

Survey on Mites Associated with Major Insect Pests Infesting Stored Grains in Middle Delta

Ferial M. A. El-Sayed¹ and Mona M. A. Ghallab²

¹Stored Grain Insects Department, Plant Protection Research Institute. ARC.

²Acarology Department, Plant Protection Research Institute. ARC.

ABSTRACT

The present study was directed towards the habitat of various mite species as predators, fungivores or as parasites associated with insects inhabiting grains and stored products. Samples were collected monthly from maize, wheat flour, broad bean, wheat and rough rice in four governorates, Kafr El-Sheikh, Dakahleya, Gharbeya and Menoufeya during the period between March 2003 and February 2004. The results revealed that: 1) The mite survey revealed the occurrence of 13 predatory species belonging to one family of the suborder Gamasida, and 6 families of the suborder Actinedida. Also 7 species belong to 4 families of the suborder Acaridida, were recorded as scavengers or fungivores. 2) The most abundant predaceous mites were: *Blattisocius keegani* Fox followed by *Cheyletus malaccensis* Oudemans, then *Blattisocius tarsalis* (Berlese). 3) The most abundant fungivore mites were: *Tyrophagus putrescentiae* (Shranck), *Rhizoglyphus robini* Claparède, and *Acarus siro* Linnaeus. 4) The most infested stored grains with mites was maize followed by wheat, rough rice, broad bean seeds then wheat flour. 5) The major insect pests of stored grains and seeds and associated mites were listed herein.

KEY WORDS: Mites, fungivores, predators, stored grains.

INTRODUCTION

Stored grains provide all of the essential nutritive requirements for insects and mites capable of chewing into the hard kernels. The biotic potential of these species is enormous and their activities cause heating of grain mass and moisture translocation which permit the development of molds and germination of the grain, and the pests proliferate.

Large numbers of mites are known to infest a variety of grains and stored products throughout the world. They attack damaged and undamaged grains devouring the embryos and other surrounding tissues. This prevents grain germination and reduces its nutritive value. They also feed on fungi and other micro-organisms. Contamination by alive and dead mite different stages as well as exuviae and faeces results in being harmful for human consumption. (Hughes 1976). Another group of mites acts as predators or parasites that prey on the eggs and developmental stages of the major and minor pests of the stored grains (Barker 1967).

Studies on mites inhabiting grains and stored products were reported previously by (Hegazy, 1961; Wafa *et al.*, 1966; Attiah, 1969; Hughes, 1976; Taha, 1985; Zaher *et al.*, 1985) and recently, by (Hoda *et al.*, 1990; Fawzy, 1996; Halawa, 2003 and El-Sanady 2005). The present work was conducted to survey mites associated with stored grains in four governorates in Nile Delta.

MATERIALS AND METHODS

During the period between March 2003 and February 2004, samples of maize, wheat, wheat

flour, broad bean and rough rice¹ were collected monthly from granaries at Kafr El-Sheikh, Dakahleya, Gharbeya and Menoufeya. Samples about 1kg. each, from the previous materials were collected in cloth bags and transported to the laboratory with a label concerning habitat locality and date of collection.

For extracting mites, an amount of 150 gm. from each sample under study was placed in modified Tullgren funnels and left for a period of 24 hours. The extracted mites were received in Petri-dishes filled with water and its edges smeared with a layer of Vaseline to prevent mites from escaping.

Extracted mites were cleared in Nesbitt's solution, then mounted in Hoyer's medium on glass slides. Specimens were identified and classified into their taxonomical rank by using different specific keys.

RESULTS AND DISCUSSION

Mite diversity and species composition of stored products:

Survey study reveals the occurrence of mites and insects inhabiting different stored crops (maize, wheat, broad bean, rough rice and wheat flour).

They feed on stored materials, fungus or being predators or parasites and the latter may be of great benefit in the biological control of associated insect and acarine pests. Twenty mite species, belong to 3 suborders representing 11 families and 16 genera were collected (Tables 1-7).

I - Predaceous mites:

The predaceous mites included 13 species representing 7 families. One family belongs to

suborder Gamasida and 6 families of the suborder Actinedida

Family Ascidae Voigts & Oudemans

Two species: *Blattisocius keegani* Fox and *B. tarsalis* (Berlese) were isolated from the aforementioned stored grains associated with acarid mites and different insects (Table 1). The highest occurrence of this family was noticed in maize (Table 2), and it was frequently found all-over the year in Gharbeya (Table 3).

Blattisocius sp. is of good potential use as predator to control stored grain pests. Barker (1967), cited that immature stages and adults of this predator fed on eggs of numbers of different grain beetles: *Tribolium confusum* (Jacqueline du Val), *T. castaneum* Herbst, *Trypoderma* sp. and *Oryzaephilus surinamensis* Linnaeus. Lindquist (1983), stated that *B. tarsalis* exerted effective natural control against stored product pyralid moth, especially *Anagasta cautella* (Walker). In Egypt, (Fawzy 1996), reared *Blattisocius keegani* Fox on two stored grain pests: *Suidasia nesbitti* (Hughes) and *Grammlichus aegypticus* Shereef & Fawzy. The adult female lived for 25.3 and 26 days and deposited averages of 24.9 and 14.1 eggs when fed on the two aforementioned preys, respectively. The adult female consumed 31 and 25 individuals of *S. nesbitti* and of *G. aegypticus* respectively during its life span. Also, (El-Sanady 2005), reared the same predator on the larval stages of *Tyrophagus putrescentiae* (Schrank) and *Rhizoglyphus robini* Claparède. The adult consumed 31.1 and 28.5 individuals of the two prementioned preys, respectively, during its life span.

Family Cheyletidae Leach

Five species were recorded: *Cheyletus malaccensis* Oudemans, *C. malayensis* Cunliffe, *C. fortis* Oudemans, *Acaropsellina sollers* Rohdendorf and *Nodele simplex* Wafa & Soliman. They were found associated with different insect pests and with astigmatid mites on which they feed in different seeds and areas (Tables 1-7).

***Cheyletus malaccensis*:** This species was the most widely distributed predator in this family and the second common mite of all stored Acari. This view is confirmed by (Hoda *et al.* 1990). It was recorded in the five sources under study. Its highest population was recorded in maize followed by wheat from Kafr El-Sheikh and Gharbeya.

Biological work on this species was undertaken by (Saleh *et al.* 1986). The immature stages and adult consumed 44 and 23.7 individuals of the stored product mite: *Aleuroglyphus ovatus* Troupeau respectively.

***Cheyletus malayensis*:** It was found only in Dakahleya, in all sources under investigation but, in

rare number (Table 2). (Hoda *et al.* 1990) collected it before from rice in Giza, Egypt.

***Cheyletus fortis*:** It was noted in few numbers in wheat, rice and maize from Kafr El-Sheikh only.

***Acaropsellina sollers*:** Few numbers were recorded from bean in Dakahleya. It feeds on acarid mites and their eggs (Summers & Price 1970).

***Nodele simplex*:** This species was separated from rice in few numbers in Dakahleya.

Family Bdellidae Dugès

Two species belonging to this family: *Spinibdella bifurcate* Atyeo and *S. depressa* (Ewing) were recorded.

***Spinibdella bifurcate*:** It was collected from maize, wheat and broad bean seeds in few numbers, from Gharbeya; and was also found in rice from Dakahleya, while *Spinibdella depressa* collected from broad bean in Gharbeya, (Atyeo 1960) and (Hughes 1961) cited that *S. bifurcate* prey on arthropod eggs and on other mites.

Family Cunaxidae Thor

Only *Cunaxa capreolus* (Berlese) was detected in this family. It was found in rice rough in the three governorates, Gharbeya, Dakahleya and Kafr El-Sheikh; in wheat from Menoufeya; and in maize and broad bean from Kafr El-sheikh.

This species was reared by Zaher *et al.* (1975) on book lice. (Lindquist 1983) stated that members of the family Cunaxidae, are used in biological control.

Family Raphignathidae Kramer

Incidence of this predatory mite *Raphignathus* sp. was recorded rarely in maize and wheat, in Menoufeya and Kafr El-Sheikh, associated with other mites and insects. It was noted before by Zaher *et al.* (1985) and Hoda *et al.* (1990) in grains in Fayoum and Giza respectively.

Family Stigmaeidae Oudemans

The predator *Apostigmaeus aegyptiacus* Soliman & Gomaa was abundant in rice only in Kafr El-Sheikh, associated with acarid mites. Members of this family are regarded as beneficial species. They prey on mites and other associated arthropods (Gonzalez, 1965).

Family Pyemotidae Oudemans

Only two individuals of *Pyemotes ventricosus* Hughes were separated from maize and flour, in Menoufeya and Dakahleya.

Members of this family are mainly parasitic on insects, sucking their haemolymph. Biological study of this parasite was carried out by Tawfic & Awad-Allah (1970) in Egypt. They recorded that *Pyemotes herfsi* (Oudemans) limited the population of the pink boll worm, *Pectinophora gossypiella* Saunders, which passing the winter and the spring in dry cotton boll. as 48 % of the caterpillars were killed. Also, Moser (1975) recorded that *P. ventricosus* was a

Table (1): Mites associated with insects in stored grains and seeds in four governorates

Governorate & stored grain	Insect pests (Order : Family)	Mites		
		Pedators	Pests	
KAFR EL-SHEIKH	Wheat	<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Cheyletus malaccensis</i> Oudemans	<i>Tyrophagus putrescentiae</i> (Schrank)
		<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Cheyletus fortis</i> Oudemans	<i>Rizoglyphus robini</i> Claparède
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)		
	Maize	<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	No mite pests
		<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Cheyletus malaccensis</i> Oudemans	
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Cheyletus fortis</i> Oudemans	
			<i>Raphignathus</i> sp.	
	Wheat flour		<i>Cunaxa capreolus</i> (Berlese)	
		<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	<i>Tyrophagus putrescentiae</i> (Schrank)
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Cheyletus malaccensis</i> Oudemans	
	Broad bean	No insect pests	<i>Blattisocius keegani</i> Fox	<i>Tyrophagus putrescentiae</i> (Schrank)
			<i>Cheyletus malaccensis</i> Oudemans	
Rough rice*		<i>Cunaxa capreolus</i> (Berlese)		
	<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	<i>Lepidoglyphus destructor</i> (Schrank)	
	<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Blattisocius tarsalis</i> (Berlese)	<i>Rizoglyphus robini</i> Claparède	
	<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Cheyletus malaccensis</i> Oudemans	<i>Tyrophagus putrescentiae</i> (Schrank)	
		<i>Cheyletus fortis</i> Oudemans		
		<i>Spinibdella bifurcata</i> Atyeo		
DAKAHLEYA	Wheat		<i>Apostigmaeus aegyptiaca</i> Soliman & Goma	
			<i>Cunaxa capreolus</i> (Berlese)	
		<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	No mite pests
	Maize	<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Cheyletus malaccensis</i> Oudemans	
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)		
		<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	No mite pests
	Wheat flour	<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Cheyletus malaccensis</i> Oudemans	No mite pests
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Cheyletus malayensis</i> Cunliffe	
			<i>Spinibdella bifurcata</i> Atyeo	
	Broad bean		<i>Pyemotes</i> sp.	
		<i>Bruchus rufimanus</i> Boheman (Coleoptera : Chrysomelidae)	<i>Blattisocius keegani</i> Fox	No mite pests
	Rough rice		<i>Cheyletus malaccensis</i> Oudemans	
No insect pests		<i>Acaropsellina sollers</i> Rhodendorf		
		<i>Cheyletus malayensis</i> Cunliffe	No mite pests	
GHARBEYA	Wheat		<i>Spinibdella bifurcata</i> Atyeo	
			<i>Nodele simplex</i> Wafa & Soliman	
		<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	<i>Lepidoglyphus destructor</i> (Schrank)
	Maize	<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Blattisocius tarsalis</i> (Berlese)	
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Spinibdella depressa</i> (Ewing)	
			<i>Cheyletus malaccensis</i> Oudemans	
	Wheat flour	<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	<i>Lepidoglyphus destructor</i> (Schrank)
		<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Blattisocius tarsalis</i> (Berlese)	<i>Goheria</i> sp.
		<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Spinibdella bifurcata</i> Atyeo	
	Broad bean		<i>Cheyletus malaccensis</i> Oudemans	
		<i>Bruchus rufimanus</i> Boheman (Coleoptera : Chrysomelidae)	<i>Blattisocius keegani</i> Fox	<i>Lepidoglyphus destructor</i> (Schrank)
			<i>Spinibdella bifurcata</i> Atyeo	<i>Rizoglyphus robini</i> Claparède
Rough rice		<i>Cheyletus malaccensis</i> Oudemans	<i>Dermatophagoides farini</i> Hughes	
	<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	<i>Lepidoglyphus destructor</i> (Schrank)	
	<i>Rhyzopertha dominica</i> (Fabricius) (Coleoptera : Bostrichidae)	<i>Spinibdella bifurcata</i> Atyeo	<i>Rizoglyphus robini</i> Claparède	
MENOUEFEYA	Wheat	<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Cheyletus malaccensis</i> Oudemans	<i>Tyrophagus putrescentiae</i> (Schrank)
			<i>Cunaxa capreolus</i> (Berlese)	<i>Dermatophagoides farini</i> Hughes
		<i>Sitophilus oryzae</i> (Linnaeus) (Coleoptera : Curculionidae)	<i>Blattisocius keegani</i> Fox	<i>Rizoglyphus robini</i> Claparède
	Maize	<i>Oryzaephilus suriameis</i> Linnaeus	<i>Blattisocius tarsalis</i> (Berlese)	<i>Acarus siro</i> Linnaeus
		<i>Sitotroga cerealella</i> Olivier	<i>Cheyletus malaccensis</i> Oudemans	
			<i>Cunaxa capreolus</i> (Berlese)	
	Wheat flour	<i>Sitophilus oryzae</i> (Linnaeus)	<i>Blattisocius keegani</i> Fox	<i>Lepidoglyphus destructor</i> (Schrank)
			<i>Blattisocius tarsalis</i> (Berlese)	<i>Rizoglyphus robini</i> Claparède
			<i>Cheyletus malaccensis</i> Oudemans	<i>Acarus siro</i> Linnaeus
	Broad bean		<i>Cheyletus malayensis</i> Cunliffe	<i>Tyrophagus putrescentiae</i>
			<i>Raphignathus</i> sp.	
			<i>Pyemotes</i> sp.	
Rough rice	<i>Tribolium confusum</i> J. du Val (Coleoptera : Tenebrionidae)	<i>Blattisocius tarsalis</i> (Berlese)	<i>Chortoglyphus</i> sp.	
		<i>Blattisocius keegani</i> Fox		
		<i>Cheyletus malaccensis</i> Oudemans		

* Rice grain with husk

Table (2): Frequency of mites in different stored grains and seeds

Suborder, Family& mite sp.	Status	Maize	Wheat	Wheat flour	Broad bean	Rough rice
I - Suborder : Mesostigmata						
Family Ascidae Viogts& Oud.						
a- <i>Blattisocius keegani</i> Fox	Predator	****	***	**	*	***
b- <i>B. tarsalis</i> Berlese	Predator	***	**	*	**	x
II - Suborder : Prostigmata						
Family Cheyletidae Leach						
a- <i>Cheyletus malayensis</i> Cunliffe	Predator	*	*	*	*	*
b- <i>C. malaccensis</i> Oudemans	Predator	****	***	*	**	*
c- <i>C. fortis</i> Oudemans	Predator	**	*	x	x	*
d- <i>Acaropsellina sollers</i> Rohdendorf	Predator	x	x	x	*	x
e- <i>Nodele simplex</i> Wafa&Soliman	Predator	x	x	x	x	*
Family Bdellidae						
a- <i>Spinibdella depressa</i> (Ewing)	Predator	x	*	x	x	x
b- <i>S.bifurcata</i> Atyeo	Predator	*	*	*	*	*
Family Cunaxidae						
<i>Cunaxa capreolus</i> (Berlese)	Predator	*	*	x	*	*
Family Pyemotidae						
<i>Pyemotes</i> sp.	Parasite	*	x	*	x	x
Family Raphignathidae (Kramer)						
<i>Raphignathus</i> sp.	Predator	*	*	x	x	x
Family Stigmaeidae Oudemans						
<i>Apostigmaeus aegyptiacus</i> Soliman& Goma	Predator	x	x	x	x	***
III- Suborder : Astigmata						
Family Acaridae Ewing & Nesbitt						
a - <i>Acarus siro</i> L.	Pest	****	*	x	x	x
b- <i>Tyrophagus putrescentiae</i> (Schrank)	Pest	*	****	****	****	***
c- <i>Rizoglyphus robini</i> Claparède	Pest	*	***	****	*	*
Family Glycyphagidae Berlese						
a- <i>Lepidoglyphus destructor</i> (Schrank)	Pest	**	***	*	*	**
b - <i>Goheria</i> sp.	Pest	*	x	x	x	x
Family Pyroglyphidae Cunliffe						
<i>Dermatophagoides farinae</i> Hughes	Pest	x	x	x	*	*
Family Chortoglyphidae Berlese						
<i>Chortoglyphus</i> sp.	Pest	x	x	*	x	x

*: 1-5 mites/sample (Rare)

***: 10-25 mites/sample (Abundant)

**: 5-10 mites/sample (Moderate)

****: < 100 mites/sample (Highly abundant)

x: Not recorded

Table (3): Survey of mite species inhabiting maize in different governorates (between March 2003 & February 2004)

Month	Mite species	Menoufeya	Gharbeya	Dakahleya	Kafr El-Sheikh
March	—	X	X	X	X
April	<i>Cheyletus malaccensis</i>	*	X	X	X
	<i>Blattisocius keegani</i>	X	X	*	X
May	<i>Cheyletus malaccensis</i>	X	X	*	*
	<i>Raphignathus sp.</i>	X	X	X	*
June	<i>Cheyletus fortis</i>	X	X	X	**
July	<i>Blattisocius tarsalis</i>	X	***	X	X
	<i>Blattisocius keegani</i>	X	*	X	X
August	<i>Blattisocius keegani</i>	*	****	*	*
	<i>Raphignathus sp.</i>	*	X	X	X
	<i>Cheyletus malaccensis</i>	X	****	**	***
	<i>Cunaxa capreolus</i>	X	X	X	*
	<i>Acarus siro</i>	****	X	X	X
Sept	<i>Blattisocius keegani</i>	*	*	*	X
	<i>Cheyletus malaccensis</i>	X	*	**	X
	<i>Spinibdella bifurcata</i>	X	*	X	X
	<i>Lepidoglyphus destructor</i>	X	*	X	X
Oct	<i>Blattisocius keegani</i>	**	****	*	*
	<i>Cheyletus malaccensis</i>	*	*	X	*
	<i>Pyemotes sp.</i>	*	X	X	X
	<i>Rizoglyphus robini</i>	*	X	X	X
	<i>Lepidoglyphus destructor</i>	*	X	X	X
	<i>Tyrophagus putrescentiae</i>	*	X	X	X
Nov	<i>Blattisocius keegani</i>	*	***	*	*
	<i>Cheyletus malaccensis</i>	*	*	X	*
	<i>Rizoglyphus robini</i>	*	X	X	X
	<i>Lepidoglyphus destructor</i>	*	X	X	X
Dec	<i>Tyrophagus putrescentiae</i>	*	X	X	X
	<i>Blattisocius keegani</i>	*	*	*	*
	<i>Rizoglyphus robini</i>	*	X	X	X
2004	<i>Tyrophagus putrescentiae</i>	*	*	X	X
	<i>Blattisocius keegani</i>	*	*	*	////
	<i>Cheyletus malaccensis</i>	X	*	X	////
	<i>Lepidoglyphus destructor</i>	*	**	X	////
Feb	<i>Goheria sp.</i>	X	*	X	////
	<i>Blattisocius keegani</i>	*	*	*	////
	<i>Cheyletus malaccensis</i>	X	*	X	////
	<i>Lepidoglyphus destructor</i>	*	**	X	////

*: 1-5 mites/sample (Rare)

***: 10-25 mites/sample (Abundant)

**: 5-10 mites/sample (Moderate)

****: < 100 mites/sample (Highly abundant)

x: Not recorded

////: Samples were not available

Table (4): Survey of mite species inhabiting wheat in different governorates (between March 2003 & February 2004)

Month	Mite species	Menoufeya	Gharbeya	Dakahleya	Kafr El-Sheikh	
2003	March	X	X	X	X	
	<i>Cheyletus malaccensis</i>	X	*	X	X	
	April	<i>Cunaxa capreolus</i>	*	X	X	X
		<i>Spinibdella depressa</i>	X	*	X	X
	May	<i>Cheyletus malayensis</i>	X	X	*	X
		<i>C. malaccensis</i>	X	X	X	*
		<i>Raphignathus</i>	X	X	X	*
	June	<i>Cheyletus fortis</i>	X	X	X	*
		<i>Blattisocius keegani</i>	X	*	X	X
		<i>B. tarsalis</i>	X	*	X	X
		<i>B. tarsalis</i>	**	X	X	X
	July	<i>B. keegani</i>	X	*	X	X
		<i>Cheyletus malaccensis</i>	X	***	X	*
		<i>Spinibdella bifurcata</i>	X	*	X	X
	August	<i>Blattisocius keegani</i>	X	*	*	X
		<i>Cheyletus malaccensis</i>	*	**	**	**
		<i>Acarus siro</i>	*	X	X	X
		<i>Blattisocius keegani</i>	*	X	X	X
	Sept	<i>B. tarsalis</i>	*	***	X	X
		<i>Cheyletus malaccensis</i>	*	**	X	***
<i>Lepidoglyphus destructor</i>		X	**	X	X	
Oct	<i>Cheyletus malaccensis</i>	X	*	X	X	
	<i>Rhizoglyphus robini</i>	*		X	X	
Nov	<i>Blattisocius keegani</i>	X	*	X	X	
	<i>Cheyletus malaccensis</i>	X	*	*	X	
	<i>Rhizoglyphus robini</i>	*	X	X	**	
	<i>Lepidoglyphus destructor</i>	X	*	X	X	
Dec	<i>Blattisocius keegani</i>	X	*	*	X	
	<i>B. tarsalis</i>	X	*	X	X	
	<i>Cheyletus malaccensis</i>	X	X	X	**	
	<i>Rhizoglyphus robini</i>	X	X	X	**	
2004	<i>Blattisocius keegani</i>	X	*	*	X	
	<i>B. tarsalis</i>	X	*	X	X	
	<i>Cheyletus malaccensis</i>	*	X	*	***	
	<i>Lepidoglyphus destructor</i>	X	***	X	X	
	<i>Tyrophagus putrescentiae</i>	X	X	X	****	
	<i>Rhizoglyphus robini</i>	*	X	X	****	
	<i>Acarus siro</i>	X	*	X	X	
	<i>Blattisocius keegani</i>	X	*	*	X	
	<i>Cheyletus malaccensis</i>	*	X	*	**	
	Feb	<i>Lepidoglyphus destructor</i>	X	**	X	X
<i>Tyrophagus putrescentiae</i>		X	X	X	***	
<i>Rhizoglyphus robini</i>		*	X	X	***	
<i>Acarus siro</i>		X	*	X	X	

*: 1 - 5 mites / sample (Rare)

**: 5 - 10 mites / sample (Moderate)

***: 10 - 25 mites / sample (Abundant)

****: < 100 mites / sample (Highly abundant)

x: Not recorded

Table (5): Survey of mite species inhabiting wheat flour in different governorates (between March 2003 & February 2004)

Month	Mite species	Menoufeya	Gharbeya	Dakahleya	Kafr El-Sheikh
March		x	x	x	////
April		x	x	x	x
May		x	x	x	x
June		x	x	x	x
July	<i>Blattisocius tarsalis</i>	*	x	x	x
	<i>Cheyletus malaccensis</i>	*	x	x	x
	<i>C. malayensis</i>	x	x	*	x
	<i>Spinibdella bifurcata</i>	x	x	*	x
August	<i>Cheyletus malaccensis</i>	*	x	x	*
Sept	<i>Blattisocius keegani</i>	x	*	x	x
	<i>Pyemotes sp.</i>	x	x	x	x
	<i>Lepidoglyphus destructor</i>	x	x	x	x
Oct	<i>Blattisocius keegani</i>	*	x	x	*
	<i>Cheyletus malaccensis</i>	x	x	*	x
	<i>Chortoglyphus sp.</i>	*	x	x	x
	<i>Rhizoglyphus robini</i>	x	****	x	x
Nov	<i>Blattisocius keegani</i>	*	*	x	*
	<i>Chortoglyphus sp.</i>	*	x	x	x
	<i>Rhizoglyphus robini</i>	x	***	x	x
Dec	<i>Blattisocius keegani</i>	*	*	x	x
	<i>Rhizoglyphus robini</i>	x	**	x	x
	<i>Lepidoglyphus destructor</i>	x	*	x	x
	<i>Tyrophagus putrescentiae</i>	x	*	x	x
2004 Jan	<i>Lepidoglyphus destructor</i>	x	*	x	x
	<i>Tyrophagus putrescentiae</i>	x	x	x	****
Feb	<i>Tyrophagus putrescentiae</i>	x	*	x	***

Table (6): Survey of mite species inhabiting broad bean seeds in different governorates (between March 2003 & February 2004)

Month	Mite species	Menoufeya	Gharbeya	Dakahleya	Kafr El-Sheikh
March		x	x	x	x
April	<i>Acaropsellina sollers</i>	x	x	*	x
May	<i>Acaropsellina sollers</i>	x	x	*	x
June	<i>Spinibdella bifurcata</i>	x	*	x	x
July	<i>Blattisocius tarsalis</i>	**	x	x	x
	<i>Cheyletus malaccensis</i>	*	x	x	x
	<i>C. malayensis</i>	x	x	*	x
	<i>Cunaxa capreolus</i>	x	x	x	*
August	<i>Spinibdella bifurcata</i>	x	*	x	x
	<i>Blattisocius keegani</i>	x	x	x	*
	<i>Cheyletus malaccensis</i>	***	x	**	**
Sept	<i>Blattisocius keegani</i>	x	*	x	x
	<i>Cheyletus malaccensis</i>	*	x	x	x
	<i>Dermatophagoides farinae</i>	x	*	x	x
	<i>Lepidoglyphus destructor</i>	x	*	x	x
Oct	<i>Blattisocius keegani</i>	x	x	*	*
	<i>Cheyletus malaccensis</i>	*	*	x	x
Nov	<i>Rhizoglyphus robini</i>	*	*	x	x
	<i>Blattisocius keegani</i>	x	x	x	*
	<i>Rhizoglyphus robini</i>	x	*	x	x
Dec	<i>Blattisocius keegani</i>	*	*	x	*
	<i>Rhizoglyphus robini</i>	*	*	x	x
2004 Jan	<i>Tyrophagus putrescentiae</i>	x	x	x	****
	<i>Lepidoglyphus destructor</i>	x	x	x	x
	<i>Blattisocius keegani</i>	x	*	x	x
	<i>Cheyletus malaccensis</i>	x	x	x	*
Feb	<i>Lepidoglyphus destructor</i>	x	***	x	x

Table (7): Survey of mite species inhabiting rough rice in different governorates (between March 2003 & February 2004)

Month	Mite species	Gharbeya	Dakahleya	Kafr El-Sheikh	
2003	March	X	X	X	
	April	X	X	X	
	May	X	X	X	
	June	<i>Blattisocius keegani</i>	*	X	X
		<i>Nodele simplex</i>	X	*	X
		<i>Cheyletus fortis</i>	X	X	*
		<i>Cunaxa capreolus</i>	X	X	*
		<i>Spinibdella bifurcata</i>	X	*	X
		<i>Tyrophagus putrescentiae</i>	X	X	X
	July	<i>Blattisocius keegani</i>	*	X	X
		<i>Cheyletus malayensis</i>	X	*	X
		<i>Spinibdella bifurcata</i>	X	*	X
		<i>Cunaxa capreolus</i>	X	X	*
		<i>Tyrophagus putrescentiae</i>	*	X	X
	Aug.	<i>Cheyletus malayensis</i>	X	*	X
		<i>Spinibdella bifurcata</i>	*	*	X
	Sept.	<i>Blattisocius keegani</i>	***	X	X
		<i>Cheyletus malaccensis</i>	*	X	*
		<i>Spinibdella bifurcata</i>	*	X	X
		<i>Lepidoglyphus destructor</i>	X	X	*
	Oct.	<i>Blattisocius keegani</i>	**	////	*
		<i>Cheyletus malaccensis</i>	X	////	*
		<i>Cunaxa capreolus</i>	*	////	X
		<i>Rhizoglyphus robini</i>	*	////	*
		<i>Blattisocius keegani</i>	*	////	*
	Nov.	<i>Cheyletus malaccensis</i>	X	////	*
<i>Rhizoglyphus robini</i>		*	////	*	
<i>Lepidoglyphus destructor</i>		*	////	**	
<i>Tyrophagus putrescentiae</i>		X	////	***	
<i>Blattisocius keegani</i>		*	////	*	
2004	Jan.	<i>Blattisocius tarsalis</i>	X	////	*
		<i>Cheyletus malaccensis</i>	X	////	*
		<i>Apostigmaeus sp.</i>	X	////	**
		<i>Lepidoglyphus destructor</i>	*	////	**
		<i>Rhizoglyphus robini</i>	*	////	*
		<i>Dermatophagoides farinae</i>	*	////	***
		<i>Tyrophagus putrescentiae</i>	X	////	***

*: 1 - 5 mites / sample (Rare)

**: 5 - 10 mites / sample (Moderate)

***: 10 - 25 mites / sample (Abundant)

****: < 100 mites / sample (Highly abundant)

////: Samples were not available

x: Not recorded

common predator of larval and pupal moths in grain storages attacking granary.

II – Grains feeders and fungivorous mites

Four families belonging to suborder Acaridida were recorded namely: Acaridae, Glycyphagidae, Pyroglyphidae and Chortoglyphidae.

Members of these families may cause direct injury by feeding and loosing weight of stored grains, and by contamination with old skins, excrement and dead bodies; also feed on fungi. Infested materials became unsuitable for human consumption and may cause digestive troubles when eaten and dermatitis when handled (Sinha, 1964).

Family Acaridae Ewing & Nesbitt

Three acarid species of this family namely, *Tyrophagus putrescentiae* (Schrank), *Rhizoglyphus robini* Claparède and *Acarus siro* Linnaeus were noted.

T. putrescentiae and *R. robini* were noted in great numbers in the five sources under study. Developmental stages of these species were found in wheat, flour and bread bean, in Gharbeya and Kafr El-Sheikh (Tables 4-6). This finding was indicated previously by Wafa *et al.*, 1966; Krantz 1978; Fawzy 1996 and El-Sanady 2005). Hughes 1961 reported that *T. putrescentiae* completed its life cycle, in 2 to 3 weeks, on wheat germ as food. In 1968, Sinha and Mills noted that *A. siro* fed on *Penicillium* sp. and distributed the spores throughout the substrate.

Family Glycyphagidae Berlese

Two glycyphagid species were recorded, *Lepidoglyphus destructor* (Schrank) and *Gohieria* Oudemans.

Lepidoglyphus destructor was frequently found in the five aforementioned stored grains. Similar result was obtained by (Fawzy, 1996). It could cause allergy when handled.

Gohieria sp.: It was collected from maize in Gharbeya. It is widely distributed in stored grains in many parts of the world (Hughes, 1976).

Family Pyroglyphidae Cunliffe

Only one species was recorded, *Dermatophagoides farinae* Hughes. It was isolated from rice and bean from Gharbeya and Kafr El-Sheikh Governorates (Table 7). It was found in flour by (Attiah 1969) and in corn and flour by (Zaher 1986).

Family Chortoglyphidae Berlese

Only, the genus *Chortoglyphus* Berlese was collected from flour in Menoufeya. Hughes, (1976), separated this species from mills and granaries. Also, (Attiah, 1969), isolated it from rice.

However the stored grains harbored predatory and parasitic mites associated with different pest species of mites and insects. Other group fed on

grains, seeds and other stored products. Contamination with their dead bodies and excreta as well as other microorganisms make it unsuitable for human use causing digestive troubles and dermatitis. Other mites prefer to feed on fungi.

Research on the potential of predatory and parasitic mites in controlling destructive insects and mites in stored grains should be augmented. The effect of naturally occurring and utilizing predatory mites associated with stored grain insects require further study.

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