A STUDY ON SOME STORED PRODUCTS INFECTED BY *CALOGLYPHUS BERLESEI*

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ABSTRACT

This experimental work was carried out to study the effect of infection by *Caloglyphus berlesei* on some stored products (soybean, wheat, maize and fishmeal) on some chemicals change. Also, Soybean, wheat, maize and fishmeal stored for three months, treated with basil and thyme at the level of 0.5%, 1.0% and 1.5% and infected with *Caloglyphus berlesei* in incubator at 28 ± 2°C, mites count monthly. The results showed that infection stored soybean, and wheat by *Caloglyphus berlesei* decreased protein content, but fiber were increased. Stored maize and fishmeal infected by *Caloglyphus berlesei* decreased protein and fat but moisture, fiber, NFE (Nitrogen Free Extract) and ash were increased. Soybean, wheat, maize and fishmeal after stored population of *Caloglyphus berlesei* increased. Adding basil powder and thyme powder with concentration of 0.5%, 1.0%, 1.5% to stored products reduce the population of *Caloglyphus berlesei*. It was clear that adding thyme 1.5% gave the lowest number of *Caloglyphus berlesei* in different period compared with other groups.

Keywords: *soybean, wheat, maize, fishmeal, basil, thyme*

INTRODUCTION

Mites are a major cause of qualitative and quantitative losses to several stored products. The pest importance of stored product mites has been reviewed and three pest risks are suggested direct consumption on human food, animal feed or other products changing the quality of infected products, they can penetrate the hard grains and feed directly on the grain kernels, therefore they destroy their germination power, change the moisture contents of medius, initiating growth and spread mold (Taha, 1985 and Gulati and Mathur, 1995). The mites change the quality of infected food by the production of secrets and feces. The massive infestation of mites changes the smell of stored products. The stored-product mites cause hypersensitivity not only for stored grain and farm workers, millers and bakers, but they also seriously endanger the health of the city population (Luczynska, *et al.* 1990; Musken, *et al*. 2003).

The soybean is one of the most economical and valuable agricultural commodities because of its unique biochemical composition. Among cereal and other legume species, it has the highest protein content (around 40%). The soybean also contains about 20% oil, the second highest content among all food legumes. Wheat is one of the most important cereal crop worldwide, in terms of production and utilization (Nadeem, *et al*. 2010). It is a major source of nutrients in many regions of the world. Wheat comprises of numerous valuable nutrients. The prime components of interests in the grain are starch (60-70%), proteins (10-15%) and non-starch polysaccharides (Saulnier, *et al*. 2007; Leon, *et al*. 2010). El-Wakil, (2011) found that basil and thyme oils at 2% caused 100% suppression of the fungal infection on peanut. Basil and thyme oils caused 100% disease control when used at both concentrations 1.5 and 2%. Fish meal is a dry fish protein concentrate consisting of typically more than 70% protein, approximately, 10% fat, approximately 10% ash, and less than 10% water (Mjøs and Solvang, 2006). Gad, (2008) studied the effect of mites on stored food, chemical analysis showed that carbohydrate, water and protein decreased but fiber, ash and fat did not effected by infection of mites. Bashir *et al*.(2013); Mahmood (2013) studied the change in quality of wheat grains in terms of physical characteristics (thousand kernel weight, moisture, wet and dry gluten), chemical characteristics (crude protein, crude fat, fiber, ash and starch) when infected by varying levels of mite infestation for six months were observed. Moisture contents were increased in grains having highest number of mites. Thousand kernel weight, wet gluten, dry gluten, crude protein, fat and starch contents were decreased in the treatments having maximum

number of mite population after six months of storage. The fiber contents increased significantly in highly infested grains. The ash contents increased in the infested grains.

Rajashekar, *et al*. (2012) develop method for grain protectants with reduced use of synthetic chemical insecticides. The main advantages of botanical pesticides ecofriendly, easily biodegradable, nontoxic to no target organisms, and many plant derived natural products acting against insects could be produced from locally available raw materials. Botanical insecticides have long been touted as attractive alternatives to synthetic chemical insecticides for pest management because botanicals reputedly pose little threat to the environment or to human health.

Mites cause qualitative and quantitative damage to stored products as they feed on its food and on the grain kernels. Consume more than 3% of the grain weight, decrease the grain germination, the deterioration of seed quality, make it unsuitable for consumption, reduction the marketing value because skins moulting and feces, change the moisture contents, initiating growth and spread mould also lead to harm humans feeder as it distraction stomic and allergic respiratory and inflammation of the mucous membranes of the nose and skin allergen.

The present work aimed to study the effect of infection by *Caloglyphus berlesei* on chemical composition of some stored products and study the effect of different levels of basil and thyme on *Caloglyphus berlesei* population.

MATERIALS AND METHODS

Chemical analysis of (wheat, soybean , maize and fishmeal) were evaluated for proximate composition [moisture, crude protein, crude fat, crude fiber, Nitrogen Free Extract (NFE) and ash according to the procedure described in AACC., (2000), methods. The NFE was calculated according to the following equation:

NFE = 100 – (% crude protein + % crude fat + %crude fiber + % ash).

Samples were analyzed before and after infestation, in Feed Analysis Unit, Animal Production Research Institute, Project fooder production from waste, Ministry of Agriculture, Dokky.

Samples of (wheat, soybean, maize, fish meal) free from any infestation were taken to laboratory of Department of Agricultural Zoology and Nematology Faculty of Agriculture Al-Azhar University. Different ratios of the two types of powders medicinal and aromatic Plants: basil powder (*Ocimum basilicum*) and thyme (*Thymus vulgaris*) at concentration of 0, 0.5%, 1.0% and 1.5%. Each of 100 gm were infested with *Caloglyphus berlesi* two males and females in stage of immaturity and propagation for the first time), three replicate for each experiment were done, control (free from any infestation). Experiment left at incubator at 28 ± 20C., the plastic can were covered with performed cover, adding water weekly, taking mite counts monthly and calculate the percentage reduction in accordance with the equation Abbott, (1925). Abbott's

formula: Corrected % = $\left(1 - \frac{\text{n in T after treatment}}{\text{n in Co after treatment}}\right)$

Where: n = Insect population, T = treated , Co = control

Statistical analyses

Statistical analysis of obtained data was conducted using SAS (SAS Institute, 1998).

RESULTS AND DISSCUSSION

The effect of infection by Caloglyphus berlesei on biochemical compounds of some stored products:

In this study the biochemical components of uninfected and infected soybean were analyzed after three months.

Data in Table (1) show that there were significant differences between infected and uninfected stored soybean in protein contents which were decreased from (48.62 % to 46.37%). Also, there were significant differences between infected and uninfected stored soybean in moisture and fiber contents. Moisture were increased from (12.73% to 18.22%) and fiber were increased from (8.55 % to 10.60%). There were no significant differences between infected and uninfected stored soybean in ash, NFE, and fat contents.

Table (1): The effect of infection by *Caloglyphus berlesei* on biochemical composition of stored soybean

Biochemical composition %	Uninfected	Infected
Protein	48.62 ± 0.54 [a]	46.37 ± 1.19 [b]
Moisture	12.73 ±0.76 [b]	18.22 ±0.68 [a]
Fiber	8.55 ±0.56 [b]	10.60 ± 0.92 [a]
Fat	1.74 ± 0.37	1.32 ±0.92
NFE	34.88 ±0.64	35.42 ± 3.36
Ash	6.21 ± 0.69	6.29 ± 0.47

Means followed by a different superscript letter only within each row are significantly different (P ≤0.05).

NFE: Nitrogen Free Extract

Data presented in Table (2) show that there were significant differences between infected and uninfected stored wheat in protein contents which were decreased from (8.32 % to 6.28%) after three months. While, there was a significant increase in fiber % from 8.44% in uninfected wheat to 11.5% in infected wheat. There were no significant differences between infected and uninfected stored wheat in moisture, ash, NFE, and fat contents.

Table (2): The effect of infection by *Caloglyphus berlesei* on biochemical composition of stored wheat.

Biochemical composition %	Uninfected	Infected
Protein	18.32 ±0.17 [a]	6.28 ± 0.23 [b]
Moisture	9.81 ±0.99	11.63 ±0.76
Fiber	8.44 ±0.36 [b]	11.5 ± 0.51 [a]
Fat	0.59 ±0.34	0.49 ±0.01
NFE	70.93 ±0.08	79.0 ±16.13
Ash	1.72 ±0.60	2.69 ±0.65

Data listed in Table (3) show that there were no significant differences between infected and uninfected stored maize in all biochemical composition contents, where protein and fat were decreased from (6.96% to 6.05%) and (1.29% to 0.64%), respectively after three months. While, moisture, ash, NFE and fiber were insignificantly increased from (11.32% to 11.75%), (1.04% to 1.16%), (87.88% to 88.59%) and (2.83% to 3.55%) respectively.

Data in Table (4) show that there were no significant differences in biochemical values between infected and uninfected stored fishmeal. Moisture, ash, fiber and NFE contents were insignificantly increased from (2.25 % to 3.00 %), (7.59% to 8%), (3.70% to 3.76%) and (36.16% to 38.24%) respectively. But protein and fat were contents decreased from (45.25% to 43.5%) and (7.3% to 6.5%) respectively.

Table (3): The effect of infection by *Caloglyphus berlesei* on biochemical composition of stored maize.

Biochemical composition %	Uninfected	Infected
Protein	6.96 ±0.76	6.05 ± 0.15
Moisture	11.32 ±0.62	11.75 ± 1.45
Fiber	2.83 ±1.04	3.55 ±0.76
Fat	1.29 ±0.44	0.64 ±0.11
NFE	87.88 ±1.22	88.59 ±2.47
Ash	1.04 ±0.06	1.16 ±0.48

Table (4): The effect of infection by *Caloglyphus berlesei* on biochemical composition of stored fishmeal.

Biochemical composition %	Uninfected	Infected
Protein	45.25± 4.52	43.5±1
Moisture	2.25 ±1.1	3.00 ±0.4
Fiber	3.70 ±0.7	3.76 ±2.58
Fat	7.3 ±0.34	6.5 ±1.1
NFE	36.16 ±2.34	38.24 ±0.04
Ash	7.59 ± 1.09	8 ±0.5

The present findings agree with Cook, *et al*. (2004) and Hubert, *et al*. (2010) who they reported that higher moisture increased mite population in stored grains. Results regarding decrease in protein and fat content can be compared with Parkinson, (1990) who concluded that mites prefer to feed on commodities with high protein and fat content. Jood, *et al*. (1995) and Ahmedani, *et al*. (2009) who declared that protein and fat content were decreased, but there were an increase in ash and fiber content of stored wheat infested by various insect pest. The bad effect as a result of infection may be due to that mite infested grains undergo a series of changes in their chemical composition and affecting the germination capacity flour prepared from contaminated grains is more acidic, has fusty smell and bitter in taste (Stejskal, *et al*. 2002).

The effect of different levels of basil and thyme powders on the population of Caloglyphus berlesei reared on some different stored products.

As shown in Table (5) adding basil powder and thyme powder with concentration of 0.5%, 1.0 % and 1.5% to infected soybean had an effect on the population of *Caloglyphus berlesei*. After one month of adding of basil and thyme at level of 1.5 %, decreased the number of mites comparing with 0 .5 % and 1.0%.I t was clear that adding thyme 1.5% gave the lowest number of *Caloglyphus berlesei* when reared on soybean in different periods (10,12 and 8 mites) respectively, compare with other groups. The highest corrected percentage 93% was observed also with 1.5 % thyme after three months.

Results in Table (6) show that it was clear that adding thyme 1.5% gave the lowest number of *Caloglyphus berlesei* when reared on wheat being 7,10 and 10 mites during first, second and third months, respectively, compare with other groups. The highest corrected percentage 83% was observed with 1.5 % thyme after three months.

Results presented inTable (7) declear that adding thyme 1.5% gave the lowest number of *Caloglyphus berlesei* when reared on maize in different periods being 2,4 and 7 mites respectively, compare with other groups. The highest corrected percentage 85%was observed with 1.5 % thyme after three months.

Results illustrated in Table (8) show that adding thyme at rat of 1.5% gave the lowest number of *Caloglyphus berlesei* when reared on fishmeal in different periods (9, 15 and 8 mites) respectively, compare with other groups. The highest corrected percentage 92% was observed with 1.5 % thyme after three months.

Table (5). The effect of soybeans; (*Glycine max* L.) treated with different levels of thyme powder (*Thymus vulgaris)* and basil powder *(Ocimum basilicum)* on the means population of *Caloglyphus berlesei*

Treatments		Initial	1 Month		2 Month		3 Month	
			Means	Corrected %	Means	Corrected %	Means	Corrected %
soybeans *Glycine Max* L	Control	0	0		0		0	
	Mites	4	38		100		123	
	basil 0 .5%	4	25	34	32	68	41	66
	basil 1.0%	4	22	42	28	72	39	68
	basil 1.5%	4	15	60	21	79	30	75
	thyme 0.5 %	4	20	47	29	71	25	79
	thyme 1.0%	4	14	63	18	82	22	82
	thyme 1.5%	4	10	73	12	88	8	93

Table (6) : The effect of wheat; *(Triticum aestivum)* treated with different levels of thyme powder (*Thymus vulgaris*) and basil powder (*Ocimum basilicum*) on the population of *Caloglyphus berlesei*

Treatments		Initial	1 Month		2 Month		3 Month	
			Means	Corrected%	Means	Corrected%	Means	Corrected%
wheat (*Triticum aestivum)*	Control	0	0		0		0	
	Mites	4	20		55		60	
	basil 0 .5%	4	14	30	32	41	47	21
	basil 1.0%	4	12	40	25	54	35	41
	basil 1.5%	4	9	55	19	65	26	56
	thyme 0 .5%	4	15	25	29	47	32	46
	thyme 1.0%	4	11	45	18	67	12	80
	thyme 1.5%	4	7	65	10	81	10	83

Table (7). The effect of maize;*(Zea maize*) treated with different levels of thyme powder (*Thymus vulgaris*) and basil powder (*Ocimum basilicum*) on the population of *Caloglyphus berlesei*

Treatments		Initial	1 Month		2 Month		3 Month	
			Means	Corrected%	Means	Corrected%	Means	Corrected%
maize*(Zea maize)*	Control	0	0		0		0	
	Mites	4	13		40		48	
	basil 0 .5%	4	10	23	25	37	30	37
	basil 1.0%	4	8	38	13	67	20	58
	basil 1.5%	4	5	61	6	85	13	72
	thyme 0.5%	4	12	7	10	75	18	62
	thyme 1.0%	4	6	53	6	85	10	79
	thyme 1.5%	4	2	84	4	90	7	85

Table (8). The effect of fishmeal treated with different levels of thyme powder (*Thymus vulgaris*) and basil powder (*Ocimum basilicum*) on the population of *Caloglyphus berlesei*

	Treatments	Initial	1 Month		2 Month		3 Month	
			Means	Corrected%	Means	Corrected%	Means	Corrected%
	Control	0	0		0		0	
	Mites	4	29		98		114	
fish meal	basil 0.5%	4	18	37	47	52	58	49
	basil 1.0%	4	15	48	41	58	35	69
	basil 1.5 %	4	10	65	28	71	15	86
	thyme 0.5%	4	17	41	35	64	25	78
	thyme 1.0%	4	11	62	23	76	12	89
	thyme1.5%	4	9	68	15	84	8	92

Stored products for long period increased the number of mites. In Table 5, 6, 7 and 8 all treatments with basil and thyme decreased mites in different periods. Adding basil at 1.5% to different stored products decreased the number of mites compared to other levels 0.5% and 1% basil. Adding 1.5% level of thyme gave the highest decrease of mites in different stored products and different period.

From Tables 5, 6, 7 and 8 it appeared that *Caloglyphus berlesei* prefer to rear in stored soybean as food compare to wheat, maize and fishmeal. The previous results were in agreement with White, *et al.* (1979) who found that acarine numbers generally increased with time. The increase in population due to biological processes and feeding activity (Gad, 2008). El-Wakil, *et al.* (2011) found that basil and thyme oils caused 100% reduction percentage when used at both concentrations (1.5 and 2%) as they caused 100% suppression of the fungal infection.

Also, obtained data agree with Ke´ ita, *et al.* (2001) who found that the essential oils from sweet basil, *Ocimum basilicum*, and African basil, *O. gratissimum*, (Labiatae) exhibited a significant effect both on the egg hatch rate and on the emergence of adults. It appear that adding repellent materials of thyme by concentration 1.5% were the effective of another methods to control of *Caloglyphus berlesei* as it reduced its population compare to other concentrations. The main advantage of basil and thyme are a natural part of human food, and has no negative effect on final consumers.

CONCLUSION

- Infection by *Caloglyphus berlesei* decrease protein in stored product.
- Stored products for long period increased the number of mites.
- *Caloglyphus berlesei* prefer to survive in stored soybean as food compare to wheat, maize and fishmeal.
- Adding thyme at level of 1.5% gave the lowest number of *Caloglyphus berlesei* in different period compared with other groups.

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دراسة على بعض المنتجات المخزنة المصابة بـ*Caloglyphus berlesei*

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أجريت هذه التجربة لدراسة تأثير الاصابة بـ*Caloglyphus berlesei* على بعض التغيرات الكيميائية للمواد المخزنة (الصويا، القمح، الذرة، مسحوق السمك)، كما تم دراسة تأثير اضافة الريحان والزعتر بنسب (٥و، ١ ، ٥و١ %) لمدة ثلاثة شهور على أعداد *Caloglyphus berlesei* كما تم التحضين على ٢٨ ± ٢ ^{0}م . وأظهرت النتائج أن الصويا والقمح المصابين ب *Caloglyphus berlesei* قد انخفض فيهم محتوى البروتين ولكن الألياف قد زادت . الذرة المخزنة المصابة وكذلك مسحوق السمك ايضا قل به البروتين والدهون ولكن زادت الرطوبة والألياف والنشويات والرماد. مسحوق الصويا والقمح والذرة والسمك بعد تخزينهم زادت بهم أعداد *Caloglyphus berlesei* . إضافة الريحان والزعتر بنسب (٥و0 ، ١ و ٥و١%) انقص اعداد الأكاروس . كان من الواضح أن إضافة الزعتر بنسبة ٥و١ % أعطى أقل الأعداد من *Caloglyphus berlesei* *فى القترات المختلفة مقارنة بالمجاميع الأخرى.*