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EFFECT OF SPRAYING INSECTICIDE TREATMENTS AND STORAGE PERIOD ON QUALITY OF SOME FABA BEAN (*Vicia faba* L.,) SEEDS

BY

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ABSTRACT

Plant-derived insecticides were found to be useful for controlling insects infestation in storage without any adverse effect on seed viability. The objective of the present study was to determine the efficiency of spraying extracts of Plant-derived insecticides namely neem kernel and black pepper in addition to a recommended application of Malathion-57% at flowering and seed setting stages on seed viability, seedling vigour, insect infestation and seed weight loss and its chemical composition (protein, carbohydrates) during storage of 0, 6,12,18 months. Two field experiments were carried out at Tag El-Eizz Agricultural Research Station, Agricultural Research Center (ARC), during 2002/2003 and 2003/2004 .While storage studied were conducted at Seed Technology Research Section, Giza under normal conditions during 30 June 2003 till December 2005. The results revealed that there was a gradual reduction in seed viability as measured by seed germination, seedling vigor and a gradual increase in insect infestation loss of seed weight. The reduction was related to the applied insecticide and storage period. Malathion-57%, ethanol extracts of neem kernel and black pepper, respectively were more efficient compared with the control. Prolonging storage period increased loss of seed weight, protein content and insect infestation levels, whereas increasing of storage period till 18 months slightly decreased seed germination, seedling vigour and carbohydrate percentage. Seeds of the variety Giza 3 were more resistant to insect infestation than Giza 2 and Sakha 1 respectively. The results suggest that spraying ethanol extracts of neem kernel and black pepper at flowering and seed setting stages as an alternative approach of using Malathion-57% before storage to keep quality of faba bean seed and for controlling insect infestation for 18 months.

INTRODUCTION

The most important feature of presowing seed for long periods is based on maintaining viability and other attributes of quality seed above prescribed minimum standards. Therefore, it is important to understand various factors that directly or indirectly influence seed during storage. There are two groups; the first group includes biotic factors such as the temperature, humidity, and seed moisture and oxygen availability. The second group includes the internal feeder or insects which lay their eggs at preharvest stage of seeds, and the external feeder or insects which infest seed and feed on their embryo/germs portion making seeds

totally unfit for germination Jackai and Daoust (1986). Ogunwolu and Odunlans,(1996) stated that storage insects cause many problems while it attaches the embryo, feeds on surface, consume nutrition components, encourages moisture uptake by infested grains, promotes the development of micro-organisms and reduce seed viability Under traditional conditions, infestation percentage reached 100% after 3 to 5 months from storage. Booker, (1967) and Caswell and Akibu, (1980). Furthermore, insect damage in stored grains and pulses may amount to 10-40% in countries where modern storage technologies have bean introduced El-Hamady *et al.*, (1999). Gupta *et al.*, (1998) and El-Lakwah *et al.*, (1999) reported that insecticidal treatment with Malathion before harvest is an important approach in order to prevent carry over of field infestation to the warehouse. But, using chemical insecticides has serious drawbacks such as, genetic resistance, toxic residues, worker safety, increasing costs of application, adverse effects on environment, decrease seed viability, and seedling vigor Krishnasamy and sheshu (1990) and Attia *et al.*, (1995). Recently, increasing attention has been given to control the storage pests through using plant materials as insecticides, Shaaya *et al.*, (1991) Miah *et al.*, (1993); Tembo and Murfih (1995). Plant materials and their derivatives are through to be generally much safer than chemical insecticides Jackai and Daousl, (1986) and had no adverse effects on seed germination or plant growth George and Patel, (1992) Furthermore, Jotwani and Sirear (1967); Makanjuola, (1989) and Echendu, (1991) reported that neem extracts reducing infestation of cowpea seeds by *Callosobruchus maculates* and there was no adverse effect on seed viability Also, El-Lakwah *et al.*, (1999) reported that the application of nemazal at the highest concentrations reduced the loss in weight of cowpea from 16.4% to 1.2% after two months from storage. The compound responsible for these activities is azadiraction a terpenoid that isolated from neem Butterworth and Morgan, (1971) . Also, Helen, (1977), reported that ground black pepper were highly toxic to cowpea weevil, *Callosobruchus maculates(F.)* and it is activity. On the other hand, Desroches *et al.*,(1995), reported that, *Vicia faba L.*, genotypes differed in infestation level by *Callosobruchus chinensis L.*, and *C. macultus F.* by the presence or absence of tannins in the seed coat and in the level of vicine and convicine in cotyledons, the larva of *C. maculates* could only develop well in seeds poor in vicine and convicine.

The objective of this study was to determine the effect of spray some faba bean plants with malathion (57%) Neem and Black Pepper solutions during flowering and pod filling stages on viability, seedling vigour, insect infestation, seed dry weight loss, protein and carbohydrate percentage faba bean seed.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Tag El-Eizz Research Station, Dakhlia Governorate in 2002/2003 and 2003/ 2004 seasons to study the effect of spraying some faba bean varieties with some insecticides and storage periods on seed viability, seedling vigour, insect infestation, seed dry weight loss, protein and carbohydrate percentage. Samples of Faba bean seeds were obtained from Legumes Crops Research Program at Field

Crop Research Institute, Agricultural Research Center, Giza, Egypt and planted in 15th November in the two seasons in ridges 3 5 meters long and 60 cm apart, the size of each sub- plot was 10.5 m^2 Split- plot Design with four replicates was utilized. The insecticide treatments were arranged in main plots; meanwhile faba bean varieties were arranged in sub-plots. All agriculture practices were performed as recommended by Ministry of Agriculture and Land Reclamanation. Seeds of Neem and Black Pepper were air dried for 10 days followed by further drying in air oven at 45 C^0 for 24 hr, the dried seeds were ground into powder using an electrical blender, sieved and preserved in a well closed containers, away from light and moisture until they were used in preparation the crude extracts. Plant extracts were prepared according to the method adopted by Freedman *et al.*,(1979). Faba bean plants were sprayed with the malathion-57%, neem and black pepper solutions at flowering and pod filling stages After harvest each sample was sieved and cleaned from husk, dust and stored in cloth bags following the studied traits were recorder directly after harvest and after 6, 12 and 18 months from storage

Germination percentage was calculated according to ISTA rules, (1999).Germination index and germination energy was calculated according to Ruan *et al.*, (2002). Mean germination time was estimated according to Alvarado et al., (1987). Germination rate was defined according to Bartlett, (1937). At the final count of germination test ten of normal most vigorous seedlings from each replicate were taken to measure the plumule and radical length in cm. Seedling vigor index was calculated with the help of data recorded on germination percentage and seedling growth according to International seed testing Association (ISTA, 1985) by the formula given below

Seedling vigor index= Seedling length (cm) x Germination percentage.

After that, the seedlings were dried in hot-air oven at 85 C^o for 12 hours. protein content (%) and carbohydrate were assessed according to A.O.A.C. (1999). Insect infestation was expressed as a percentage of damage seeds according to Jood *et al.*, (1996). At the end of each storage period the dry weight loss percentage was calculated according to Dick, (1987)

Data collected from these experiments were subjected to analysis of variance as combined analysis as mentioned by (Gomez and Gomez,1984), and the treated averages were compared by using the least significant differences (LSD) method.

RESULTS AND DISCUSSION

Table (1) showed the effect of storage period on seed viability and seedling vigour. Prolonging storage period from harvesting to 18 months reduced significantly seed germinability from 99 to 91 However, it still meets the standard required for seed certification and trade (85%) Germination index, germination energy and germination rate were slightly influenced by storage period of 18 months. But, there was no significant effect of storage period on mean germination time The reduction in seed germinability after 12 and 18

months of storage might be due to high respiration rate. On the other hand, the three faba bean varieties have bean reacted similarly to the storage period and insecticide treatments with the exception for germination energy of seeds Giza 3 where it was lower than those of other varieties (Giza 2 and Sakha 1).It is to be noted that the initial seed quality is of great interest. This because seed lots of vigorous and non-deteriorated seeds can be stored for longer than deteriorated lots. In our study the initial germination percentage was high (95%). In this case of high quality seed, it is possible to carry over the seed for longer period (18 months).

Table (1): Effects of storage period and insecticide treatments on seed viability indicators of three faba bean varieties (combined data in 2003 / 2004 and 2004/2005 seasons).

Treatment	Standard germination %	Germination index	Germination energy	Mean germination time (day)	Germination rate
A- Storage period/M					
0	99	4.36	13.30	3.83	0.643
6	98	4.38	13.20	3.83	0.640
12	95	4.26	13.20	3.82	0.631
18	91	4.15	13.10	3.82	0.621
LSD at 0.05%	**1.0**	**0.43**	**0.2**	**ns**	**0.002**
B- Varieties					
Sakha 1	95	4.26	13.11	3.81	0.631
Giza 3	96	4.30	12.19	3.84	0.638
Giza 2	96	4.30	13.26	3.83	0.633
LSD 0.05%	**n.s**	**n.s**	**0.16**	**ns**	**n.s**
C- Insecticide treatments					
Control	95	4.26	13.14	3.79	0.630
Black pepper	96	4.26	13.17	3.84	0.633
Neem kernel	96	4.28	13.20	3.84	0.635
Malathion	97	4.34	13.22	3.84	0.637
LSD 0.05%	**1.0**	**n.s**	**n.s**	**ns**	**n.s**

Seedling characters were also influenced by storage periods and insecticide treatments (Table 2). The length of plumule and radical of the seedling from seed stored for 12 and 18 months was significantly lower than that of seeds at the beginning of storage. This specially true for the length of plumule and length of studied faba bean varieties. Treating seed with Malathion, neem kernel and black pepper was significantly higher than that of untreated seeds. Parkin (1963) has reviewed the use of contact insecticides on seed viability. He stated an adverse effect of insecticides on seed viability and vigour and some of them are

dangerous to handle. Nevertheless, in our study we have used successfully Malathion, neem and black pepper without ing reduction in seed viability and seedling vigour. There were insignificant differences between faba bean varieties as to seedling length (plumule+radical) and its vigour and it might be due to slight variation in genetic composition. might be due to differences in seedling thickness which have not been measured in this study. The main effect of insecticide treatments revealed that plant-derived insecticides Black pepper. Neem kernel and Malathion were more efficient in their effect on seedling characters compared with control treatment. The authors believe that the effect of plant-derived insecticides and Malathion on seedling characters is similar to its effect on seed germinability with increasing storage period.

Table (2): Effects of storage period, and insecticide treatments on seedling characters, of three faba bean varieties (combined data in 2003/2004 and 2004/2005 seasons).

Treatment	Plumule length (cm)	Radical length (cm)	Seedling dry weight (g)	Seedling vigor index
A- Storage period/M				
0	11.1	11.8	4.38	2262.4
6	10.6	11.2	4.24	2147.9
12	10.0	10.6	3.79	1957.9
18	9.1	9.3	3.60	1687.5
LSD at 0.05%	**0.11**	**0.13**	**0.05**	**21.4**
B- Varieties				
Sakha 1	10.3	10.8	4.40	2021.2
Giza 3	10.2	10.7	4.16	2018.8
Giza 2	10.1	10.6	3.58	2001.8
LSD at 0.05%	**n.s**	**n.s**	**0.06**	**n.s**
C- Insecticide treatments				
Control	9.8	10.3	3.96	1914.2
Black pepper	10.1	10.7	4.04	2000.7
Neem kernel	10.4	10.9	4.07	2045.4
Malathion	10.5	11.1	4.12	2095.3
LSD 0.05%	**0.11**	**0.13**	**0.05**	**21.4**

Table (3) showed that storage period and insecticides treatments had an obvious effect on seed composition (protein and carbohydrate), insect infestation level and losses in seed dry weight. Seed protein was represented 28.7% of the whole seed weight after 18 months compared to 26.9% at the beginning of storage Doharey *et al.*, (1983) concluded that green gram seed protein increased with increasing storage period and insect infestation with legume weevils.

Seed carbohydrate was represented 68.7% of the seed at the beginning of storage in contrast with 64.9% after 18 months. The difference in seed protein (%) after 18 and 0 months (control) was associated with an opposite difference in

seed carbohydrate (%) which might be explained by increasing insect activity as storage period increased. The insects in storage are feeding on carbohydrate rather than other components of the seed and therefore the increase in insect infestation as a companied with a decrease carbohydrate% and an increase in weight losses of the seed. Seed of Giza 3 had higher protein content than those Giza 2 and Sakha 1 varieties. As a result Sakha 1 and Giza 2 respectively had higher carbohydrate % than Giza 3. Nevertheless, there were insignificant differences between the three varieties in insect infestation and weight loss percentage (Table 3). On the other hand the mean effect of Malathion and plant-derived insecticides and insect infestation level on protein and weight loss of the seed was significant compared with untreated seed (control). But, there was insignificant effect of various insect treatments on carbohydrate content of the seed.

In conclusion, faba bean plants (*Vicia faba L.*) can be sprayed with malathion or ethanol extracts of Neem and Black Pepper to control legumes weevil and storage until 18 months without harmful effect on seed viability or seedling vigor.

Table (3): Effects of storage period; insecticide treatments on protein, carbohydrate, insect infestation and weight seed loss of three faba bean varieties (combined data in 2003/2004 and 2004/2005 seasons).

Treatment	Protein %	Carbohydrate %	Insect infestation %	Seed weight loss %
A- Storage period/M				
0	26.9	68.7	2.0	0.00
6	27.3	67.7	3.4	1.03
12	27.9	64.8	7.1	3.28
18	28.7	64.9	9.2	3.31
LSD at 0.05%	**0.6**	**2.8**	**0.4**	**0.2**
B- Varieties				
Sakha 1	26.9	65.5	5.6	2.26
Giza 3	29.2	68.9	5.4	2.11
Giza 2	27.0	65.4	5.3	2.14
LSD at 0.05%	**0.3**	**3.3**	**n.s**	**ns**
C- Insecticide treatments				
Control	28.2	65.9	7.2	3.35
Black pepper	27.8	65.6	5.7	2.70
Neem kernel	27.5	67.2	4.8	1.48
Malathion	27.3	67.6	3.9	1.09
LSD at 0.05%	**0.6**	**ns**	**Ns**	**0.22**

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تأثير الرش بالملاثيون والمستخلصات النباتية ومدة التخزين على جودة التقاوي والإصابة الحشرية فى بعض أصناف الفول البلدي.

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تهدف هذة الدراسة الى تحديد تأثير رش بعض اصناف الفول البلدي (سخا ١، جيزة ٣ وجيزة ٢) فى مرحلتى الإزهار وامتلاء الحبوب بالملاثيون (٥٧%) وبعض المستخلصات النباتية (مستخلص الإيثانول لبذور الفلفل الاسود والنيم) وكذا تأثير مدة التخزين (صفر، ٦، ١٢، ١٨ شهر) على جودة التقاوي والإصابة الحشرية والفقد فى الورن للبذور اجريت تجربتين حقليتين بمزرعة محطة البحوث الزراعية- بتاج العز مركز البحوث الزراعيه خلال موسمى النمو ٢٠٠٣/٢٠٠٢، ٢٠٠٤/٢٠٠٣،بينما امتدت دراسات التخزين تحت الظروف العاديه خلال الفترة من يونيو ٢٠٠٣ حتى نهاية ديسمبر ٢٠٠٥.وتشير اهم النتائج المتحصل عليها الى ان زيادة فترات التخزين من صفر إلى ١٨ شهر ادى الى انخفاض تدريجي فى نسبة الإنبات وقوه البادرات وزيادة نسبةالإصابة الحشرية والفقد فى الورن الجاف للبذور بعد ٦ شهور من التخزين . كما تغير محتوى البذور من البروتين والكربوهيدرات حيث زادت نسبة البروتين وانخفضت نسبة الكربوهيدرات على اساس الورن الجاف للبذور.وكانت بذور الصنف جيزة ٢ الأعلى فى حيوية التقاوى وقوه انبات البادرات والنسبة المئوية للبروتين والكربوهيدرات ، وبذور الصنف جيزة ٣ الأقل إصابة حشرية. وكانت الاختلافات غير معنوية بين الأصناف فى الفقد فى الوزن الجاف للبذور ومتوسط رمس الإنبات .كما أدى الرش بالملاثيون ٥٧ % الى الحفاظ على حيوية التقاوى وقدرتها على انتاج بادرات قوية وأقل نسبه اصابة حشرية وفقد فى الورن الجاف للبذور ، تلاه الرش بمستخلص الإيثانول لبذور النيم ثم الفلفل الأسود وذلك مقارنة بالكنترول. أشارت النتائج الى أن بذور الصنفين جيزة ٣ ، جيزة ٢ هي الأكثر احتفاظا بحيويتها بعد ١٨ شهر من التخزين ثم الصنف سخا ١ على الترتيب وتوصى الدراسة بإمكانية الرش (أثناء مقاومة المن خلال مرحلتي التزهير وامتلاء القرون) بالملاثيون-٥٧% أوبمستخلص الإيثانول لبذور النيم أو الفلفل الأسود للحد من تلوث البيئة والحصول على بذور منخفضة الإصابة الحشرية وامكانية تخزينها كتقاوى لمدة تصل الى ١٨ شهر (carry over seeds) . مع الحفاظ على حيويتها.