6
Thyme oil	12.30 A	11.5 AB	1.79 A	1.68 BCD	145.53 AB	146.10 A	32.22 A	30.24 A	816.2 A	766.1 A	188.6
Clove oil	13.0 AB	12.0 ABC	1.93 A	1.72 BCD	184.37 A	185.0 A	4.666 AB	4.687 AB	118.1 ABCD		
Pepper mint oil	13.20 AB	12.7 ABC	1.93 ABC	1.72 ABCD	146.20 BC	15.43 E	38.60 AB	30.96 ABC	977.9 AB	784.3 BC	210.0
Marjoram oil	10.15 BC	10.2 CDE	1.44 BC	1.40 BE	137.17 DE	137.25 B	20.1 BC	18.2 CD	510.7 BC	461.6 CD	115.2
Lemonine oil.	13.40 AB	12.0 ABC	1.95 AB	1.85 AB	145.52 BC	142.31 B	42.9 A	37.0 AB	1026.8 AB	973.3 AB	245.5
Onion oil	11.10 BC	10.5 DE	1.50 CDE	1.47 CDE	135.14 E	136.1 B	21.0 BC	20.58 CD	531.9 BC	521.4 CD	125.5
Selecron (synth.insecticide)	13.0 AB	12.0 ABC	1.79 AB	1.70 ABC	137.7 CD	137.0 B	35.8 A	30.5 ABC	906.9 AB	725.2 BC	200.5
Control	9.7 C	9.6 E	1.46 C	1.30 E	144.32 CD	141.67 B	16.8 C	16.32 D	425.6 C	413.4 D	100.0

Treatments	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	Mean of two seasons
	seasons										
Thyme oil	14.60 A	13.5 A	2.12 A	2.00 A	145.21 BC	142.15 B	50.88 A	48.0 A	1286.9 A	1215.9 A	219.0
Eucalyptus oil	12.o ABC	11.0 BC	1.64 AB	1.54 BCDE	136.66 DE	140.0 B	26.24 BC	24.64 BCD	664.7 CD	628.2 B	153.6
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Marjoram oil	10.15 BC	10.2 CDE	1.44 BC	1.40 BE	137.17 DE	137.25 B	20.1 BC	18.2 CD	510.7 BC	461.6 CD	115.2
Lemonine oil.	13.40 AB	12.0 ABC	1.95 AB	1.85 AB	145.52 BC	142.31 B	42.9 A	37.0 AB	1026.8 AB	973.3 AB	245.5
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Control	9.7 C	9.6 E	1.46 C	1.30 E	144.32 CD	141.67 B	16.8 C	16.32 D	425.6 C	413.4 D	100.0

Treatments	2004 seasons	2005	2004	2005	2004	2005	2004	2005	2004	2005	Mean of two seasons
	No. of pods /plant				Yield of fresh pods/plant(g)		Total yield of fresh pods /fed. (Ton)			Relative .% of control	
Thyme oil	14.60 A	13.5 A	2.12 A	2.00 A	145.21 BC	142.15 B	50.88 A	48.0 A	1286.9 A	1215.9 A	219.0
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Pepper mint oil	13.20 AB	12.7 ABC	1.93 ABC	1.72 ABCD	146.20 BC	15.43 E	38.60 AB	30.96 ABC	977.9 AB	784.3 BC	210.0
Clove oil	18.0 BCD	18.0 BC	1.44 BC	1.40 BE	197.8 BC	188.32 B	5.013 AB	4.771 AB	123.5 ABC		
Marjoram oil	10.2 DE	18.0 BC	1.44 C	1.40 BE	137.25 D	200.0 B	20.1 BC	5.067 BC	510.7 CD	461.6 CD	115.2
Pepper mint oil	20.0 BC	18.0 BC	1.95 BC	1.85 AB	200.2 B	200.0 B	5.072 AB	5.067 BC	128.0 AB		
Lemonine oil.	13.40 ABC	12.0 ABC	1.95 AB	1.85 AB	145.52 BC	142.31 B	42.9 A	37.0 AB	1026.8 AB	973.3 AB	245.5
Marjoram oil	14.0 AB	13.0 AB	1.64 D	1.47 CDE	164.64 D	158.94 D	4.171 AB	4.026 AB	103.5 AB		
Onion oil	11.10 DE	10.5 DE	1.50 D	1.47 CDE	135.14 E	136.1 B	21.0 BC	20.58 CD	531.9 BC	521.4 CD	125.5
Lemonine oil	22.0 BC	20.0 CDE	2.32 ABC	2.23 CDE	232.80 A	223.60 B	5.897 BC	5.715 BC	146.6 AB		
Selecron (synth.insecticide)	13.0 AB	12.0 ABC	1.79 AB	1.70 ABC	137.7 CD	137.0 B	35.8 A	30.5 ABC	906.9 AB	725.2 BC	200.5
Onion oil	14.0 AB	14.0 ABC	1.74 ABC	1.74 ABC	174.0 B	170.72 B	4.403 AB	4.325 AB	110.3 ABC		
Control	9.7 E	9.6 E	1.46 C	1.30 E	144.32 CD	141.67 B	16.8 C	16.32 D	425.6 C	413.4 D	100.0
Selecron(synth.insecticide)	20.0A BC	18.0 BC	2.00 A	1.99 A	200.0 B	199.60 BC	5.066 AB	5.056 B	127.8 C		
Control	12.0 E	12.0 D	158.42 E	154.24E	4.013 E	3.907 D	100.0				

natural essential oils during late summer seasons of 2004 and 2005

Mean having the same letter (s) in the same column do not significantly differ using Duncan's Multiple Range Test at 5% level

The most superior ones were thyme oil followed by lemonine oil and pepper mint oil .These oils gave high total yield increments of 198.3, 145.5 % and 110.0 % respectively over the control. Also clove eucalyptus, onion and marjoram were effectively increased total seed yield of their plants by 88.6 %, 53.6 % 25.5 % and 15.9 % respectively.

The same data cleared that, selecron (synth. Insecticide) gave lower seed yield than thyme, lemonine and pepper mint oils but higher than the other oils. These yield increments as a result of essential oils application may be explained based on their ant- oxidantal ameliorative effect on the whole physiological and metabolical processes against the damage of temperature extremes. In turn may insuring potent seed setting activities followed by sufficient biometabolites supply for seed growth and development as previously cited and discussed .

2-Storage experiments

2-1- Effect of prior essential oils during field application :

The presented data in Table (5) showed the effect of the applied essential oils during the growing seasons on storability and cowpea weevil infestation as well as viability of the dry seeds obtained from their plants and stored for 5 months during 2004 / 2005 and 2005 / 2006 .

Such data indicated that, all oils were greatly improved storability of their seeds, reduced percentages of weight loss, damage and perforated seeds due to cowpea weevil infestation in comparison with the control in the two seasons. Meanwhile, paralleled these potent preserved and protective effects with considerable enhancable effect on germination parameters (viability) of their seeds and length (growth) of the emerged seeding . The same data cleared that, the most effective treatments were thyme oil, lemonine oil and pepper mint oil.These oils respectively gave more effective natural potential insecticidal effect than selecron the synthetic one,they reduced seed damage from 100 % (control) to 2.2, 3.5 and 4.8 %, inf. Perforated seeds from 100% to 2.7, 6.6 and 8.2 % and weight losses from 60 % to 2.0, 4.29 and 5.8 % (mean of the two seasons .) .

In similar,it was reported that ,a key pest of cowpea is cowpea weevil (*callosobruchus maculates*) , a bruchid that infest both pod in the field and seeds in storage (Stool , 1988) . Also,that,100% of the storage seeds can be damaged causing weight losses up to 60 % (Tanzubil , 1991) .Meanwhile , 90 -100 % losses in terms of perforated seeds occurred after 6 months storage (Keit *et al*., 2000).

In addition,many workers cited the insecticidal effects of numerous essential oils and botanicals in safe controlling of many pests (Yadava and Bhatnagar , 1987; Tanzubil , 1991 ; Akhauri and Yadava , 1999 ; Keit *et al*., 2000 and El-shamma and Doss , 2002). .These natural agents evolved their insecticidal effects via their toxic monoterpenoids and act as insect repellents,

antifeedants , oviposition and adult emergence inhibitors (El – Baroty 1997 ; Keit *et al*., 2000)

Table (5): Effect of the prior field sprays of essential oils on storability and viability of seed during 2004 -2005 and 2005-2006

parameters	Weight losses %		Damage %		Infested perforated seeds %		Germination %		Germination rate		Seedling length (cm)	
seasons Treatment	2004 / 2005	2005 / 2006	2004 / 2005	2005 / 2006	2004 / 2005	2005 / 2006	2004 / 2005	2005 / 2006	2004 / 2005	2005 / 2006	2004 / 2005	2005 / 2006
Thyme oil	2.1	1.9	2.0	2.4	2.0	2.54	100.0 A	99.40 A	1.70 A	1.65 A	23.50 A	22.82 A
Eucalyptus oil	16.4	15.2	14.0	14.6	24.0	26.0	95.80 CD	95.50 CD	1.41CDE	1.41BCD	20.32 AB	18.87 AB
Clove oil	10.4	10.6	4.0	4.4	21.0	23.0	96.40 BCD	96.70BC	1.49BCD	1.47ABCD	21.19 AB	20.13 AB
Pepper mint oil	5.8	5.8	4.0	5.6	8.0	8.4	97.20 BC	97.00ABC	1.58 ABC	1.52ABC	22.00 AB	21.60 A
Marjoram oil	20.0	22.0	5.0	5.4	29.0	32.0	94.70 CD	94.20 D	1.26 EF	1.28 DE	12.56 C	16.00 BC
Lemonine oil	4.0	4.5	3.0	4.0	6.0	7.2	98.90 AB	98.30 AB	1.62 AB	1.59 AB	22.07 AB	22.15 A
Onion oil	20.0	21.2	4.2	4.8	25.0	27.0	95.20 CD	94.80 CD	1.37 DE	1.36 CD	18.66 B	17.06 BC
Selecron(-synth. insecticide)	5.0	6.8	4.0	5.0	8.0	9.2	96.3 BCD	96.60 BC	1.48 BCD	1.46 ABCD	21.00 AB	20.12 AB
Control	59.0	61.0	100	100	100	100	94.0 D	93.70 D	1.18 f	1.15 E	14.10 c	14.3 C

Mean having the same letter (s) in the same column do not significantly differ using Duncan's Multiple Range Test at 5% level

2-2 Effect of storage fumigants :

Either the applied synthetic fumigant (Al – phosphide) or the natural ones includes thymol, camphor and menthone (aromatic crystal basic components),essential oils,i.e.MS, garlic and margoram all to far extent preserve and protect their seeds in comparison with the control during 5 months storage in the two seasons (Table 6)The same data cleared that, Al – phosphide , MS oil and thymol were the most effective ones , they highly reduced weight losses from 60 % to 0.4 ,1.5 and 3 % , damage from 100 % to 0.0 , 0.0 and 7.5 % and the inf. Perforated seeds from 100 % to 1.0 , 2.0 and 8.0 % respectively . Also camphor followed by marjoram oil,menthone and garlic oil respectively showed beneficial preserved and safe insecticidal

protective effects in the two seasons.These results and effects could be explained and agreemented as previously mentioned and cited .

Once again, from the data of storage experiments (Table 5 and 6) the most pronounced arising problems during long term storage of the harvested cowpea seeds are the progressive weight losses (60%) , damage (rotted and decayed seeds) (100%) and perforated seeds (100%) due to cowpea weevil infestation . Also, pronouncedly the safe , effective and cost effective long term preservation and protection of the storage seeds being obtained either by spraying thyme oil (2ml / L) 4 times during the growing season and / or by applying MS oil 0.5 ml /kg seeds / 1000 cm3 head space twice during 5 months storage as natural fumigant .

Table (6): Effect of essential oils and aromatic major components applied as fumigants on storability of cowpea seeds during 2004–2005and 2005-2006 seasons.

parameters / seasons / Treatments	Weight losses %		Damage%		Inf. Perforated seed %	
	2004-2005	2005-2006	2004-2005	2005-2006	2004-2005	2005/2006
Thymol	2.9	3.1	7.0	8.0	7.5	8.5
Campher	3.0	3.4	10.1	10.0	8.4	9.6
Menthone	7.4	7.8	19.9	21.1	14.1	15.9
Garlic oil	7.0	7.2	20.5	21.5	12.3	13.9
Ms oil	1.4	1.6	0.0	0.0	2.0	2.0
Marjoram	4.5	5.5	20.2	19.8	14.2	15.9
Al-phosphide	0.4	o.4	0.0	0.0	0.9	1.1
control	59.0	61.0	100	100	100	100

Mean having the same letter (s) in the same column do not significantly differ using Duncan's Multiple Range Test at 5% level

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تاثير بعض الزيوت الاساسيه (الطبيعيه) على انتاجيه وقابليه تخزين اللوبيا

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نفذت تجارب حقليه وتجارب تخزين على نبات اللوبيا (صنف البلدى) وبذورها الجافه خلال موسمى ٢٠٠٤-٢٠٠٥ و ٢٠٠٥-٢٠٠٦ لدراسه تاثير بعض الزيوت العطريه المستخلصه بالتقطير المائى و بعض موادها الفعاله العطريه كمضادات اكسده طبيعيه وكمبيدات حشريه نباتيه على الاداء المحصولى للنباتات الناميه تحت ظروف الحراره المرتفعه خلال الموسم الصيفى المتاخر وكذلك القابليه التخزينية والاصابات الحشريه للبذور المخزنه لمده ٥ شهور على درجه حراره الغرفه .

وقد استخدمت فى هذا البحث سبعه زيوت عطريه طبيعيه بطريقه الرش فى الحقل وهى زيوت الزعتر والكافور والقرنفل والنعناع الفلفلى والبردقوش واليمونين والبصل . ايضا استخدمت ثلاثه مواد فعاله عطريه هى الثيمول والكامفور والمنثون (فى صوره متبلوره متطايره) وثلاثه زيوت عطريه للثوم والبردقوش والميثيل سلسلات كمتبخرات طبيعيه بالمقارنه مع فوسفيد الالومنيوم (مبيد متبخر تخليقى) .

وتلخصت النتائج الحقليه ونتائج التخزين فى الاتى :-

ادى رش كل الزيوت العطريه (مضادات اكسده ومبيدات طبيعيه) الى تحسن كبير فى الاداء المحصولى والقابليه التخزينيه للبذور المخزنه لمده ٥ شهور وكانت زيوت الزعتروالليمونين والنعناع الفلفلى على التوالى افضلها بدرجه معنويه حيث ادت الى زياده الوزن الجاف لنباتاتها بمقدار ٣٢,٥ – ٣١,٤ -٢٧,١% والمحصول الكلى للقرون الغضه بمقدار ٥٠,٧ -٤٦,٦ -٢٤,٠% والمحصول الكلى للبذورالجافه بمقدار ١٩٨,٣ -١٤٥,٥ -٠.١١٠ % مقارنه بالنباتات غير المعامله .

وفي تجربة التخزين الأولي التي اعقبت المعاملات الحقلية ايضا حسنت نفس المعاملات بدرجه كبيره القابليه التخزينيه وحيويه بذورها وخفضت نسبه البذور التالفه من ١٠٠% الى ٢,٢ -٣,٥ -٤,٨ % ونسبه البذور المثقبه والمصابه بخنفساء اللوبيا من ١٠٠% الى ٢,٧ -٦,٦ – ٨,٢ % ونسبه الفقد فى الوزن من ٦٠% الى ٢,٠ – ٤,٢ – ٥,٨ % على التوالى. وفى تجربه التخزين الثانيه (معاملات اثناء التخزين) كانت معاملات التبخير بفوسفيد الالومنيوم يليها زيت الميثيل سلسيلات العطري يليها الثيمول العطرى هى الافضل بدرجه كبيره فى تحسين القابليه التخزينيه حيث خفضت نسبه التلف من ١٠٠% الى ٠ - ٠ -٧,٥% ونسبه البذور المصابه المثقبة من ١٠٠ % الى ١ – ٢ -٨ % ونسبه الفقد فى الوزن من ٦٠ % الى ٠,٤ – ٥.١ – ٣,٠ % على التوالى .

لذلك توصى الدراسه برش زيت الزعتر العطرى او زيت الليمونين العطرى بتركيز (٢ مل / لتر) اربعه مرات خلال موسم النمو لنباتات اللوبيا الناميه تحت ظروف الحراره المرتفعه للحصول على اعلى محصول للقرون والبذور وافضل قابليه تخزين وأقل خسائر واصابات للبذور المخزنة لمدة ٥ شهور علي درجة الحرارة العادية.

كذلك استخدام زيت الميثيل سلسيلات بطريقه التبخير فى المخازن (مرتان) بتركيز (٠,٥ مل /١ ك بذور / ١٠٠٠ سم^{٣} فراغ) كمعامله'طبيعيه آمنه للحصول على افضل قابليه تخزينيه واقل خسائر و إصابات للبذور المخزنه لمده ٥ اشهر علي درجة الحرارة العادية.