

## Article

### **Preliminary observations on mites found in domesticated animal food factories in Karaj, Iran**

Marjan Seiedy<sup>1</sup>, Alireza Saboori<sup>2</sup> & Hossein Allahyari<sup>2</sup>

*1 Department of Animal Biology, School of Biology, College of Science, University of Tehran, Tehran, Iran; e-mail: mseyyedi@ut.ac.ir*

*2 Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran; e-mails: saboori@ut.ac.ir & allahyar@ut.ac.ir*

#### **Abstract**

Between March 2004 and May 2005, 16 species of mites belonging to the suborders Prostigmata and Oribatida, and order Mesostigmata were found in wheat, barley, beet pulp and cottonseed meal (in the residue from, for example, the floor, equipment and the outside of sacks) in five factories producing food for domesticated animals. Mites were not found in samples of maize and bran collected. The factories are all in the Karaj region of Alborz Province in Iran.

**Key words:** mites, fauna, Oribatida, Mesostigmata, Prostigmata

#### **Introduction**

The infestation of stored food products by mites and other arthropods is usually associated with three types of damage (Stejskal 2001). Firstly, storage mites directly endanger human and animal health due to allergenic contamination of food (Olsson and Hage-Hamsten 2000; Arlian 2002). Secondly, mites are vectors of toxicogenic fungi (Hubert *et al.* 2004) and thus indirectly contribute to contamination of food and feed with mycotoxins (Griffiths *et al.* 1959; Hubert *et al.* 2004). Thirdly, mites cause significant grain weight losses and decreased germinability (Ždárková & Reska 1976). Mites often infest grain during harvesting, transporting, processing for consumption and storage. According to their feeding habits, they can be divided into phytophages, predators and fungivores (Li 1984).

It has been reported that they can also lead to human and animal acariasis such as acarodermatitis, intestinal acariasis, pulmonary acariasis and allergy (Li & Li 1988).

In Iran, many research works have been conducted on stored product mites. Sepasgozarian (1977 a, b, 1978) recorded mites associated with stored food products extensively in Iran. Other studies were carried out in Kazerun (Fars Province) (Ostovan 1993), Neka (Mazandaran Province) (Ardeshir *et al.* 2000), Tehran (Tehran Province) (Yousefi Porshekeh 2006), Zanjan (Zanjan Province) (Mirzaei 2005) and Karaj (Alborz Province) (Seiedy *et al.* 2009).

So far in Iran, researchers have not investigated factories producing food for domesticated animals. During the period between March 2004 and May 2005, stored

food products were sampled in five such factories in Karaj, Iran, to study the occurrence and abundance of mites. The results of this work are presented here.

## Material and methods

Samples of different stored products, namely wheat, barley, maize, bran, beet pulp and cottonseed meal were collected approximately every weeks from five factories producing food for domesticated animals (Behamin, Chine, Keshtzar, Khoshe Talaei, Kosar).

From March 2004 to May 2005, a total of 600 samples of the six products were collected from the five factories. The samples were placed in plastic bags, sealed, and then transferred to the laboratory for investigation. Each of the six stored product items was treated as follows: one sample (2.5 kg), consisting of five subsamples (0.5 kg), was taken from five sampling points per factory; all 2.5 kg samples were gently combined and blended, and then a 200 g subsample was placed on a Berlese funnel and left for 2 days to extract the mites (Ardehshir *et al.* 2000). The specimens were cleared in Nesbitt's fluid at ambient temperatures and mounted on glass slides using Hoyer's medium (Krantz and Walter 2009). Different mite taxa were mounted on separate slides. The mites were identified by using various publications (e.g. Hughes 1976 and Smiley 1991). Specimens were then sent to Drs. A. Bochkov and F. Ardehshir for confirmation of identity. The specimens are deposited in the Acarological collection, Jalal Afshar Zoological Museum, College of Agriculture, University of Tehran, Karaj, Iran.

## Results

During this investigation, 16 species of mites were identified belonging to 8 families, one order and two suborders as follows: Prostigmata: Cheyletidae; Mesostigmata: Ascidae and Laelapidae; Oribatida: Euphthiracaridae, Oribatulidae, Tectocephidae, Suctobelbidae and Astigmatina: Acaridae. The highest total diversity was observed in Behamin factory in barley, beet pulp and wheat (Table 2).

The most frequently found species was *Tyrophagus longior* (Gervais, 1844) which occurred in almost half of the infested samples (Table 3). It was followed by *Acaropsellina sollers* (Kuzin, 1940) in 41.2% of the infested samples; *Cheyletus carnifex* Zachvatkin, 1935 in 34.5%; *Neocotyledon rhizoglyphoides* (Zachvatkin, 1937) in 16.6%; *Cosmoglyphus oudemansi* Zachvatkin, 1937 in 13.3%; *Proctolaelaps regalis* De Leon, 1963 and *Androlaelaps casalis* (Berlese, 1887) in 4.6%; *Oribatula* sp. in 11.9%; *Acarus farris* Oudemans, 1905 in 5.3%, *Cheyletus malaccensis* Oudemans, 1903 in 17.2%, *Zygoribatula* sp. in 6.6%; *Cheyletus malayensis* Cunliffe, 1962 and *Haemogamasus pontiger* Berlese, 1904 in 1.3%, *Rhysotritia ardua* (C. L. Koch, 1841) in 7.9%, *Tectocephus velatus* (Michael, 1880) in 18.6% and *Flagrosuctobelba* sp. in 0.6%.

Mites were extracted from 247/600 (41.1%) samples (Table 1). Altogether 60 samples of maize and bran were taken but no mites were found in them. Overall, and for the two major cereals, barley and wheat, the lowest percentages of infested samples were observed in Behamin factory: 8.6%, 16.6% and 10%, respectively. On the other hand, the two highest percentages of infested samples were found in Kosar and Chine factories, 57.3% and 44.6% respectively.

**Table 1.** Summary of mite infestations in material samples collected from five domesticated animal food factories in Karaj from March 2004 to May 2005

	Kosar	Chine	Keshtzar	Khoshe talaei	Behamin	Total
Barley:						
No. samples	30	30	30	30	30	150
No. infested: % infestation	26: 86.6%	22: 73.3%	18: 60%	20: 66.6%	5: 16.6%	91: 60.6%
Wheat:						
No. samples	30	30	30	30	30	150
No. infested: % infestation	28: 93.3%	20: 66.6%	15: 50%	9: 30%	3: 10%	75: 50%
Beet pulp						
No. samples	30	30	30	30	30	150
No. infested: % infestation	23: 76.6%	18: 60%	9: 30%	2: 6.6%	1: 3.3%	53: 36.6%
Cottonseed meal						
No. samples	30	30	30	30	30	150
No. infested: % infestation	9: 30%	7: 23.3%	3: 10%	5: 16.6%	4: 13.3%	28: 18.6%
Total						
No. infested: % infestation	86: 57.3%	67: 44.6%	45: 30%	36: 24%	13: 8.6%	247: 41.1%

For barley, the highest diversity of mites was seen in Kosar factory and this was significantly different to that in Khoshe Talaei and Behamin factories ( $F= 2.9$ ,  $df= 4$ ,  $P= 0.0302$ ).

For wheat, the highest and lowest diversity of mites was recorded in Behamin factory and Kosar factory, respectively, and there was a significant difference ( $F= 3.37$ ,  $df= 4$ ,  $P= 0.0155$ ).

For beet pulp, the highest and lowest diversity of mites was recorded in Behamin factory and Keshtzar factory, respectively, and there was a significant difference ( $F= 2.66$ ,  $df= 4$ ,  $P= 0.0420$ ).

For cotton seed meal, the highest contamination was recorded in Keshtzar factory and Behamin factory and the lowest contamination was recorded in Kosar factory. The difference was significant ( $F= 2.33$ ,  $df= 4$ ,  $P= 0.0673$ ).

**Table 2.** The diversity of mites in five domesticated animal food factories

Food	Barley	Beet pulp	Cotton seed meal	Wheat
Kosar	-0.29±0.3a	2.95±0.19bc	21.40±0.14b	3.01±0.18c
Keshtzar	-0.84±0.3ab	2.65±0.19c	45.91±0.14a	5.52±0.18ab
Chine	-1.28±0.3ab	3.63±0.19abc	33.62±0.14ab	3.38±0.18bc
Khoshe talaei	-1.92±0.3b	4.33±0.19ab	37.74±0.14ab	5.04±0.18abc
Behamin	-2.09±0.3b	4.66±0.19a	41.83±0.14a	6.56±0.18a

Mean ± SE followed by the same letter within columns were not significantly different based on Duncan's multiple range tests at  $\alpha = 0.05$

## Discussion

Mites are common inhabitants of stored products of all kinds, including grain and grain-based commodities at all stages of processing. Mites that occur in these commodities belong to different families and genera, and most of them are apparently harmless. For example, the Oribatida (except Astigmatina) collected during this investigation are probably accidental occupants as they are more usually found in soil habitats. However, some species cause direct damage by attacking

grain, or indirect damage by contaminating foodstuffs. That contamination can make commodities unpalatable to livestock and unacceptable as human food (Li 1984).

**Table 3.** Mite species found in five domesticated animal food factories in Karaj from March 2004 to May 2005

Percentage of infested samples containing listed species					
	Wheat	Barley	Beet pulp	Cottonseed meal	Total
<b>ASTIGMATA</b>					
Acaridae					
<i>Acarus farris</i>		2%		3.3%	5.3%
<i>Tyrophagus longior</i>	20%	23.3%			43.3%
<i>Cosmoglyphus oudemansi</i>	13.3%				13.3%
<i>Neoacotyledon rhizoglyphoides</i>	16.6%				16.6%
<b>PROSTIGMATA</b>					
Cheyletidae					
<i>Acaropsellina sollers</i>		17.3%	19.3%	4.6%	41.2%
<i>Cheyletus carnifex</i>		4.6%	11.3%	18.6%	34.5%
<i>Cheyletus malaccensis</i>		9.3%	7.3%	6%	17.2%
<i>Cheyletus malayensis</i>		1.3%			1.3%
<b>ORIBATIDA</b>					
Tectocepheidae					
<i>Tectocepheus velatus</i>	6%	6%	4.6%	2%	18.6%
Euphthiracaridae					
<i>Rhysotritia ardua</i>	6.6%		1.3%		7.9%
Oribatulidae					
<i>Oribatula</i> sp.	2%	5.3%	2%	2.6%	11.9%
<i>Zygoribatula</i> sp.	3.3%	3.3%			6.6%
Suctobelbidae					
<i>Flagrosuctobelba</i> sp.		0.6%			0.6%
<b>MESOSTIGMATA</b>					
Ascidae					
<i>Proctolaelaps regalis</i>		3.3%	1.3%		4.6%
Laelapidae					
<i>Androlaelaps casalis</i>		3.3%	1.3%		4.6%
<i>Haemogamasus pontiger</i>			1.3%		1.3%

In this research we found that the Acaridae is a major family with some high populations. These mites prefer a high relative humidity (at least 60%). In this research, *T. longior* was the dominant species and was found in stored grain infested with fungi. Live spores of fungi (such as *Penicillium* and *Aspergillus*) are always found in the feces of this mite, which feeds on the fungi growing on the grain. The spores can be thus widely distributed by the mites and the mildewing of the grain is accelerated (Li 1984). In damp places, development of this mite is enhanced and probably this species seeks out water and humidity. Therefore, in the damp or humid stores, this species is more abundant. Furthermore, this species can be observed in the media cultures of mycology and bacteriology laboratories, causing damage to the cultures of these microorganisms and, therefore, some problems.

Extensive use of chemical poisons as pesticides not only is expensive, but also causes problems such as resistance to pesticides, secondary pest emergence and bioenvironmental contamination. Therefore, biological control factors have an important role in pest control. Cheyletid mites have a major role in the control of stored product mites, particularly the astigmatines *A. siro* and *Lepidoglyphus destructor* (Gerson *et al.* 2003). The diet of species of Ascidae and Laelapidae (Mesostigmata) includes arthropods. *Androlaelaps casalis* and *Haemogamasus pontiger*, common stored product inhabitants, will feed on small beetle larvae and other mites that occur with it (Barker 1968a, b).

In the domesticated animal food factories, food materials were not kept in a standardized condition. For example, these materials were not always packed in bags, but were laid directly on the floor. Remains of food materials that, without disinfection, can cause further infestation were in the stores. Remains of food materials that absorb moisture from the floor cause suitable conditions for mite population increases. Another infestation factor that may be more important is the enlargement of store size that causes problems related to temperature, humidity and sanitation control.

With due attention to the nutritional role of materials such as wheat, barley, beet pulp and cottonseed meal for domestic animals and birds, it is necessary to preserve the quality and the value of these materials by using modern methods and systems of management. Therefore, to minimize mite infestations, the following aspects must be considered: 1. observance to sanitation; 2. removal of the remains of materials from the store; 3. prevention of dust entrance into the store; 4. correct observance to the material package and bags, their spacing (distance and height) and use of pallets in order to prevent moisture penetration; 5. gathering and removal of the food remains from the store floor before storage of a new product, and 6- the control of temperature and humidity in the environment.

Further studies are needed to understand the differences in mite populations found in our investigation so that better management systems can be put in place to prevent and control mite infestations.

### Acknowledgements

We are thankful to Dr. A. Bochkov (Zoological Institute of the Russian Academy of Science, Russia) for confirming the identification of the cheyletid species and Dr. F. Ardeshir (Iranian Plant Protection Research Institute, Iran) for confirming the identification of the remaining taxa.

### References


- Ardeshir, F., De Saint Georges-Grèdelet, D., Grootarert, P., Tirry, L. & Wauthy, G., (2000) Preliminary observation on mites associated with stored grain in Iran. *Belgian Journal of Entomology*, 2: 287–293.
- Arlan, L.G. (2002) Arthropod allergens and human health. *Annual Review of Entomology*, 47: 395–433.
- Barker, P. S. (1968a) Notes on the bionomics of *Haemogamasus pontiger* (Berlese) (Acarina: Mesostigmata), a predator on *Glycyphagus domesticus* (DeGeer). *Manitoba Entomologist*, 2: 85–7.

- Barker, P.S. (1968b) Bionomics of *Androlaelaps casalis* (Berlese) (Acarina: Laelapidae), a predator on mite pests of stored grain. *Canadian Journal of Zoology*, 46: 1099–1102.
- Griffiths, D.A., Hodson, A.C. & Christensen, C.M. (1959) Grain storage fungi associated with mites. *Journal of Economic Entomology*, 52: 514–518.
- Hammer, M. (1979) Investigations on the oribatid fauna of Java. *Kongelige Danske Videnskabernes Selskab Biologiske Skrifter*, 22 (9): 1–79.
- Gerson, U., Smiley, R.L. & Ochoa, R. (2003) *Mites (Acari) for pest control*. Oxford, Blackwell Science, 539 pp.
- Hubert, J., Stejskal, V., Kubátová, A., Munzbergová, Z., Váňová, M. & Ždárková, E. (2004) Mites and fungi in heavily infested stores in the Czech Republic. *Journal of Economic Entomology*, 97: 2144–2153.
- Hughes, A.M. (1976) The mites of stored foods and houses. *Technical Bulletin, Ministry of Agriculture, Fisheries and Food, London*, 400 pp.
- Krantz, G.W. & Walter, D.E. (2009) *A manual of acarology*. Third edition. Texas Tech University Press; Lubbock, Texas, 807 pp.
- Li, L.S. (1984) Stored grain mites in China: their distribution and effects. In: Griffiths, D.A. & Bowman, C.E. (Eds) *Acarology 6*, Ellis Horwood, Chichester, Volume 2, pp. 1002–1005.
- Li, L.S. & Li, Y.R. (1988) *Acarology*. Chongqing Publishing House, Chongqing, China, 520 pp.
- Mirzaei, M. (2005) Faunistic survey of mites of stored products in Zanjan Province. M. Sc. Thesis. *Science and Research Branch, Islamic Azad University*, 171 pp.
- Olsson, S. & Hage-Hamsten, M. (2000) Allergens from house dust and storage mites: similarities and differences, with emphasis on the storage mite *Lepidoglyphus destructor*. *Clinical and Experimental Allergy*, 30: 912–919.
- Ostovan, H. (1993) Faunistic survey of mites of stored product in Kazerun and biology of important species. M. Sc. thesis, *College of Agriculture, Tarbiat Modares University*, 172 pp.
- Seiedy, M., Saboori, A., Kamali, K. & Kharazi Pakdel, A. (2009) Mites (Acari) found in flour mills in the Karaj region of Iran. *Systematic & Applied Acarology*, 14: 191–196.
- Sepasgozarian, H. (1977a) Mites of stored product, a guide to scientific approaches. *Ministry of Agriculture - Plant Protection Organization Publication*, 26, 1–37.
- Sepasgozarian, H. (1977b) Twenty years of researches in Acarology in Iran. *Journal of Iranian Society of Engineers*, 56: 40–50.
- Sepasgozarian, H. (1978) Stored pests of Iran and their control. *University of Tehran Press*, 288 pp.
- Smiley, R.L. (1991) Mites (Acari). In: Gorham, J.R. (Ed.). *Insect and mite pests in food. An illustrated key. United States Department of Agriculture, Agriculture Handbook*, No. 655, Volume 1, pp. 3–44.
- Stejskal, V. (2001) A new concept of economic injury level that includes penalization of damage to quality and safety of agricultural products. *Plant Protection Science*, 37: 151–156.
- Yousefi Porshekeh, A. (2006) Faunistic survey of mites of stored wheat and flour in Tehran Province. M. Sc. thesis, *Islamic Azad University of Arak*, 171 pp.

Ždárková, E. & Reska, M. (1976) Weight losses of groundnuts (*Arachis hypogaea* L.) from infestation by the mites *Acarus siro* L. and *Tyrophagus putrescentiae* (Schrank). *Journal of Stored Products Research*, 12: 101–104.

Received: 15 April 2011  
Accepted: 15 January 2012

#### COPYRIGHT

 Seiedy *et al.* Persian Journal of Acarology is under free license. This open-access article is distributed under the terms of the Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.

#### چکیده

از فروردین سال ۱۳۸۳ تا اردیبهشت ماه ۱۳۸۴، ۱۶ گونه از کنه‌های دو زیراسته پیش‌استیگمایان و نهان‌استیگمایان و راسته میان‌استیگمایان در گندم، جو، تفاله چغندر قند و کنجاله پنبه (برای نمونه، باقیمانده آرد، روی دستگاه‌ها و بیرون از کیسه) از پنج کارخانه تولیدکننده خوراک دام جمع‌آوری شدند. در ذرت و سبوس جمع‌آوری شده نمونه‌ای یافت نشد. همه کارخانه‌ها در کرج، استان البرز قرار داشتند.