Arthropod Infestation in Samples of Stored Seeds in the Czech Republic

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Abstract: Twenty-one types of seed samples (mainly vegetable and grass seed) were analysed in laboratory and 60% arthropod infestation (14 *Acarina*, 5 *Psocoptera* species) was found. The seeds of beet, grass, onion, radish and lettuce were most sensitive to infestation. *Acarus siro* was a dominant mite pest from all aspects (frequency, abundance and seed diversity infestation), followed by *Tyrophagus putrescentiae, Tarsonemus granarius* and *Lepidoglyphus destructor*. *Cheyletus eruditus* was a dominant predatory mite. *Lepinotus patruelis* was the most frequent psocid pest.

Key words: mites; psocids; *Acarina*; *Psocoptera*; stored seed; stored product pests

Many mites and psocid species are well known as stored-product pests of various agricultural commodities. Papers concerning faunistic research of pests of stored seeds in the Czech Republic are focused mainly on arthropod occurrence in stored grain or food commodities (Žďárková 1967, 1998; Zuska *et al*. 1984; Werner *et al*. 1999; Stejskal *et al*. 2003; Kučerová *et al*. 2003). However, comprehensive research on arthropod occurrence in stored seeds has not been conducted yet, except several minor notes on seed infestations in Žďárková (1967) and Obr (1978). To fill this gap, the presented paper brings a survey of arthropod infestation of 21 seed types (mainly vegetable and oil seed, grass seed and seed outlets). The infestation was detected in seed samples analysed during the years 1999–2003 at the Department of Stored-Product Pest Control , Research Institute of Crop Production. These samples were sent to this laboratory for species diagnostics from various seed stores in the Czech Republic.

MATERIAL AND METHODS

Altogether 201 samples of 21 seed types were analysed in laboratory for pest infestation (*Acarina*, *Psocoptera*). We determined the species and examined population density. The whole analysed samples (ca 10–100 g) were placed on Tullgren funnel (exposure time 24 h) to extract arthropods. Extracted specimens were counted individually or with the use of Solomon's method (Solomon 1945). Mite and psocid species were determined under the microscope on slides. Determination was done mainly according to Günther (1974), Hughes (1976) and Lienhard (1990, 1998). The abundance of particular species was recalculated per kg of seed to become comparable.

RESULTS

Arthropod diversity and types of seeds

Altogether 19 species were identified in seed samples. Out of these, 14 were mite species (Astigmata 4, Prostigmata 6, Mesostigmata 4) and 5 psocid species. A detailed list of arthropod species and their occurrence on particular seed types are presented in Table 1. The greatest diversity of species was found on beet (10 species), followed by grass (9), onion (9), radish (8) and lettuce seed (7). The ratio of pest to beneficial arthropod species

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Table 1. Mite and psocid species and their occurrence in particular seed types (number of specimens/kg of infested sample)

Type of seed	0n	Ka	Ko	Ct	Pa	Pt	Ru	Ra	Be	Le	Sp	Sw	Co	Li	Po	Gs	So
ACARINA																	
Acaridae																	
Acarus siro L.	23	96	146				357	168	293	200	10				15	17 521	60 000
Acarus farris (Oudemans)								60									
Tyrophagus putrescentiae (Schrank)	2			1 058		50	160	101	87	1 496				60		2 273	140
Glycyphagidae																	
Lepidoglyphus destructor (Schrank)	20	27						55	176	248						69	200
Tarsonemidae																	
Tarsonemus granarius Lindquist	100		12	330				68		46	10		612			278	
Tydeidae																	
Tydeus interruptus Sig Thor											40					37	
Cheyletidae																	
Cheyletus aversor Rohdendorf									48								
Cheyletus eruditus (Schrank)	11	109	91		60		20	102	42	254	20	30	312			66	770
Cheyletus malaccensis Oudemans	2							3									
Cheyletus hendersoni Baker										6							
Dermanyssidae																	
Androlaelaps casalis (Berlese)																3	
Haemogamasus pontiger (Berlese)									60								
Ascidae																	
Blattisocius keegani Fox									5								
Oribatidae								60									
PSOCOPTERA																	
Liposcelididae																	
Liposcelis decolor (Pearman)	2									28						1 300	
Liposcelis corrodens (Heymons)	4																
Trogiidae																	
Lepinotus reticulatus Enderlein									165				60			50	
Lepinotus patruelis Pearman	5								43		40		60				
Lachesillidae																	
Lachesilla pedicularia (L.)									30								

On – onion, Ka – kale (*Brassica oleracea*), Ko – kohlrabi, Ct – carrot, Pa – parsley (*Petroselinum hortense*), Pt – parsnip (*Pastinaca sativa*), Ru – runch (*Raphanus sativus*), Ra – radish, Be – beet, Le – lettuce, Sp – spinach, Sw – swede, Co – coriander, Li - linseed, Po – poppy, Gs – grass seed, So – seed outlet

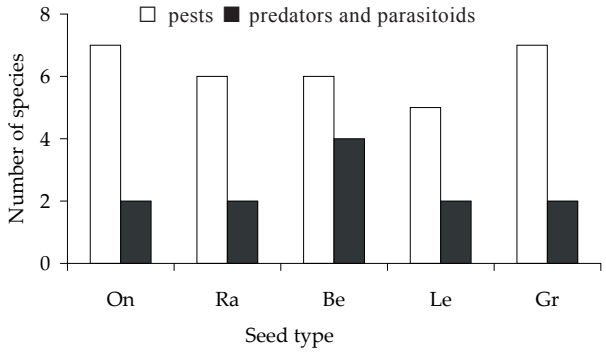


Figure 1. Ratio of pest to beneficial arthropod species in frequently infested seed types

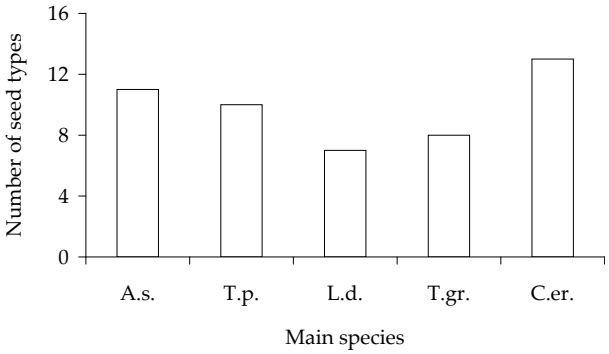


Figure 2. Spectrum of seed types infested by the main mite species (A.s. – *Acarus siro*, T.p. – *Tyrophagus putrescentiae*, L.d. – *Lepidoglyphus destructor*, T.g. – *Tarsonemus granarius*, C.e. – *Cheyletus eruditus*)

occurrence in these seeds is shown in Figure 1. Seed outlet, seed of spinach and coriander were infested by 5–4 species. Absolutely no species were found on the seed of cabbage, scorzonera (*S. hispanica*), dill and clover. The remaining types of seed were infested with 1 to 3 species (Table 1). *A. siro* infested the highest number of seed types (11) from all pest mites. The predator mite *C. eruditus* was located in 13 seed types (Figure 2).

Frequency and abundance of arthropods in seed samples

Arthropod infestation was found in 60% of all analysed seed samples (201). The individual samples were infested with 0 to 5 species (Figure 3). Frequency of *Acarina* (86.8%) and *Psocoptera* species in infested samples is shown in Figure 4. *A. siro* and *C. eruditus* were the most frequent (38% and 40%), followed by *T. putrescentiae* (25%). *L. patruelis* was the most frequent psocid (5%). The mite *A. siro* occurred in 49% of samples together with their predator *C. eruditus* and in 51% of samples without predator. Average abundance of arthropod species (a) and groups (b) found in seed samples of three categories (vegetable and oil seed, grass seed, seed outlets) is shown in Figure 5. Generally, mites were three times more abundant than psocids in vegetable and oil seed and 1.4 times more abundant in grass seed. In seed outlets

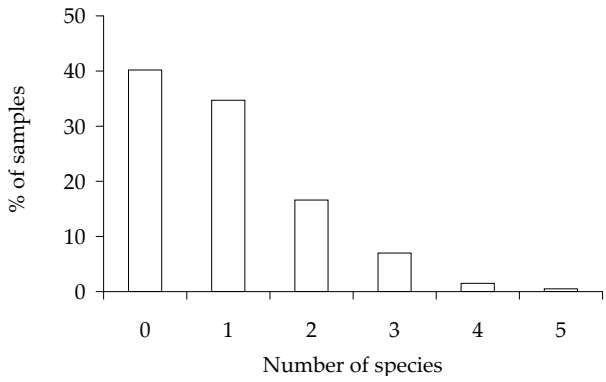


Figure 3. Frequency of multiple species infestation in seed samples

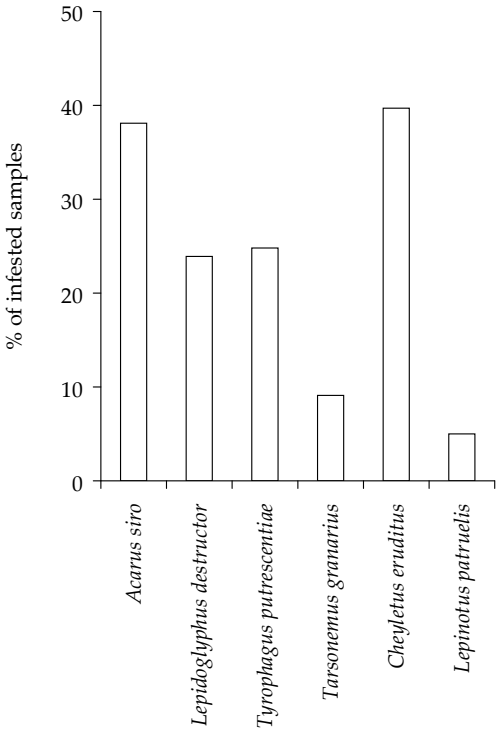
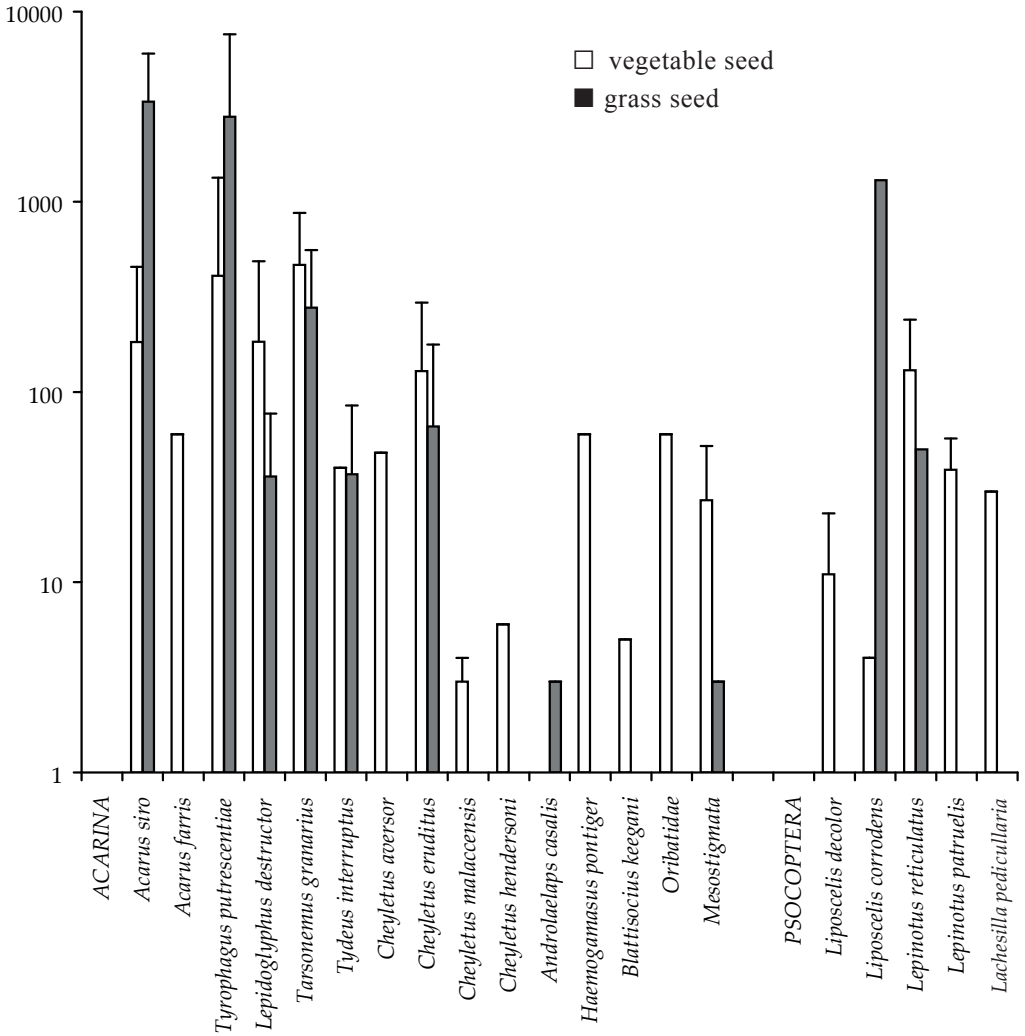


Figure 4. Frequency of the main arthropod species in infested seed samples

(a)



(b)

Type of sample	Analysed samples No.	Infested samples No.	Mite pests abundance (mean ± SD)	Mite predator abundance (mean ± SD)	Total mite abundance (mean ± SD)	Psocid pests abundance (mean ± SD)
Vegetable and oilseed	174	105	224 ± 161	47 ± 51	113 ± 140	43 ± 45
Grass seed	24	13	1304 ± 1466	66 ± 112	941 ± 1 336	675 ± 625
Seed outlet	3	3	20113 ± 28204	770 ± 530	12 390 ± 23 809	–

Figure 5. Abundance of particular species (a) and arthropod groups (b) found in seed samples (number of specimens per kg of infested sample)

only mites were found (average abundance of 12.390 specimens/kg). The pest:predatory mite ratio was 5:1 (vegetable seed), 20:1 (grass seed) and 26:1 (seed outlets).

DISCUSSION

A. siro was found to be both the most prevalent and most abundant mite pest in seed samples. This species also infested greatest diversity of seed types. *C. eruditus* occupied the same position in the category of predatory mites. These findings are in accordance with the fact that these species are generally the most important and frequent stored-product mites in grain and other food commodities (Žďárková 1967; Cobanoglu 1996). The other mite species found in seed samples are also common in other stored products. The only

exception is a rare predatory mite *C. hendersoni*, which was reported from the Czech Republic only once – in a sample of wheat and millet (Žďárková 1979).

In the case of psocids, the most frequent species in seed samples was *L. patruelis*. On the other hand, *L. decolor* was the most frequent and abundant species in recent years in grain stores (Stejskal *et al*. 2003).

The most frequent predatory mite *C. eruditus* preys mainly on acaroid mites, especially on *A. siro*, (Žďárková 1991), but it can also occasionally prey on psocids (Kučerová 2003). The ratio of A. *siro* occurrence in samples alone and together with their predator was about 1:1. The occurrence and abundance of *C. eruditus* depends on various environmental factors; one of them is the population density of its prey (Lukáš *et al*. 2002).

Acaroid mites and psocids pose agricultural and medical problems (Stejskal *et al*. 2002). They can damage various stored commodities. In the case of grain and other seeds, the harm is mainly done to the germ (Žďárková 1996; Kučerová 1999, 2002). The presence of arthropods in stored commodities is also connected with their interactions with fungi (Sinha 1968; Žďárková 1996; Stejskal *et al*. 2002; Hubert *et al*. 2003). Damage to the seed germ due to arthropod – fungi interactions leads to a decline of seed germination.

It is evident from our results that prevention of losses during seed storage require an early detection of pest infestation. This is urgent especially in the case of highly susceptible seed types, such as seed of beet, onion, lettuce, radish and grass. The heavy infested outlets are also a potential source of seed reinfestation. If predatory mites are absent or in low abundance in stored seeds, it is beneficial to artificially add *C. eruditus* as a preventive biological agent (Žďárková *et al*. 1998).

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Souhrn

Kučerová Z., Horák P. (2004): **Výskyt členovců ve vzorcích skladovaných osiv v České republice.** Czech J. Genet. Plant Breed., **40**: 11–16.

Byly prováděny rozbory vzorků osiv (21 druhů, celkem 201 vzorků) na výskyt skladištních členovců. Celkově bylo napadeno 60 % analyzovaných vzorků. Bylo determinováno 14 druhů roztočů (*Acarina*) a 5 druhů pisivek (*Psocoptera*). Osiva řepy, trav, cibule, ředkvičky a salátu byla vůči napadení skladištními škůdci nejnáchylnější. *Acarus siro* byl dominantním škodlivým roztočem z hlediska četnosti, počtu jedinců na l kg osiva i počtu napadených druhů osiv, následovaly druhy *Tyrophagus putrescentiae, Tarsonemus granarius* a *Lepidoglyphus destructor*. *Cheyletus eruditus* byl dominantní dravý roztoč. Z pisivek se nejčastěji vyskytoval druh *Lepinotus patruelis.*

Klíčová slova: roztoči; pisivky; *Acarina*; *Psocoptera*; skladované osivo; skladištní škůdci

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