Dynamical Fluctuations of Mites' Populations Associated with some Varieties of Stored Onion and Garlic in the Stores at Alexandria and Menoufia Governorates

Zaki, A.M.*, H.M.A. El-Nenaey and S.H.D. Masry****

* Dept. of Econ. Entomol. & Agric. Zool., Fac. of Agric., Menoufia Univ., Egypt.
** Plant Protection Res. Institute, Agric. Res. Center, Cairo, Egypt.

ABSTRACT

The adopted investigation was carried out to study the populations ecology of associated mites with some stored onion and garlic varieties in certain localities at Alexandria and Quisna regions during the subsequent seasons of 2000 and 2001. The following points had been established and clarified:

1. The population density of acarid mites as a total numbers was the highest in both localities and both seasons followed by actinedid mites and gamasid mites
2. The population density of acarid mites was the highest on all examined varieties of onion and garlic crops.
3. The population density of gamasid mites as a total numbers in both stored onion and garlic varieties took the second rank of occurrence during season 2000 in Alexandria region.
4. The population density of mites associated with onion and garlic varieties in season 2000 was more than those in season 2001.
5. The population density as a total numbers of mites associated with stored onion and garlic varities in Alexandria region was more than that in Quisna region during both seasons.
6. The prevailing thermic conditions in Alexandria store are lower than that in Quisna store. On the contrary, in Alexandria store the prevailing hygro-conditions are higher than that of Quisna store.
7. Effects of the recorded hygro-thermic conditions on the population dynamics of found mite individuals varied considerably from region to another.
8. The variations in the population densities of the three mite suborders were correlated with the differentiation in temperature and relative humidity factors as well as the species and varieties of both crops.

Additional key words: Onion, garlic, mite suborders and species composition.

INTRODUCTION

Mites of all kinds of stored products are very important economically, primarily because they attack processed or finished goods which value increases significantly as they move through the marketing channels. Likewise, the pest control of stored product is proportionately high due to the expense of packaging and complying with regulatory requirements, foreign and domestic pesticide laws. The biological control reduce the cost by reducing the amount of pesticides used (Bruce, 1982)

Stored onion and garlic crops are liable to be attacked by certain mites in stores. Acarid mites damage food materials and food products by feeding on them and thus causing loss of quality and quantity (Zdarkova and Reska, 1976).

Mites induce a strong minty odour to the stored products (Watters, 1967). Furthermore, production of taints and odours due to their presence is one of the reasons for the low grading of infested food (Howe, 1965). Some of stored product mites also serve as vectors of some species of fungi and bacteria (Wafa et al., 1966). Others may cause allergies, asthma and dermatitis (Yu et al., 1997). Also, they can induce hazard effects to human and/or animal health by eating diet infested with them (Zdarkova et al., 1993 and Baker, 2000).

The factors causing soil mites to aggregate are still unknown. Generally such a distribution might be explained by several factors, e.g. the clustering of eggs, the choice of microhabitats, which are particularly suitable as a result of local conditions (Edwards and Lofty, 1971; Usher, 1976 and Zaki, 1983).

Therefore, it seemed worthwhile to make an attempt to study and compare the population densities of mite suborders associating with two varieties of each of onion and garlic crops in stores at Alexandria and Quisna.

MATERIALS AND METHODS

Mites associated with onion and garlic crops in the stores:

The present study was carried out in stores at Alexandria and Quisna regions and the laboratory of Economic Entomology & Agriculture Zoology, Faculty of Agriculture, University of Menoufia, Shebin El-Kom. The population densities of mites associating with two varieties of stored onion crops (Balady and Giza 20) and garlic crops (Balady and Chinese) during the following seasons of 2000 and 2001 were studied.

1. Sampling and identification:

One month after the beginning of storage, samples of about 250g of spread straw layer under each of testèd onion and/or garlic varieties were collected at fortnight intervals during the storage period and replicated three times. Each taken sample of spread straw layer under each variety was placed in a plastic bag. Bags were transported immediately in the same day to the laboratory for extraction.

2. Extraction methods:

The samples were placed in Tullgren funnels, upon a wire screen insert (30cm diameter, 6 mesh openings). A 40-watt bulb on top of each funnel served as the heat light source to drive the arthropods downward into a 200-ml glass jar containing 70% ethyl alcohol. Samples were left to dry on the funnels for 72 h. After the extraction period; the contents of the glass jar were transferred to screw-cupped jars, where predacious and scavenging arthropods were held for counting using a stereomicroscope.

From the extracted mixture of different arthropods, three mite suborders (Actinedida, Gamasida and Acaridida) were selected and counted. Then mites were transferred in another small pots, by using a very fine camel hair brush (000) under a binocular-microscope. All of the transferred mites were covered with drops of lactic acid and left for a period of 3 – 4 weeks to be cleared up.

Two types of preparation were used for mites according to Grandjean (1949) and explained by Zaki (1983), the temporary and the permanent preparations.

3. Identification:

Firstly, identification of mite specimens was carried out by using the temporary mounted (open preparation), which was easy to study all the specimens positions by changing and moving the individual as desired, using the research microscope under the maximum magnification force. In regard to routine identification tasks and time factor, the open mounts were more economical than the permanent preparations. On the other hand, the permanent mounts were easily handled, ready for an immediate study of different parts of mite specimens, and namely the observed important constant taxonomic characters.

More than 1000 mite specimens from different samples were identified using the keys of Krantz (1978), Balogh and Mahunka (1983) and Zaher (1986).

Data were subjected to the analyses of variance test (ANOVA), with mean separation at the 1% and/or 5% levels of significance. Duncan's Multiple Range Test was used to compare the averages of the treatments, according to the method of Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The experiments were designed to survey and study the ecology of the mites associated with two varieties of each of onion and garlic crops in stores in Alexandria and Quisna during the seasons of 2000 and 2001. Furthermore, the influence of store hygro-thermic conditions on the population densities of mites associated with these crops was studied and discussed.

Distribution and abundance of the three detected mite suborders, i.e. Acaridida, Actinedida and Gamasida associated with straw beneath two varieties of onion and garlic crops in the two localities were statistically analyzed.

1. Population fluctuations of mites associated with onion and garlic crops in stores:

1.1. In Alexandria stores:

1.1.1. Mites associated with onion crop:

Obtained data of the analyses of variances assured that the population densities of the three mite suborders were affected by the tested varieties and fortnight intervals during both the storage seasons in Alexandria stores. The population densities have no significant differences at the 5% level of probability between date of inspections, the crop varieties and interaction of date x varieties during both seasons of 2000 and 2001. Except for acarid mites there were significant differences between the population densities and crop varieties during the season of 2000.

However, results in Table 1 indicated that there were significant differences between onion varieties Balady and Giza 20 or/nd garlic variety

Balady during storage period from July the 8th to August the 21st 2000. Meanwhile, there were no significant differences between onion variety Giza 20 and garlic varieties Balady and Chinese during the same periods.

On the other hand, data present in Table 1 and illustrated in Fig. 1 indicated that the population densities of the total mites associating with both varieties of onion crop fluctuated from an inspection date to another during the season of 2000. There was one peak for each of the onion varieties Balady and Giza 20 in the 3rd week of July and the 3rd week of August 2000 at store temperature of 33°C for both peaks and R.H. 83 and 80%, respectively.

In season 2001, data in Table 2 and Fig. 2 confirmed that there were two peaks of mite occurrences on stored onion crop. The first peak was in the 1st week and 3rd week of July for Giza 20 and Balady varieties at store temperature of 32 and 34°C and R.H. 87 and 81%, consecutively. The second peak was during the 3rd week of August for both varieties at store temperature of 32°C and R.H. 87%.

From results in Tables 1 and 2 and graphically demonstrated in Figs. 1 and 2, it could be elucidated that as a total numbers the population density of mites associated with onion variety-Balady was higher than that of onion variety-Giza 20 during season 2000. An inverse trend was found between the population density of mites associated with both varieties during season 2001.

Regard to data shown in Tables 1 and 2 and illustrated in Fig. 3 the populations of acarid mite species have the highest occurrence than the population of each of actinedid and gamasid mite species during both the seasons of investigation. In this respect, the occurrence rtes of Acaridida, Actinedida and Gamasida were 56.4, 21.7 and 21.9% for onion variety Balady of onion, respectively, and 44.8, 24.6 and 30.5% for Giza 20, consecutively in season 2000. However, in season 2001 the proportions of the previous three taxa were 55.5, 29.7 and 14.8% for variety Balady, and 46.1, 34.3 and 19.6% for variety Giza 20, successively.

1.1.2. Mites associated with garlic crop:

Data shown in Table 1 and Fig. 1 revealed that the population densities of total mites associated with both varieties of garlic crop fluctuated from a period to another in season 2000. There was one peak for variety garlic Balady in the 1st week of September at store temperature of 30°C and R.H. 76%. For garlic variety Chinese two peaks were observed in the 1st week of July and the 1st week of August 2000 at store temperature of 31 and 34°C and R.H. 77 and 79%, respectively.

The exhibited results in Table 2 and illustrated in Fig. 2 denoted that for garlic variety Balady there was one peak of mites occurrence in the 1st week of July 2001 at store temperature of 32°C and R.H. 87%. While, two peaks were observed for the variety Chinese in the 1st week of July and the 2nd week of September 2001 at store temperature of 32 and 31°C and R.H. 87 and 81%, respectively

From results in Tables 1 and 2 and graphically illustrated in Figs. 1 and 2, it could be asserted that, as a total numbers, the population density of mites associated with garlic variety-Balady was lower than that of the Chinese one during both seasons of 2000 and 2001.

On the other hand, as shown in Tables 1 and 2 and Fig. 4, it could be concluded that the populations of acarid mite species have the highest occurrence than the populations of actinedid and gamasid mite species during both the seasons of inspections. While, the population density of gamasid mites associated with straw under garlic crops during season 2000 was higher than that of season 2001. However, the calculated percentages of Acaridida, Actinedida and Gamasida populations were 38.8, 19.9 and 41.3% for garlic variety-Balady, respectively, and 42.1, 25.2 and 32.7% for the variety-Chinese of garlic crop, consecutively in season 2000. However, in season 2001 the proportions of the populations of the three mite suborders were 45.7, 34.2 and 20.1% for variety-Balady, and 46.4, 29.0, and 24.6% for variety-Chinese, successively.

In addition, Fig. 1 shows that the population density of mites associated with onion crop was higher than the population density of mites associated with garlic crop during season 2000. Meanwhile, onion variety-Balady had the highest numbers of mites' occurrence followed by onion variety-Giza 20, garlic varieties Chinese and Balady. During season 2001 results in Fig. 2 revealed that the occurrence of mite populations beneath garlic variety-Chinese was more than mite populations beneath onion variety-Giza 20 followed by garlic variety-Balady and onion variety-Balady.

1.2. In Quisna stores:

1.2.1. Mites associated with onion crops:

Analyses of variances confirmed that varieties and fortnight intervals affected the population densities of the three mite suborders during the two storage seasons in Quisna region. However, the population densities of mites have no significant differences at the 5% level of probability between date of inspections, crop varieties and interaction of date x varieties in Quisna stores during season 2000 (Table 3).

From data in Table 4, it could be declared that in season 2001the population densities of acarid mites had highly significant differences during the inspection periods at the 1% level of probability. In the same time, the population densities of mites have no significant differences at the 5% level of probability between date of inspections, crop varieties and interaction of date x varieties. However, there were significant differences between the population densities of acarid mites associated with onion variety-Giza 20; garlic varieties-Balady and Chinese during the investigation periods. For instance, there was significant difference between the mean numbers of acarid mites under onion variety-Giza 20 in August the 21st and June the 25th, versus insignificant differences found between the measured population densities during the four

resting periods. The populations of the associated mites with garlic varieties-Balady and Chinese had significant differences between the inspection period of July the 23rd and all resting periods.

The induced data in Table 3 and graphically illustrated in Fig. 5 inferred that the population densities of the total mites associated with both varieties of onion crop fluctuated from a time to another during season 2000. There were two peaks for onion variety-Balady in the 4th week of July and the 4th week of August 2000 at store temperature of 34°C for both peaks and R.H. 78 and 77%, respectively. On the other hand, there was one peak for onion variety-Giza 20 in the 4th week of August 2000 at store temperature of 34°C and R.H. 77%.

Data given in Table 4 and Fig. 6 declared that in season 2001 there was one peak of mite occurrence under onion variety-Balady in the 1st week of August 2001 at store temperature of 32°C and R.H. 81%. While, the associated mites with onion variety-Giza 20 have two peaks of abundant. The first peak was in the 4th week of July 2001 at store temperature of 32°C and R.H. 82%. The second one occurred during the 3rd week of August 2001 at store temperature of 31°C and R.H. 74%.

Regard to season 2000, from exhibited results in Table 3 and Fig. 7, it could be elucidated that, as a total numbers, the population density of acaridid mites associated with onion variety-Balady was higher than that of onion variety-Giza 20. An inverse trend was observed between the population densities of actinedid and gamasid mites associated with both varieties.

For season 2001, the illustrated results in Table 4 and Fig. 8 show the estimated population density as a total of the three mite suborders associated with onion variety-Giza 20 which was more than that of onion variety-Balady.

On the other hand, from Tables 3 and 4 and Fig. 7, it could be noticed that the populations of acarid mite species had the highest occurrence than the populations of actinedid and gamasid mites during both the seasons of investigations. In this respect, the occurrence percentages of Acaridida, Actinedida and Gamasida were 46.8, 29.1 and 24.1% for onion variety-Balady, respectively, and 44.0, 31.6 and 24.4 for onion variety-Giza 20, consecutively in season 2000. However, in season 2001 the proportions of the previous three taxa of mites were 53.6, 23.1 and 23.3 for variety-Balady, and 44.4, 28.5 and 27.0 for variety-Giza 20, successively.

1.2.2. Mites associated with garlic crop:

As shown in Table 3 and demonstrated in Fig. 5 data revealed that the population densities of total associated mites with both the tested varieties of garlic fluctuated from a period to another in season 2000. There was one peak for garlic variety-Balady in the 2nd week of August at store temperature of 35°C and R.H. 80%. While, two peaks for variety Chinese of garlic crop were observed in the 4th week of July and the 4th week of August 2000 at store temperature of 34°C for both peaks and R.H. 78 and 77%, successively.

The exhibited results in Table 4 and Fig. 6 also showed that for both garlic varieties there were two peaks of mites' populations in the 4th week of July and

the 3rd week of August 2001 at store temperature of 32 and 31°C and R.H. 82 and 74%, consecutively.

From the included results in Tables 3 and 4 and demonstrated in Figs. 5 and 6, it could be asserted that as a total numbers the population density of mites associated with garlic variety-Balady was lower than that of garlic variety-Chinese during both the seasons of 2000 and 2001.

On the other hand, as shown in Fig. 8 the population of acarid mite species has the highest occurrence than the populations of actinedid and gamasid mite species during both seasons of inspections. The population density of gamasid mites associated with straw under the used varieties of garlic crop during season 2000 was higher than that of season 2001. However, the population percentages of Acaridida, Actinedida and Gamasida were 39.3, 29.6 and 31.1 for garlic variety-Balady, respectively, and 38.3, 30.3 and 31.4 for garlic variety-Chinese, consecutively in season 2000. In season 2001 the proportions of the three mite suborders were 57.6, 20.6 and 21.8 for variety-Balady, and 46.5, 28.0, and 25.5 for variety-Chinese, successively.

In addition, the exhibited results in Fig. 5 show that the population density of mites associated with onion crop was higher than that of associated mites with garlic crop during season 2000. Meanwhile, onion variety-Giza 20 has the highest numbers of occurrence followed by onion varity-Balady; garlic variety-Chinese and Balady. Also, during season 2001 Fig. 6 reveals that the occurrence of mite populations associated with garlic variety-Balady was more than mite populations associated with garlic variety-Chinese followed by onion varieties-Giza 20 and Balady.

2. Correlation coefficient between mite suborders associated with onion and garlic varieties and store temperature °C and R.H %:

The tabulated data in Table 5 show the statistical correlation analyses between the population densities of each of the three mite suborders and recorded temperature degrees and relative humidity percentages in the stores of onion and garlic crops in both seasons and localities under consideration.

In Alexandria region, data presented in Table 5 indicate that the population densities of the three mite suborders were insignificantly correlated with prevailing temperature and R.H.% in stores during season 2000. Meanwhile, during season 2001 there were positive and significant correlation between the population densities of actinedid mites or gamasid mites and temperature degrees at 5% level of probability. In addition, the total numbers of inspected mites was positively and highly significantly correlated with temperature degrees and significantly correlated with R.H.% at 1% and 5% level of probability, respectively.

In Quisna region, data given in Table 5 also showed that the population densities of the three mite suborders were positive and insignificantly correlated with temperature and negative and insignificantly correlated with R.H.% in stores during season 2000, except for gamasid mites there was positive and

significant correlation with temperature. Meanwhile, during season 2001 there were positive and negative insignificant correlation between the population densities of either actinedid mites or gamasid mites; and temperature degrees and R.H.% at 5% level of probability, successively. The opposite results were true for the correlated estimates of acarid mites and total mites with temperature and R.H.%.

3. Comparison between the mite populations in the two localities:

As results of made experiments and observations on the ecology of mites associated with stored onion and garlic crops in Alexandria and Quisna regions the following points had been established and clarified:

a.The population density of acarid mites as a total numbers was the highest one in both localities and both seasons followed by actinedid mites and gamasid mites.

b.The population density of acarid mites was the highest one associated with the four tested varieties of onion and garlic.

c.The population density of gamasid mites, as a total numbers, in the stored of varieties onion and garlic took the second rank of occurrence during season 2000 in Alexandria region.

d.The population density of associated mites with onion and garlic varieties in season 2000 was more than those in season 2001.

e.The population density, as a total numbers, of associated mites with stored onion and garlic varieties in Alexandria region was more than that in Quisna region during both seasons.

f.The degrees of temperature in Alexandria store conditions were lower than that in Quisna store.

g.On contrary, Alexandria store the estimated percentages of relative humidity were higher than that of Quisna store.

h.Effects of temperature and R.H. % conditions on the population dynamics of mite individuals vary considerably from region to another.

i.The variations in the population densities of the three mite suborders might be attributed to the differentiation in temperature and relative humidity factors as well as the mite species and varieties of both crops.

In Egypt, some acarid mite species were recorded associating with stored products (Wafa et al., 1966; Attiah, 1969; El-Atrozy, 1974; Saleh, 1980; Zaher et al., 1984 and El-Desoky, 1991).

Members of the family Acaridae are widely distributed living on organic matters. They usually infest stored seeds, flour, dried meat, cheese, chocolate and other foodstuffs. Also contamination with their dead bodies and excreta as well as other microorganisms makes food products undesirable causing digestive troubles to the human and his domestic animals. Some granary mites transmit pathogenic to agricultural crops (Zaher, 1986).

The present results are in line with those of Franzolin and Baggio (2000) who found that ***Tyrophagus putrescensis*** associated with stored products.

Mite populations showed a greater reproductive rate during summer and at the beginning of autumn due to high temperatures and R.H.%.

In Korea, Chol et al. (1988) found that the population densities of the acarid mite, ***Rizoglyphus echinopus*** tended to increase with continuous cropping. Within a garlic field, the density of mites increased gradually from sowing until winter; and then from mid-March, peaking at harvest in late of May to early of June.

4. Species composition:

It is worthwhile to mention that the fortnightly estimates of mites' abundance in stores conditions at both localities were represented by the means of inspected mites in 200 g of straw samples taken from the stores beneath both tested varieties of onion and/or garlic crops. The overall averages were considered as the average of six periods of sampling for each replicate.

In order to clarify the relative contribution made to the fauna by the main species of mites, the system of grouping of Davis (1962) and explained by Zaki (1983) has been adopted in which species were grouped into classes on basis of their dominance values or levels.

As shown in Table 6 the dominance levels are as follow occasionally under 5%, frequently from 5 to 10% and always over 10%. The obtained data represent the distribution of mite species in various stores under consideration.

Specimens of about 821 mounted individuals of the three mite suborders were randomly chosen and identified (Table 6) using the maximum magnification force of research microscope under supervision of Prof. Dr. Zaki. However, a total of thirteen mite species following ten genera belonging to seven families of three mite suborders were collected and recovered from straw under stored varieties of onion and garlic crops in the investigated stores at Alexandria and Quisna regions. The percentage of suborder Acaridida was 54.2% and represented by four species belonging to four genera following two families. The proportion of suborder Actinedida was 27.5% and represented by five species belonging to three genera following two families. The proportion of suborder Gamasida was 18.3 % and represented by four species belonging to three genera following three families.

It could be noticed from Table 6 that the most common mite species associating with stored varieties onion and garlic were ***Rhizoglyphus robini*** Claparede and ***Tyrophagus pustrescentiae*** (Schrank) (Acaridida, Acaridae) as forage and fungivorous harmful mites; represented 32.5 and 16.9%, respectively. Meanwhile, the most abundant predatory mite species were ***Cheyletus malaccensis*** Oudemans, ***C. eruditus*** (Schrank) (Actinedida, Cheyletidae), ***Blattisocius keegani*** Fox (Gamasida, Ascidae) and ***Macrocheles merdarius*** (Berlese) (Gamasida, Macrochelidae); represented 13.7, 6.7, 7.7 and 5.2%, successively.

The present results are in harmony with those of Krantz (1978) who reported that typical predacious ground species may be found in many families

of Gamasida and Actinedida including the Macrochelidae, Ascidae, and Cheyletidae. Phytophagous soil species feeding on root tissue, corms or bulbs were found in the families Acaridae, while most other members of Acaridida are known as saprophagous species.

In Egypt, Zaher (1986) mentioned that ***T. putrescentiae*** is fungivorous as it feeds and reproduces on three fungi, i.e. ***Botrytis*** sp., ***Fusarium*** sp. and ***Penicillium*** sp. No reproduction occurred on clean onion tissues.

Hoda et al. (1990) stated that the species from families Cheyletidae and Cunaxidae are predacious mites associated with stored products.

The present data well agree with Estebanes and Rodriguez (1991) who recorded a total of 12 mite species among them ***T. putrescentiae*** and ***R. robini*** associated with onion crop in Mexico.

The previous results are in line with those of Zaher (1986), Daiber (1996), Park (1997) and Na Seung et al. (1998) who observed that the bulb mites ***Rizoglyphus*** spp., affect and feed on stored onion and garlic.

Diaz et al. (2000) found that the bulb mite of genus ***Rhizoglyphus*** (Acaridae) has been identified as pests of many crops and ornamentals in storage, in the field and in the greenhouse. The most important hosts are the species of family Liliaceae (e.g. ***Allium*** spp.).

Rezk (2000) stated that the most common species associating with stored products are those of family Acaridae (27.69%) followed by the families Ascidae (19.7%) and Cheyletidae (11.2%).

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Table 1. Comparison between mean numbers of the three detected mitesuborders associating with stored onion and garlic varieties in Alexandria region during season 2000.

Date of collection	Mean no. of the three mite suborders associated with onion and garlic varieties during 2000											
	Acaridida				Actenidida				Gamasida			
	Onion		Garlic		Onion		Garlic		Onion		Garlic	
	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese
July 8th	31.3 a	10.3 b	4.3 b	19.0 ab	9.0	7.0	2.7	5.0	17.7	15.0	15.7	27.0
July 21st	53.3 a	13.7 b	6.3 b	16.3 b	15.7	8.3	5.0	7.3	20.7	16.0	5.7	7.7
August 7th	36.0 a	19.0 b	8.7 b	15.7 b	17.0	13.7	2.3	12.0	11.7	13.3	8.3	15.0
August 21st	26.7 a	26.7 a	9.3 b	19.0 ab	13.0	11.0	4.7	9.0	11.3	11.7	8.7	11.7
September 5th	21.3 a	21.7 a	16.0 a	17.7 a	11.3	10.0	7.0	17.7	6.3	9.3	10.3	6.0
September 19th	18.0 a	12.3 a	6.7 a	8.7 a	5.7	7.0	4.7	6.7	5.0	5.3	6.0	7.3
Grand mean	31.1	17.3	8.6	16.1	11.9	9.5	4.4	9.6	12.1	11.8	9.1	12.5
LSD at 5%	Between varieties = 15.14				NS				NS			

In a row, means followed by the same letter are not significant at the 5% level by LSD.

Table 2. Comparison between mean numbers of the three detected mite suborders associating with stored onion and garlic varieties in Alexandria region during season 2001.

Date of collection	Mean no. of the three mite suborders associated with onion and garlic varieties during 2001											
	Acaridida				Actenidida				Gamasida			
	Onion		Garlic		Onion		Garlic		Onion		Garlic	
	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese
June 23rd	25.3	9.0	15.7	11.7	3.7	11.7	6.0	12.7	3.0	4.3	5.7	7.0
July 7th	15.0	24.0	22.0	25.0	8.3	15.0	10.3	11.7	5.7	5.7	8.3	17.3
July 20th	17.7	23.3	14.7	28.0	17.0	10.0	13.0	11.3	6.3	8.0	7.7	13.7
August 2nd	16.3	16.0	9.0	12.0	10.0	19.0	17.7	13.7	4.0	13.0	9.0	13.7
August 18th	24.0	26.3	14.3	27.7	8.0	13.3	14.0	14.7	4.3	10.7	6.0	7.7
August 31st	11.3	14.3	17.3	16.7	11.7	15.0	8.3	11.7	6.0	6.3	4.0	4.7
Grand mean	18.3	18.8	15.5	20.2	9.8	14.0	11.6	12.6	4.9	8.0	6.8	10.7
LSD at 5%	NS				NS				NS			

Table 3. Comparison between mean numbers of the three inspected mite suborders associating with stored onion and garlic varieties in Quisna region during season 2000.

Date of collection	Mean no. of the three mite suborders associated with onion and garlic varieties during 2000											
	Acaridida				Actenidida				Gamasida			
	Onion		Garlic		Onion		Garlic		Onion		Garlic	
	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese
July 11th	11.3	20.0	7.3	9.3	16.0	11.7	5.7	8.0	10.3	8.0	6.3	9.0
July 27th	19.7	17.0	9.7	17.3	14.3	13.3	9.0	18.3	11.0	11.3	9.3	9.3
August 10th	15.3	29.3	14.3	12.0	14.0	14.7	10.7	8.0	8.7	10.7	9.7	10.7
August 24th	39.0	29.7	13.0	13.3	10.3	19.3	10.3	9.7	16.3	19.0	10.7	11.7
September 9th	26.3	18.3	12.0	8.7	16.3	18.0	7.7	6.0	11.7	14.0	8.7	9.7
September 24th	16.0	11.0	8.7	8.3	8.3	13.0	5.7	4.7	8.0	6.3	6.7	6.3
Grand mean	21.3	20.9	10.8	11.5	13.2	15.0	8.2	9.1	11.0	11.6	8.6	9.4
LSD at 5%	NS				NS				NS			

Table 4. Comparison between mean numbers of the three inspected mite suborders associating with stored onion and garlic varieties in Quisna region during season 2001.

Date of collection	Mean no. of the three mite suborders associated with onion and garlic varieties during 2001											
	Acaridida				Actenidida				Gamasida			
	Onion		Garlic		Onion		Garlic		Onion		Garlic	
	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese	Balady	Giza 20	Balady	Chinese
June 25th	9.3 a	10.7 b	6.0 c	11.0 b	3.7	7.3	3.7	8.7	4.0	10.3	5.0	6.0
July 9th	11.3 a	12.0 ab	11.3 c	11.7 b	4.7	8.7	8.3	11.7	5.3	9.7	6.0	10.3
July 23rd	17.0 a	17.3 ab	42.0 a	30.3 a	6.0	10.3	12.7	13.0	7.0	8.3	16.7	16.7
August 5th	18.3 a	13.0 ab	18.7 bc	18.0 b	7.0	7.7	5.3	10.3	9.0	8.3	8.0	8.7
August 21st	15.7 a	21.3 a	18.7 bc	19.0 b	6.7	12.3	6.7	12.3	5.0	10.3	4.7	7.7
September 2nd	10.3 a	12.3 ab	24.7 b	10.7 b	7.3	9.3	6.7	4.7	5.3	5.7	5.7	6.0
Grand mean	13.7	14.4	20.2	16.8	5.9	9.3	7.2	10.1	5.9	8.8	7.7	9.2
LSD at 5%	9.39				NS				NS			

In a column, means followed by the same letter are not significant at the 5% level by LSD.

Table 5. The deduced simple correlation coefficient values between the populations of the three mite suborders associating with stored onion and garlic crops in Alexandria and Quisna and stores conditions during seasons 2000 and 2001.

Source of variance	Effects of store temperature and R.H.% on three mite suborders							
	Alexandria				Quisna			
	Season 2000		Season 2001		Season 2000		Season 2001	
	Temp. °C	R.H.%	Temp. °C	R.H.%	Temp. °C	R.H.%	Temp. °C	R.H.%
Acaridida	0.267 ns	0.291ns	0.226 ns	0.175 ns	0.315 ns	- 0.263 ns	- 0.162 ns	- 0.177 ns
Actinedida	0.324 ns	0.231 ns	0.475 *	0.386 ns	0.337 ns	- 0.077 ns	0.073 ns	0.018 ns
Gamasida	0.195 ns	0.121 ns	0.437 *	0.386 ns	0.442 *	- 0.377 ns	0.095 ns	0.234 ns
Total mites	0.317 ns	0.285 ns	0.549 **	0.453 *	0.395 ns	- 0.266 ns	- 0.095 ns	- 0.044 ns

* = Significant at 5% level, ** = Significant at 1% level and ns = Not significant.

Table 6. A list of the recovered mite species from straw under stored onion an garlic crops in store.

Suborder of Acari	Family	Mite species	Occurrence @
Acaridida	Acaridae	*Rhizoglyphus robini* Claparede	***
		Tyrophagus putrescentiae (Schrank)	***
	Anoetidae	*Anoetus* sp.	*
		Histiostoma sp.	*
Actinedida	Cheyletidae	*Cheyletus malaccensis* Oudemans	***
		Cheyletus eruditus (Schrank)	**
		Acaropsis docta (Berlese)	*
		Acaropsis sollers (Rohdendorf)	*
	Cunaxidae	*Cunaxa* sp.	*
Gamasida	Macrochelidae	*Macrocheles merdarius* (Berlese)	**
	Ameroseiidae	*Kleemannia plumosus* (Oudemans)	*
	Ascidae	*Blattisocius keegani* Fox	**
		Blattisocius mali Fox	*

@ Based on 821 mite specimens, where * = occasionally, ** = Frequently and *** Always.

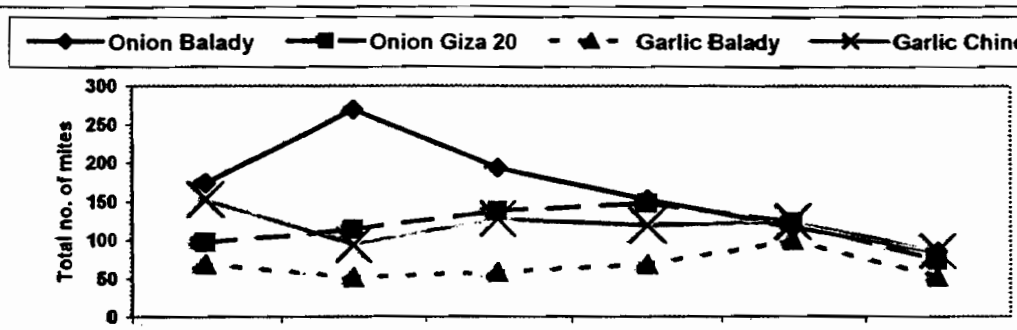

Fig. 1 : Population fluctuations of mites associated with two varieties of onion and garlic crops in stores at Alexandria, during season 2000.

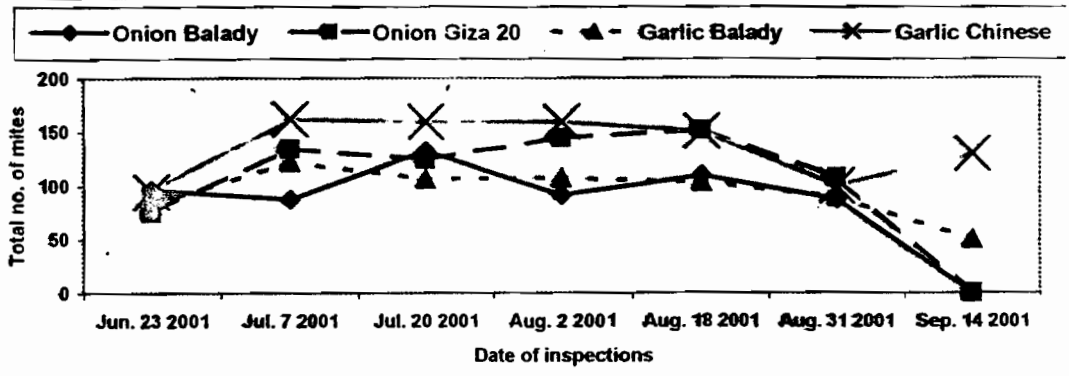

Fig. 2 : Population fluctuations of mites associated with two varieties of onion and garlic crops in stores at Alexandria, during season 2001.

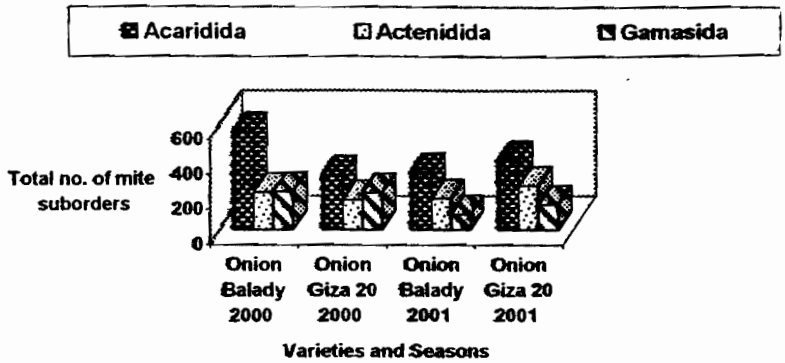

Fig. 3 : Comparison of three mite suborders associated with two varieties of onion crops in stores at Alexandria, during seasons of 2000 and 2001 .

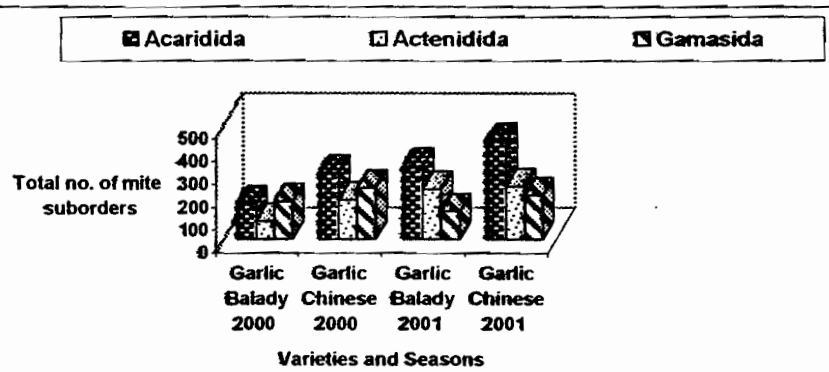

Fig. 4 : Comparison of three mite suborders associated with two varieties of garlic crops in stores at Alexandria, during seasons of 2000 and 2001.

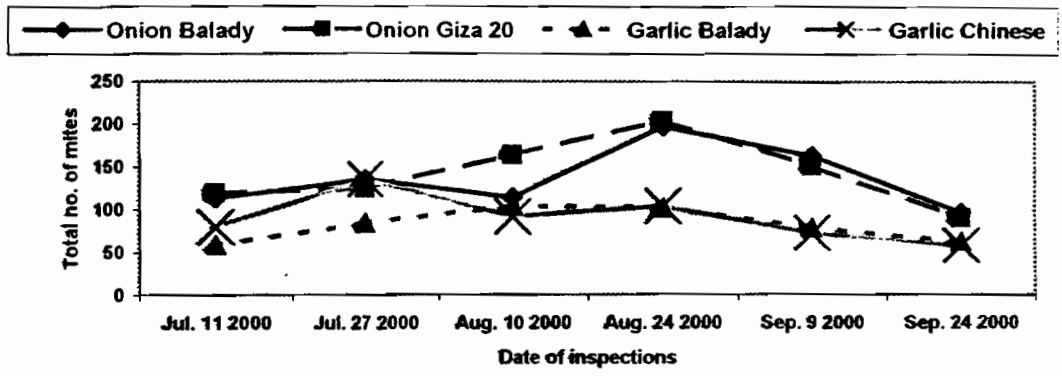

Fig. 5 : Population fluctuations of mites associated with two varieties of onion and garlic crops in stores at Quisna, during season 2000.

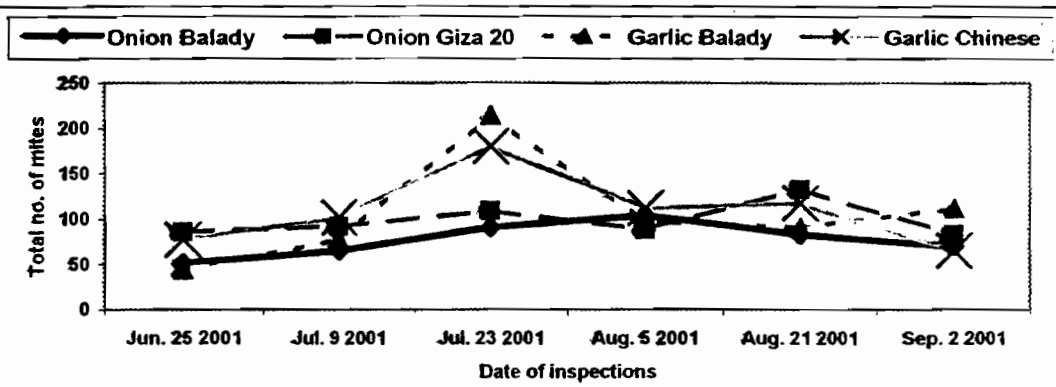

Fig. 6 : Population fluctuations of mites associated with two varieties of onion and garlic crops in stores at Quisna, during season 2001.

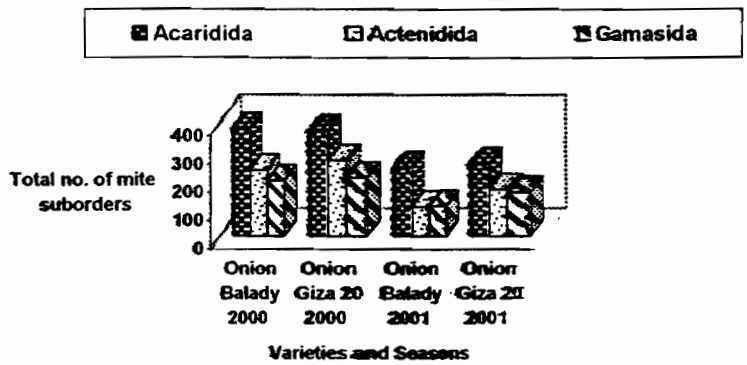

Fig. 7 : Comparison of three mite suborders associated with two varieties of onion crops in stores at Quisna, during seasons of 2000 and 2001.

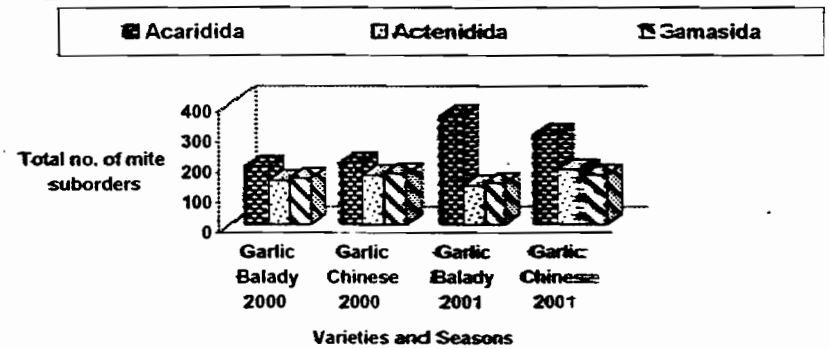

Fig. 8 : Comparison of three mite suborders associated with two varieties of garlic crops in stores at Quisna, during seasons of 2000 and 2001.

الملخص العربى

التغيرات الديناميكية العددية لعشائر الحلم المصاحب لبعض أصناف محصولي البصل والثوم المخزونة فى محافظتى الإسكندرية والمنوفية

أمينة محمد زكى* - حسن محمد أحمد النعناعى** - سعد حمدى ضيف مصرى**

* قسم الحشرات الاقتصادية والحيوان الزراعى - كلية الزراعة - جامعة المنوفية - مصر.

** معهد بحوث وقاية النبات - مركز البحوث الزراعية - القاهرة - مصر.

** معهد بحوث وقاية النبات - مركز البحوث الزراعية - القاهرة - مصر.

من التجارب والمشاهدات للدراسات الايكولوجية للحلم المصاحب لمحاصيل البصل والثوم فى منطقتى الإسكندرية والمنوفية خلال موسمى ٢٠٠٠ و ٢٠٠١ أوضحت النتائج النقاط التالية:

١- كانت الأعداد الكلية لأكاروسات الأكاريدى هى الأعلى فى كلا منطقتين الدراسة خلال الموسمين المتتالين يليها فى ذلك أكاروسات الأكتينديدى ثم أكاروسات الجامسيدى.

٢- كانت الكثافة العددية لأكاروسات الأكاريدى هى الأعلى المصاحبة لجميع أصناف محاصيل البصل والثوم.

٣- كانت الكثافة العددية لأكاروسات الجامسيدى عموما فى مخازن البصل والثوم فى المرتبة العددية الثانية خلال موسم ٢٠٠٠ فى الإسكندرية.

٤- الكثافة العددية للأكاروسات المصاحبة لمحاصيل البصل والثوم خلال موسم ٢٠٠٠ كانت أكثر منها خلال موسم ٢٠٠١.

٥- الكثافة العددية للأكاروسات المصاحبة للبصل والثوم فى مخازن منطقة الإسكندرية كانت أكثر منها فى منطقة قويسنا خلال الموسمين.

٦- كانت درجات الحرارة فى مخازن الإسكندرية أقل منها فى مخازن قويسنا.

٧- فى المقابل كانت النسبة المئوية للرطوبة النسبية فى مخازن الإسكندرية أعلى منها فى مخازن قويسنا.

٨- تأثيرات درجات الحرارة ونسب الرطوبة النسبية على حركة مجموع الأكاروسات تختلف من منطقة إلى أخرى.

٩- الاختلافات فى الكثافة العددية لتحت الرتب الثلاث ربما يرجع إلى الاختلاف فى درجات الحرارة والرطوبة النسبية إلى جانب أنواع وأصناف المحاصيل المختلفة.