Short Communication

Outdoor Occurrence of Stored-Product Pests (*Coleoptera*) in the Vicinity of a Grain Store

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Abstract

Kučerová Z., Aulický R., Stejskal V. (2005): **Outdoor occurrence of stored-product pests (*Coleoptera*) in the vicinity of a grain store.** Plant Protect. Sci., **41**: 86–89.

The species composition, frequency and abundance of insect pests (*Coleoptera*) occurring outside a grain store were explored. Wheat bait traps were used for pest monitoring; they were changed every month from April to September. For the first time the outdoor occurrence of primary and secondary stored-product pests was documented in the Czech Republic. Seven species of *Coleoptera* were found outside the grain store. Pest abundance and frequency were in high correlation. The primary pest *Sitophilus granarius* was dominant.

Keywords: *Coleoptera*; *S. granarius*; grain bait traps; outdoor infestation

Infested grain residues are often present in insufficiently cleaned empty grain stores (Kučerová *et al.* 2003) in the Czech Republic and are a serious source of infestation for the next bulk of grain to be stored (Stejskal & Kučerová 1996). Spillage and grain residues very often occur outside the stores and may also be correlated with pest occurrence. IPM practices are mostly directed toward detecting and controlling pests inside storage facilities or within the commodity, not in the outdoor vicinity of the store (Dowdy & McGaughey 1994). Yet some of the stored-product pests are highly mobile and temporarily and spatially patchy in distribution (Campbell et al. 2002); therefore, information on pest population occurrence, ecology and behaviour in the vicinity of storage facilities is important both for effective monitoring and controlling of stored-product pests.

Our preliminary investigation was focussed on outdoor infestation. The aim of this work was to study the composition, frequency and abundance of stored product pests (*Coleoptera*) outside a grain store because this type of information, though essential for effective IPM programs, is absent not only in the Czech Republic but also in other European countries.

MATERIAL AND METHODS

The research was conducted in the proximity of a flat grain store in Central Bohemia. The occurrence of pests outside the facility was analysed. Wheat bait traps were used to simulate the presence of grain residues outside the store. The monitoring was done from spring to autumn of 2004, during which period normal management practices were

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conducted in the store, including regular chemical control (June).

Outdoor trapping was conducted around the perimeter of the grain facility. The grain store (50 by 20 m) had a concrete wall construction. Five bait traps were placed outside the store at the base of the wall, 5 m apart from each other, close to ventilation openings. The bait trap was designed to capture crawling insects (*Coleoptera*): bags (size 15 by 10 cm) made from plastic netting (size of the mesh openings 2 × 2 mm) each held 100 g of whole wheat grains. The first set of bait traps was placed in their outside locations in the middle of March. The traps were replaced by new ones always after 1 month of exposure, altogether 6 times.

The 30 exposed baits were analysed in the laboratory. Each bait was separately sifted (sieving machine – exposure time 2 min, mesh size 1 × 1 mm), the beetles were then removed, identified and counted.

RESULTS

The occurrence, abundance and dynamic of particular species in the outside baits during the monitoring period are shown in Figure 1. Seven species were found, including the four important primary pests *Sitophilus granarius* (Linné, 1758), *Cryptolestes ferrugineus* (Stephens, 1831), *Tribolium castaneum* (Herbst, 1797) and *Oryzaephilus surinamensis* (Linné, 1758), and three secondary pests, *Typhaea stercorea* (Linné, 1758), *Ahasverus advena* (Waltl, 1832) and *Cryptophagus* sp. The number of pest species and their abundance in-

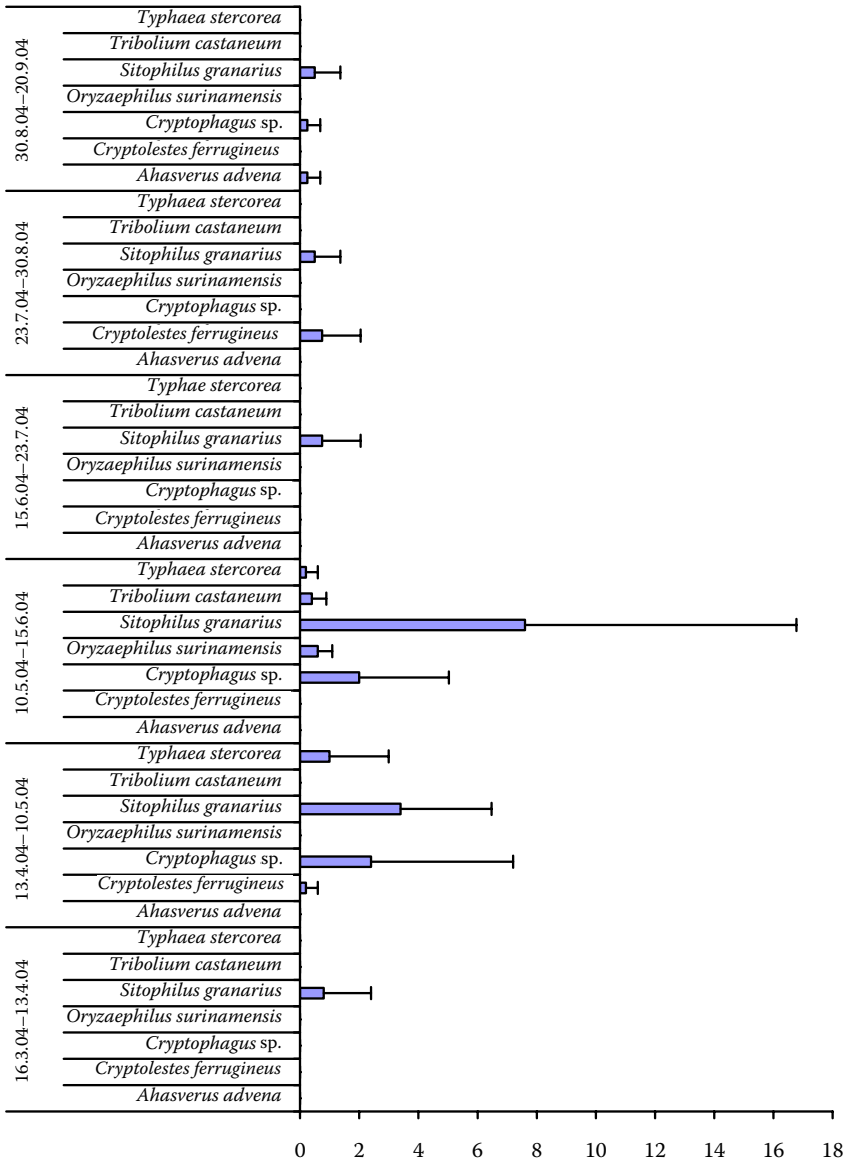

Figure 1. Occurrence of pests (abundance = number of specimens/1 grain bait, mean and SD) in outdoor grain traps during the observed period (6 months)

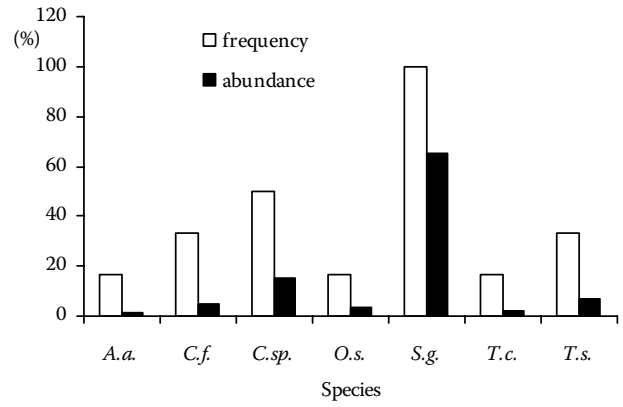

Figure 2. Average abundance and frequency of separate beetle pest species in outdoor grain traps

A.a. = *Ahasverus advena*
C.f. = *Cryptolestes ferrugineus*
C.sp. = *Cryptophagus* sp.
O.s. = *Oryzaephilus surinamensis*
S.g. = *Sitophilus granarius*
T.c. = *Tribolium castaneum*
T.s. = *Typhae stercorea*

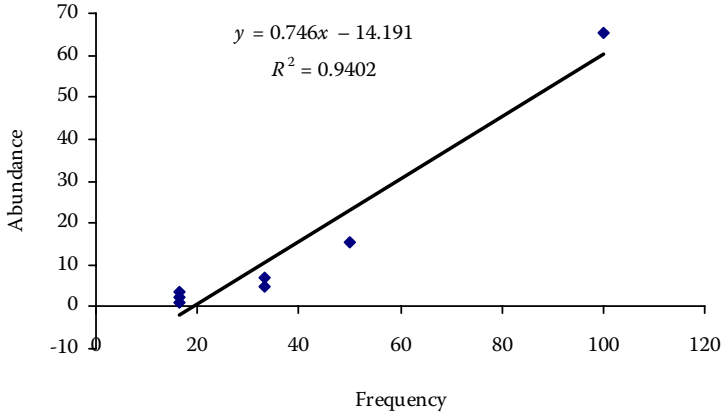

Figure 3. Correlation between abundance and frequency of captured species in outdoor

creased with time, reached a maximum in May and June, then declined rapidly during July, but did not drop to the 0 level. Overall frequency and abundance and their close correlation (r = 0.9) for all captured species are presented in Figures 2 and 3. The highly mobile internal grain feeder *S. granarius* was the most frequent and abundant pest.

DISCUSSION

These results confirmed for the first time that various stored beetle pests, both primary and secondary, can occur and survive in grain residues outside and near to a grain store during the temperate period of the year in Czech farm conditions.

The species composition recorded in the outside grain traps includes both strictly synanthropic species and those that occur partially or predominantly in open nature. Pest immigration in grain traps can thus originate from both the anthropogenic indoor and natural outdoor locations. For example, the synanthropic species *S. granarius* is normally found only in stores, not in open nature (Howe 1965). Weevils (and other primary grain pests) can then emigrate from inside sources into baits. On the other hand, *Cryptophagus* species are found often in mouldy grain in stores, but their natural environment is in wide open spaces. Their presence in outdoor baits can indicate either immigration in traps from the store or a feral population in proximity of the traps.

Migration of grain pests into and out of a storage facility is generally influenced by a complex of various factors (biological, physical, technological). Frequency and abundance of pests in the outdoor traps was probably particularly affected by changes in the conditions inside the neighbouring store during the observed period (e.g. absence of grain, followed by chemical control in summer). In spite of chemical control implemented inside the store, some pests (*Sitophilus, Cryptolestes, Ahasverus*) survived outside till the new crop was put into storage. Such a situation poses a risk for the cleanliness of the commodity stored closeby because only a few pest specimens are sufficient for starting another population increase. Dowdy and McGaughey (1994) found e.g. that farms in the USA with a high number of stored product insects outside of storage facilities also had a high number of insects in the stored grain. The potential for outside populations to influence inside populations has implications for the effectiveness

of different management and monitoring tools (Campbell & Mullen 2004).

Residual outdoor populations represent potential hazardous foci of re-infestation of stored commodities inside a grain store. A continuation of this preliminary research focused on details of the interactions between inside and outside populations is needed.

CONCLUSIONS

1. Serious primary pests, such as *S. granarius, T. castaneum, O. surinamensis* and *C. ferrugineus,* can occur and survive outside in the vicinity of a grain storage facility during the temperate period of the year in the Czech Republic.

2. Untreated grain residues outdoors are suitable destinations for pest colonisation and can thus become potential sources for re-infestation of stored grain.

3. It is strongly recommended to extend IPM on stored product pests and grain residues occurrence to the outside of grain stores (stored-product pest monitoring outdoors, avoidance of pest entry into the store from the outdoor environment, cleaning, preventive or repressive control in close vicinity of store).

References

Campbell J.F., Mullen M.A., Dowdy A.K. (2002): Monitoring stored-product pests in food processing plants: a case study using pheromone trapping, contour mapping and mark-recapture. Journal of Economic Entomology, **95**: 1089–1101.

Campbell J.F., Mullen M.A. (2004): Distribution and dispersal behaviour of *Trogoderma variabile* and *Plodia interpunctella* outside a food processing plant. Journal of Economic Entomology, **97**: 1455–1464.

Dowdy A.K., McGaughey W.H. (1994): Seasonal activity of stored-product insects in and around farm-stored wheat. Journal of Economic Entomology, **87**: 1351–1358.

Howe R.W. (1965): *Sitophilus granarius* (L.) (Coleoptera, Curculionidae) breeding in acorns. Journal of Stored Products Research, **1**: 99–100.

Kučerová, Z., Aulický R., Stejskal V. (2003): Accumulation of pest-arthropods in grain residues found in an empty store. Zeitschrift für Pflanzenkrankheit und Pflanzenschutz, **110**: 499–504.

Stejskal V., Kučerová Z. (1996): The effect of grain size on the biology of *Sitophilus granarius* I. Oviposition, distribution of eggs and adult emergence. Journal of Applied Entomology, **120**: 143–146.

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Abstrakt

Kučerová Z., Aulický R., Stejskal V. (2005): **Venkovní výskyt skladištních škůdců (*Coleoptera*) v blízkosti obilního skladu**. Plant. Protect. Sci., **41**: 86–89.

Cílem práce bylo zjistit druhové složení, frekvenci a abundanci skladištních škůdců (*Coleoptera*) vyskytujících se vně obilního skladu. Pro monitorování škůdců byly použity návnadové pasti. Výměna pastí byla prováděna během jednoho roku jednou měsíčně (duben až září). Vně skladu bylo nalezeno celkem 7 druhů skladištních brouků. Byla zjištěna vysoká korelace mezi abundancí a frekvencí skladištních škůdců. Dominantním druhem byl primární škůdce *S. granarius*. Výskyt primárních a sekundárních skladištních brouků venku v blízkosti skladu byl dokumentován v ČR poprvé.

Klíčová slova: *Coleoptera*; *S. granarius*; obilní návnadové pasti, venkovní výskyt

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