EFFECT OF SOME PRACTICES ON ONION BULB PESTS IN FAYOUM GOVERNORATE

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Abstract

Field and store experiments were curried out in Fayoum governorate, during 2008/9 and 2009/10 seasons to evaluate the role of certain integrated management procedures in the field (planting date, over irrigation and intercropping) and in the store (variety, storage place and onion layer thickness) in reducing infestation percentage of onion bulb pests; *Eumerus amoenus* Loew*, Carpophilus spp.*, *Atherigona orientalis* Schin and *Ephestia cautella* (Walker). Results showed that, the infestation percentages were slightly affected with planting date which were insignificant higher in early planting date in the beginning of November than in the beginning of December, while strongly affected with over irrigation and intercropping which were higher in over irrigated and intercropped treatments than control for the previous pests during both seasons. During storage, infestations were slightly affected with variety during both seasons for the first three pests, while it was significant higher on Behery var. than Giza 20 var. during the first season for *E. cautella* only. The bulbs infestation percentages for *E. amoenus, Carpophilus spp.*and *A. orientalis* in case of indoor treatment were significantly lower than in outdoor treatment during both seasons, with exception of *E. cautella* only. Also increasing layer thickness of bulbs in the store (60 cm.), increased the infestation percentage for the first three pests while reducing the infestation percentage of *E. cautella* during both seasons. Regardless of variety the results emphases that prevent of water stress and intercropping after bulb formation in the field and storing onion bulbs in aired and shaded store with 30 cm height were useful to reduce infestation of onion bulb pests during storage.

INTRODUCTION

Onion *Alium cepa* L. is attacked in the Fayoum with four insect pests in the field namely: *Eumerus amoenus* Loew (Diptera : Syrphidae)*, Carpophilus spp.* [*C. immaculatus* Luc., *C. hemipterus* L.] (Coleoptera: Nitidulidae), *Atherigona orientalis* Schin (Diptera : Muscidae) and the infestation continue in the stores in addition to *Ephestia cautella* (Walker), (Lepidoptera : Phycitidae). These insect pests cause reduction in quantity and quality of onion bulbs. The estimated weight loss ranged from 25.78 to 24.10% (Sabra et al, 2011, Abu-Hashish, 1998). Also, Gupta et al, 1991, reported that *A. orientalis* and *Carpophilus spp.* caused yield losses to stored

onion in India. Because onion bulbs not only freshly consumed but also stored bulbs consumed all the year round, it is important to ensure good quality bulbs and produce healthy bulb yields for storage for a long period, so management considerations of pest control must be taken both in the field and in the store.

The present study aims to evaluate the role of certain IPM procedures in the field (planting date, over irrigation and intercropping) and others in the store (variety, storage place and onion layer thickness) on reducing yield losses caused by onion bulb pests after bulbs formation in the field and during storage under Fayoum conditions.

MATERIALS AND METHODS

IBM procedures were tested against onion bulb insects in onion field and store in Fayoum Governorate, during 2008/2009 and 2009/2010 seasons. The experiments were started in the field and continued in the store.

A- Field Experiments:

An area of about 1/2 fed. was divided into five equal plots (replicates), each contained four equal subplots represented the treatments:

1- Control:

Its subplots were planted with onion seedlings (Giza 20 var.) at the recommended date (end of November).

2- Planting date:

The five replicates of this treatment were planted one month after the control at the end of December.

3- Over irrigation:

More irrigation was followed every two weeks instead of three weeks during the period from beginning of March till end of April.

4- Intercropping

In this treatment, the subplots of onion plants were intercropped with maize at the beginning of April. The intercropped subplots received excesses of water irrigation especially during maize planting till harvest while the irrigation in the control was ended one month earlier.

All another agricultural practices were normally done with no application of any insecticides. At harvest time (end of May), 100 bulbs were randomly collected from each subplot and transferred to the laboratory for examination to record numbers of healthy and infested bulbs with insect pests under study.

B- Store Experiments:

Three experiments were conducted during the storage period from the beginning of June to the end of October, as follows:

1. Variety Experiment:

Bulbs of two onion varieties (Giza 20 & Behery) were stored at aired; shaded stores. The bulbs were kept in piles, each measured 2 m. wide x10 m. long x 60 cm. height. In the beginning of August, five biweekly samples of 100 bulbs each were randomly collected from each variety and investigated to count the numbers of healthy and infested bulbs as well as the numbers of main insect pests.

2. Storage Place Experiment:

Onion bulbs of Giza 20 variety were stored under two conditions:

a- Aired shaded store (indoor)

b- Open field store (outdoor).

In the open storage case, the bulbs were kept in piles similar to that described before and covered with dry rice straws. In the indoor store, bulbs were also stored in similar piles. Five biweekly samples each contains 100 bulbs from each site were randomly collected and examined to record numbers of healthy and infested bulbs as well as numbers of insect pests per infested bulb.

3.Onion layer thickness:

After harvest the bulbs were stored in pills of two thicknesses (30 and 60 cm.) at the beginning of June in aired and shaded store. Five samples of 100 bulbs from each storage thickness were randomly taken biweekly and examined carefully against the insect infestations, as mentioned before.

RESULTS AND DISCUSSION

A. Effect of field treatments on the infestation:

1. Planting date:

As shown in Table (1), three insects infested onion bulbs in the field were recorded; *E. amoenus, Carpophilus spp.* and *A. orientalis* while *E. cautella* infest onion only on the store. Venkatesh and David, 2001, reported that *E. cautella* infest onion bulbs in store probably with decrease in relative contents of moisture, pyruvic acid and total sulfur.

The present study revealed that, these insects (regardless of species) not significantly affected by planting date. Whereas the infestation in the early plantation (control) ranged 5.4 – 18.0 % in the 1st season and 7.8 – 20.2 % in the second season. While in the late plantation date it ranged 8.0 – 21.0 % and 10.0 – 22.4 %, in

the two seasons, respectively. These results pointed to that, delaying the recommended plantation date, for one month increased the infestation with the three aforementioned insects in both seasons. In this respect, Haydar and El-Sherif (1990), reported that, the onion plants of early planting date (beginning of November) were less susceptible to the infestation by insect pests.

Table 1. Percent of bulbs infested with three insects under three agricultural field practices during 2008/9 and 2009/10 seasons.

Infested bulbs %							
Season		*E. amoenus*		*A. orientalis*		*Carpophilus spp.*	
		Control	Treatment	Control	Treatment	Control	Treatment
Planting date							
2008/2009	x	18.0	21.0	9.4	15.0	5.4	8.0
	t	1.65		1.86		1.96	
2009/2010	x	20.2	22.4	11.2	14.0	7.8	10.0
	t	0.73		0.92		1.47	
Irrigation							
2008/2009	x	18.0	27.0	9.4	17.4	5.4	9.0
	t	2.36*		2.38*		2.57*	
2009/2010	x	20.2	29.0	11.2	19.0	7.8	12.4
	t	2.40*		2.39*		2.36*	
Intercropping							
2008/2009	x	18.0	25.4	9.4	16.6	5.4	8.8
	t	4.23*		2.30*		2.61*	
2009/2010	x	20.2	27.2	11.2	16.8	7.8	12.0
	t	3.38*		2.48*		2.45*	

t_{∞_8} = 2.30

2. Irrigation

Data presented in table (1) revealed that, onion bulbs of the over irrigated area were subject to a higher infestation with *E. amoenus*, *A. orientalis* and *Carpophilus spp.* than those of the control. In the first season the infestation percentages with these insects were 18.0, 9.4 and 5.4% in the control and 27.0, 17.4 and 9.0% in the treatment, respectively. In the second season, these percentages were 20.2, 11.2 and 7.8% for control and 29.0, 19.0 and 12.4% for the over irrigated area, respectively. Statistical analysis revealed that excess irrigation for onion fields, significantly increased the infestation with the three previous insects. This result was acceptable because onion bulbs that exposed to water stress became more susceptible to infect with rots and attract these pests. Schwartz (2011), mentioned that, water stress, especially near harvest, increased infection with bulb rot during storage. Also, Lomonaco and Almeida (1995) found that, *A. orientalis* was the most frequent species in decomposing onions.

3- Intercropping

The data presented in the same previous table showed that, intercropping process significantly increased the infestation with the three insects; 25.4 – 27.2, 16.6 – 16.8 and 8.8 – 12.0 % for the treatment and 18.0 – 20.2, 9.4 – 11.2 and 5.4- 7.8 % for the control in 2008/9 and 2009/10 seasons, respectively. In general, during intercropping process the water stress and mechanical damage during plantation clearly make the bulbs more susceptible to the infestation with the previous insect pests. In this respect, Mahmoud (2008) reported that, the mechanical wounded bulbs indicated higher infestation with *E. amoenus* which was 4-5 times as healthy bulbs in store.

B. Effect of storage treatments on the infestation:

1. Variety:

Data given in Table (2) showed that, throughout 2008/9 and 2009/10 seasons, the infestation with *E. amoenus* and *E. cautella* were relatively higher for Behery than Giza 20 variety. It ranged regardless of season, 18.6 - 23.0 and 18.0 - 20.2 % for *E. amoenus* and 13.2 - 20.2 and 12.4 - 16.2% for *E. cautella* in the onion varieties, respectively. In contrast, these percentages were slightly higher for *A. orientalis* and *Carpophilus spp* for Giza 20 than Behery var.; 6.2 & 4.2 and 4.8 & 3.8% for *A. orientalis* and 12.2&13.4 and 11.2 and 10.2% for *Carpophilus spp.* in 2008/9 and 2009/10 seasons, respectively (Table 2). Statistical analysis emphasis that, susceptibility of the two varieties against the infestation with these insects was not significantly differed except for *E. cautella* during the first season only.

2. Storage place:

Based upon the data presented in Table (2), the numbers of infested bulbs were higher in case of outdoor than in indoor stored onions during both seasons for all insects except *E. cautella*. In outdoor treatment, the percent of infestations with *E. amoenus, A. orientalis* and *Carpophilus spp* were 24.6, 7.0 and 16.4 % in the first season and 21.2, 8.4 and 18.0% in the second season, respectively. In case of indoor treatment, these findings were lower; 17.4, 4.2 and 10.2% in the first season and 15.2, 5.0 and 12.6% in the second season for the three considered insect pests, respectively. On the other hand, the infestation with the fourth insect (*E. cautella*) was higher (23.2& 16.0%) in the indoor treatment than that in the outdoor (18.8 &12.2%). Statistical analysis revealed that, the percent of infested bulbs were strongly affected by storage place, the indoor store had lower infestation than outdoor one for all studied insect pests. Mahmoud, et al, 2007, found that, the infestation of stored onion bulbs with *E. amoenus* was lower in indoor than outdoor treatment.

Table 2. Percent of bulbs infested with four insects under three storage treatments during 2008/9 and 2009/10 seasons.

		Infested bulbs %							
		E. amoenus		*A. orientalis*		*Carpophilus spp.*		*E. cautella*	
Variety									
2008/2009		Giza 20	Behery	Giza 20	Behery	Giza 20	Behery	Giza 20	Behery
	x	20.2	23.0	6.2	4.8	12.2	11.2	16.2	20.2
	t	1.56		0.52		0.56			2.66*
2009/2010	x	18.0	18.6	4.2	3.8	13.4	10.2	12.4	13.2
	t	0.35		0.45		1.74		0.45	
Storage place									
2008/2009		Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor
	x	24.6	17.4	7.0	4.2	16.4	10.2	18.8	23.2
	t	4.01*		2.89*		2.67*		2.98*	
2009/2010	x	21.2	15.2	8.4	5.0	18.0	12.6	12.2	16.0
	t	3.89*		5.01*		3.76*		3.41*	
Onion layer thickness									
2008/2009		30 cm.	60 cm.	30 cm.	60 cm.	30 cm.	60 cm.	30 cm.	60 cm.
	x	21.6	25.4	3.6	6.6	8.8	10.0	26.8	18.4
	t	1.27		3.81*		1.08		4.37*	
2009/2010	x	22.8	26.0	4.4	7.0	7.8	9.2	17.4	12.4
	t	1.57		3.47*		1.02		2.88*	

$t_{\infty_8} = 2.30$

3. Onion layer thickness

As shown in Table (2), increasing of bulb layer sickness in the store (60 cm.), increased the infestation with *E. amoenus*, *A. orientalis* and *Carpophilus spp,* while reduced the infestation with *E. cautella* during both seasons. The infestation percentages for 60 cm. treatment were 25.4& 26.0%, 6.6&7.0%, 10.0&9.2% and 18.4&12.4% in 2008/9 and 2009/10 season, respectively. These percentages were 21.6&22.8%, 3.6&4.4%, 8.8&7.8% and 26.8&17.4% for 30 cm. treatment in both seasons, respectively. T-test explained insignificant differences between thin (30 cm.) and thick layer (60 cm.) for the infestation with *E. amoenus* and that with *Carpophilus spp*. On the other hand, these differences were significant for *A. orientalis* and *E. cautella* throughout both seasons. These results explained that, the three stored onion insects; *E. amoenus A. orientalis* and *Carpophilus spp.* Prefer thick layer (6.6 – 26.0% infestation) than thin layer (3.6 – 22.8%) for attacking the bulbs. The opposite was happened with *E. cautella* which preferred the onion thin layers than those sick ones, 17.4 – 26.8 and 12.4 – 18.4% infestation, respectively. In general, all results illustrated in Table (2) indicated that, regardless of onion variety, storing the bulbs in indoor in thin layers (30 cm.) reduced the infestation with various tested insects.

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تأثير بعض عناصر المكافحة المتكاملة على خفض نسبة الإصابة

بالآفات الحشرية التي تصيب البصل بمحافظة الفيوم

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أجريت تجربتان احداهما في الحقل والاخرى في المخزن لتقييم دور بعض الاجراءات كعناصر للمكافحة المتكاملة في خفض نسبة الإصابة بالآفات الحشرية التي تصيب البصل بعد مرحلة تكوين الابصال في الحقل (ميعاد الزراعة – التحميل – زيادة ماء الري) وخلال فترة التخزين (الصنف – مكان التخزين – سمك طبقة التخزين) تحت ظروف محافظة الفيوم خلال موسمي 2009/2008 و2010/2009 وهذه الافات هي ذبابة البصل الكبيرة *Eumerus amoenus* Loew وخنافس الفاكهة المجففة *Carpophilus spp* وذبابة الأزريجونا *Atherigona orientalis* Schin. في الحقل والمخزن بالاضافة الى فراشة البلح(Walker) *Ephestia cautella* التي تصيبه في المخزن فقط.

وأظهرت نتائج الدراسة في الحقل ان نسبة الاصابة في الزراعة المبكرة خلال اواخر نوفمبر كانت اقل منها في الزراعة خلال اواخر ديسمبر بدرجة طفيفة وغير معنوية للآفات موضع الدراسة، بينما تأثرت نسبة الاصابة بدرجة كبيرة بالتحميل وزيادة مياه الري حيث كانت نسبة الاصابة عالية في المساحات المحملة خلال موسمي الدراسة وكذلك في المساحات التي بها زيادة ماء الري مقارنة بالكنترول.

وأظهرت الدراسة ايضا ان صنف البصل سواء جيزة 20 أم بحيري ليس له تأثير معنوي على نسبة الإصابة بالآفات الثلاث الاولى بينما كانت نسبة اصابة الصنف بحيري بفراشة البلح أعلى من جيزة 20 خلال الموسم الاول فقط حيث كانت الأختلافات معنوية. اما بالنسبة لمكان التخزين فكانت نسبة الاصابة في الابصال المخزنة في مخزن مظلل جيد التهوية أقل منها في الابصال المغطاه بالقش المخزنة في الحقل المكشوف وكان الأختلاف معنويا بالنسة للثلاثة افات الاولى خلال موسمي الدراسة وعلى العكس من ذلك تبين ان نسبة الاصابة كانت أقل في الحقل المكشوف عنها في المخزن بالنسبة لحشرة *E. cautella* خلال الموسمين. كماكان لسمك طبقة التخزين تأثير معنوي على زيادة نسب الاصابة حيث زادت في الابصال المكدسة بأرتفاع 60سم خلال الموسمين بالنسبة لكل من *E. amoenus* و *A. orientalis* و*Carpophilus spp* عنها في الابصال المخزنة بسمك 30سم وعلى العكس من ذلك وجد ان الاصابة بحشرة *E. cautella* كانت أقل في الابصال المكدسة (60سم) عنها في الابصال المخزنة بسمك 30سم. وبصفة عامة فإن موعد الزراعة والصنف غير مؤثران على نسبة الاصابة بآفات البصل في المخزن ، وعليه يمكن التوصية بعدم زيادة ماء الري وعدم تحميل أي محصول على البصل والتخزين في مخازن مظللة وجيدة التهوية بسمك لايزيد عن 30سم لخفض نسبة الإصابة بالآفات الحشرية في المخزن.