Belgian Journal of Entomology 2 (2000) : *287-293*

Preliminary observations on mites associated with stored grain in Iran

by Fariba ARDESHIR[1], Danielle DE SAINT GEORGES-GRIDELET[1], Patrick GROOTAERT[1], Luc TIRRY[2] & Georges WAUTHY[1]

[1]Royal Belgian Institute of Natural Sciences, Department of Entomology, 29 rue Vautier, B-1000 Brussels, Belgium (e-mail: ardeshir@kbinirsnb.be).
[2]University of Gent, Faculty of Agricultural & Applied Biology Sciences, Coupure Links 653, B-9000 Gent, Belgium.

Abstract

A survey of mites associated with stored grain was conducted in northern Iran in December 1996. On the whole, 11 species of mites belonging to the orders Astigmata and Prostigmata were found. Prostigmata were the dominant group, and among prostigmatid predators, *Cheyletus malaccensis* OUD. was the most common species. Among Astigmata, *Lepidoglyphus destructor* (SCH.) was the most abundant species. The intriguing absence of other major species known to infest stored grain (e.g. *Acarus siro* L.) could result from predation pressure and/or chemical control during and before the period of sampling.

Keywords : mites, stored grain, Iran.

Introduction

Mites associated with stored cereals cause important damage to agricultural products (SINHA & WALLACE, 1973; HUGHES, 1976). Deterioration of the quality and germinating power of the grain, and in its hygienic condition, is considered to be the most serious effect of mite infestation (PULPÁN & VERNER, 1965; SINHA & WALLACE, 1966; WHITE *et al.*, 1979). In addition, storage mites can also induce bronchial asthma, perennial rhinitis and dermal allergies to man (e.g. CUTHBERT *et al.*, 1979).

To date, no comprehensive study has been conducted on mites associated with stored grain in any part of Iran. This study is a preliminary survey of mites living in stored grain in northern Iran (Caspian sea regions; Fig. 1). Studies in these regions are of great interest because: (1) regional, temperature and

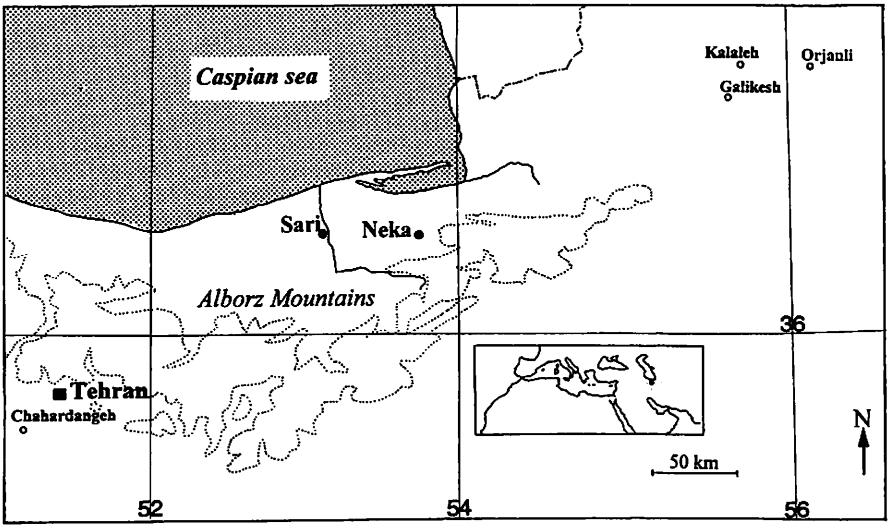

Fig. 1. Map of northern Iran showing sampling sites (closed circles) and grain harvesting places (open circles) just to the south-east of the Caspian sea.

humidity conditions appear to be favourable for development of the major species of stored product mites; for instance, in 1996, mean monthly values of temperature (17°C) and R.H. (79%) (data from the Tehran meteorological station) fitted in quite well with the threshold values (10°C and 75% R.H.) reported by SINHA (1968); and (2), the control measures appear to be variable and more or less intensive according to the storage locations; for instance, in a silo studied in Neka, cleaning activities are hindered because of the continuous inflow of grain; as well, in the flour-mill in Sari, broken-grain and chaff are stored without chemical control.

Material and methods

A total of 55 samples of bulk and bagged wheat were collected in three sites and 11 distinct habitats (Table 1). The sampling was carried out in December 1996. Samples were taken in whole grains (in seven habitats), broken grains (in two habitats), dust (in one habitat) and chaff (in one habitat). In each location, five samples of 100 g of material were collected randomly for extraction using modified Berlese-Tullgren funnels. The efficiency of mite extractions was verified by opening and examining the inside of approximately 100 damaged grains in each sample, but no mite was found in any grain. For mite detection in fine dust and cereal residues, samples were treated with a ethanol-NaCl flotation method (HART & FAIN, 1987). The identification of specimens was mainly based on the key by Hughes (1976).

Table 1. Habitats in which storage mites were studied. Given in the table are the abbreviated forms used in the text as well as short descriptions of the location and origin of stored products.

Study site	Habitat	Location	Origin
1. Silo de Neka	*G1* : whole grains	top 10cm of a 3,000-ton reservoir on the 9th floor	imported from Australia Canada and Europe
	G2 : whole grains	surface of an aluminium 12-Kg container in the laboratory	crops in Orjanli (Golestan province)
	G3 : whole grains	as for *G2*	crops in Kalaleh (Golestan province)
	G4 : whole grains	as for *G2*	crops in Galikesh (Golestan province)
	B1 : broken grains and debris	cracks and crevices near the reservoir on the 9th floor	as for *G1*
	D1 : dust	exterior ledge on silo building near air vents	-
2. Flour-mill in Sari	*G5* : whole grains	top of the 75-ton bulk in the main reservoir	crops in Mazandaran province
	B2 : broken grains and debris	inside 50-kg sacks in a store	as for *G5*
	C : chaff	as for *B2*	as for *G5*
3. Hangar in Sari	*G6* : whole grains	top of the bulk in a store	as for *G5*
	G7 : whole grains	inside 50-Kg sacks in a store	crops in Chahardangeh (Tehran province)

Results

Only 19 out of 55 samples collected from eight locations (Table 2) were inhabited by mites. Eleven species of mites belonging to nine families and two orders (Prostigmata and Astigmata) were found.

Prostigmata, mainly predators, were the dominant group constituting 64% of the mite fauna. As shown in Table 2, predatory mites were found everywhere except : (1) in the grain of three sample locations (habitats G4, G5 and G6 in Table 1) which were apparently azoic; and (2), in habitat B2 where the assemblage was made up of herbivorous and fungivorous or detritivorous astigmatid populations (*Lepidoglyphus destructor*, *Tyrophagus putrescentiae* and *Suidasia nesbitti*) which correlatively were quite abundant. Other curtailed assemblages are those formed by predatory species only, as was observed in the grains of habitats G1 and G3. In contrast, mite assemblages of locations G7, B1 and D appeared to be much more balanced from a trophic standpoint. Yet a substantial species richness and a relevant numerical structure of populations were detected in the assemblage D.

Table 2. Distribution and abundance of prostigmatid and astigmatid mites in eight storage grain habitats in northern Iran.

	G_1	G_2	G_3	G_7	B_1	B_2	D	S
Prostigmata								
Erythracarina bechteinia Oud. **[P]**	-	-	-	-	-	-	+	-
(Anystidae)								
Spinibdella sp. **[P]**	-	-	+	-	-	-	+	-
(Bdellidae)								
Cheyletomorpha lepidopterorum (Sh.) **[P]**	+	+	-	-	-	-		-
Cheyletus malaccensis Oud. **[P]**	+	+	-	+	+	-	++	++
(Cheyletidae)								
Tarsonemus sp. **[F, P, H]**	-	-	-	+	-	-	-	-
(Tarsonemidae)								
Lorryia sp. **[H, F]**	-	-	-	+	-	-	+	-
Tydeus sp. **[P, H, De, F]**	-	+	-	+	-	-	++	-
(Tydeidae)								
Astigmata								
Tyrophagus putrescentiae (Sch.) **[F,H]**	-	-	-	+	-	++	+	-
(Acaridae)								
Lepidoglyphus destructor (Sch.) **[F,H]**	-	-	-	-	+	+++	-	++
(Glycyphagidae)								
Dermatophagoides farinae Hug. **[R]**	-	+	-	+	-	-	+	-
(Pyroglyphidae)								
Suidasia nesbitti Hug. **[H, De]**	-	-	-	-	+	+++	+	-
(Suidasiidae)								

Abbreviations. Codes for habitats are given in Table 1. Abundance: +, 1-25 ind./500 g of material collected; ++, >25 and <100 ind./500 g; +++, >100 ind./500 g. Trophic status: De, detritivores (i.e. reductor organism inhabiting dead organic matter of vegetal or animal origin); F, fungivores (i.e. survive and multiply on fungi associated with stored products); H, herbivores (i.e. feed on a wide range of food of plant origin); P, predators (i.e. feed on mites and eggs of mites as well as on stored grain insects); R, saprophagous and pulvicolous (i.e. reductor organism inhabiting any organic dust).

* None of the remaining grain samples (i.e., habitats *G4*, *G5* and *G6* in Table 1) showed specimen.

On the other hand, regarding the demographic structure, there were consistent differences between populations developed by *L. destructor* and those of other astigmatids studied. In *L. destructor* populations were formed mostly by inert hypopial forms (facultative heteromorphic deutonymphs), whereas adult stages were mainly found in other species.

Discussion

The lack of mites in more than 60% of the samples and in three habitats surveyed in this study can presumably be related to variable effects of biological and chemical controls. In fact, a relatively large amount of mite populations was disclosed only in the silo of Neka, especially in dusty corners of storage premises (habitat D in Table 1), and this could be explained by reduced cleaning activities in a building which has capacity for around 100,000 tonnes of cereal products.

Among Prostigmata, several species found in this survey (i.e. cheyletid, tydeid, bdellid and anystid mites) are known to be predators of other mites and/or insects (e.g. BARKER, 1991). The most common predator was *Cheyletus malaccensis*. This species occurs frequently in storage facilities in Iraq, Egypt, India, Pakistan and China (SHEN, 1975; SALEH *et al.*, 1985; NANGIA & CHANNABASAVANNA, 1989; ZAMAN, 1990; MAHMOOD, 1992), and its wide distribution could be mainly attributed to the resistance to residual acaricides (e.g. ZDÁRKOVÁ, 1994, and references therein).

Concerning the Astigmata, the most plausible interpretation for the lack of *Acarus siro*, a major pest of stored grains in temperate regions (e.g. NANGIA & CHANNABASAVANNA, 1989, and references therein), is that predation pressure exerted by cheyletid mites during the weeks preceding the sampling period has drastically reduced the size of the populations (PULPÁN & VERNER, 1965). Indeed, climatic conditions in the Caspian sea region appear to be favourable to *A. siro* which has been previously found in house dust in northern Iran (AMOLI & CUNNINGTON, 1977). Another possibility, perhaps complementary to the previous one, is that extremely low density results from chemical control. In fact, the importance of chemical control can be assessed considering relatively large-sized populations developed by *L. destructor* in cereal residues (broken-grain and chaff) of the flour-mill in Sari (habitats B2 and S in Table 1, respectively) which were enclosed in sacks and thereby did not undergo any treatment.

Besides a high resistance to acaricides (HUGHES, 1976), *L. destructor* can survive relatively low temperatures and irregularly fluctuating environments as a cryptic, inactive hypopus during several months and even more than one year (KNÜLLE, 1991). As break in the development depends on a temperature threshold that is around 12°C in stored grains (KNÜLLE, 1991), temperature conditions prevailing in the Caspian sea region in December 1996 (the mean monthly temperature was 11.6°C) can easily explain the accumulation of hypopodes we observed.

L. destructor as well as another important pest of stored foodstuffs, *Tyrophagus putrescentiae*, occur commonly in granaries, warehouses and farm stores (PULPÁN & VERNER, 1965; SINHA, 1968). Yet the current survey highlighted two patent differences between both species: (1) because break in development arises below 7-10°C in *T. putrescentiae* (e.g. CUNNINGTON, 1969), populations were composed of adults and to a lesser extent of juveniles (no hypopode in this species); (2) besides chemical control being inoperative in cereal residues, as indicated above, the abundance of *L. destructor* in chaff (habitat C in Table 1) could be attributed to its ability to feed on organic particles (HUGHES, 1976), to its resistance to dry conditions (ZAHER *et al.*, 1985) and/or to its capacity to stem the predation (PULPAN & VERNER, 1965).

On the other hand, *Suidasia nesbitti* is known to inhabit a wide variety of foodstuffs (SALEH *et al.*, 1985). Given that the association of *S. nesbitti* with insects has been reported by some authors (e.g. HUGHES, 1976), we suspect that high density observed in broken grain in Sari (habitat B2 in Table 1) may be positively correlated with the presence of numerous dead insects.

Finally, *Dermatophagoides farinae*, like other pyroglyphids, is a reductor organism feeding mostly on organic fragments of animal or human origin (ARLIAN, 1989). Given that *D. farinae* is responsible for allergic disease in man (FAIN *et al.*, 1990), the relevance of this survey and of others to be conducted in the future to the knowledge of the mite fauna in northern Iran is not trivial.

Acknowledgements

This work was supported by a grant to F. ARDESHIR from the Agricultural Research, Education and Extension Organization of Iran. We thank Mrs M. VAN ASSCHE, Mrs I. SAUVAGE and Mr R.D. KIME for their valuable assistance.

References

AMOLI K. & CUNNINGTON A.M., 1977. - House dust mites in Iran. *Clinical Allergy*, 7 : 93-101.

ARLIAN L.G., 1989. - Biology and ecology of house dust mites, *Dermatophagoides* sp. and *Euroglyphus* sp. *Immunology and Allergy*, 9 : 339-356.

BARKER P.S., 1991. - Bionomics of *Cheyletus eruditus* (Schrank) (Acarina: Cheyletidae), a predator of *Lepidoglyphus destructor* (Schrank) (Acarina: Glycyphagidae), at three constant temperatures. *Canadian Journal of Zoology*, 69 : 2321-2325.

CUNNINGTON A.M., 1969. - Physical limits for complete development of the copra mite, *Tyrophagus putrescentiae* (Schrank) (Acarina: Acaridae). *In* : EVANS G.O. (Ed.) *Proceedings of the 2nd International Congress of Acarology*. Akadémiai Kiadó, Budapest : 241-248.

CUTHBERT O.D., BROSTOFF J., WRAITH D.G. & BRIGHTON W.D., 1979. - "Barn allergy": asthma and rhinitis due to storage mites. *Clinical Allergy*, 9 : 229-236.

FAIN A., GUÉRIN B. & HART B. J., 1990. - *Mites and allergic disease*. Allerbio, Varennes en Argonne. 190 pp.

HART B.J. & FAIN A., 1987. - A new technique for isolation of mites exploiting the difference in density between ethanol and satured NaCl: qualitative and quantitative studies. *Acarologia*, 28 : 251- 254.

HUGHES A.M., 1976. - *The mites of stored food and houses*. Ministry of Agriculture, Fisheries and Food, Technical Bulletin no.9, London, 400 pp.

KNÜLLE W., 1991. - Genetic and environmental determinants of hypopus duration in the stored-product mite *Lepidoglyphus destructor*. *Experimental & Applied Acarology*, 10 : 231-258.

MAHMOOD S.H., 1992. - Mite fauna of stored grain seeds in central Iraq. *Journal of Stored Products Research*, 28 : 179-181.

NANGIA N. & CHANNABASAVANNA G.P., 1989. - Acarines associated with stored products in Karnataka, India. *In* : CHANNABASVANA G.P. & VIRAKTAMATA C.A. (Eds) *Progress in Acarology*. Vol. 2. Acarological Society of India, Bangalore : 241-248.

PULPÁN J. & VERNER P.H., 1965. - Control of tyroglyphoid mites in stored grain by the predatory mite *Cheyletus eruditus* (SCHRANK). *Canadian Journal of Zoology*, 43 : 417-432.

SALEH S.M., EL-HELALY M.S. & EL-GAYAR F.H., 1985. - Survey on stored product mites of Alexandria (Egypt). *Acarologia*, 26 : 87-93.

SHEN C.P., 1975. - Preliminary notes on chinese cheyletid mites and the life history of *Cheyletus malaccensis* OUDEMANS (Acarina: Cheyletidae). *Acta Entomologica Sinica*, 18 : 316-324.

SINHA R.N., 1968 - Climate and potential range of distribution of stored-product mites in Japan. *Journal of Economic Entomology*, 61 : 70-74.

SINHA R.N. & WALLACE H.A.H., 1966. - Association of granary mites and seed-borne fungi in stored grain and in outdoor and indoor habitats. *Annals of the Entomological Society of America*, 59 : 1170-1181.

SINHA R.N. & WALLACE H.A.H., 1973. - Population dynamics of stored-product mites. *Oecologia*, 12 : 315-327.

WHITE N.D.G., HENDERSON L.P. & SINHA R.N., 1979. - Effect of infestation by three stored-product mites on fat acidity, seed germination and microflora of stored wheat. *Journal of Economic Entomology*, 72 : 763-766.

ZAHER M.A., MOHAMED M.I. & ABDEL-HALIM S.M., 1985. - Incidences of mites associated with stored seeds and food products in upper Egypt. *Experimental & Applied Acarology*, 2 : 19-24.

ZAMAN M., 1990. - Entomophagous insects and mites found in Jute field at Tarnab, Peshawar (Pakistan). *Journal of Insect Science*, 3 : 133-135.

ZDÁRKOVÁ E., 1994. - The effectiveness of organophosphate acaricides on stored product mites interacting in biological control. *Experimental and Applied Acarology*, 18 : 747-751.