

## Weight Losses of Wheat Grains Caused by Psocid Infestation (*Liposcelis bostrychophila*: Liposcelididae: Psocoptera)

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### Abstract

KUČEROVÁ Z. (2002): **Weight losses of wheat grains caused by psocid infestation** (*Liposcelis bostrychophila*: Liposcelididae: Psocoptera). Plant Protect. Sci., **38**: 103–107.

Psocids are commonly found to be a persistent pest in structures of grain stores. Grain residues are potential pest reservoirs that serve as sources of grain re-infestation. Weight losses caused by psocids on broken wheat kernels were measured. Average weight loss of grain samples was 9.7% after 3 months of *Liposcelis bostrychophila* infestation. The weight losses were positively correlated with progeny production.

**Keywords:** *Liposcelis bostrychophila*; Psocoptera; stored grain; weight losses

Stored product losses resulting from insect infestation are extensive. They are usually associated with the occurrence of internal feeders such as *Rhyzopertha dominica* (STEJSKAL *et al.* 1999) or *Sitophilus* sp. (KUČEROVÁ & STEJSKAL 1994). But many of the so-called secondary pests can also play an important role in directly damaging stored products.

Stored-product psocids used to be regarded as a nuisance, feeding especially on moulds. In recent years there has been a gradual world-wide recognition that psocids do produce a series of distinct pest problems in the area of food and grain storage (TURNER 1994, 1999; TURNER & ALI 1993, 1996). Psocids are commonly found and often very abundant in cereal stores (SINHA 1988; KALINOVIC & GÜNTHER 1990; KALINOVIC & IVEZIC 1994; PIKE 1994; BÜCHI 1994, 1995; ROESLI & JONES 1994; REES 1994; REES *et al.* 1994; SANTOSO *et al.* 1996). They are a real problem in grain stores (HO & WINKS 1995), particularly in hot and humid areas. In the Czech Republic they also appeared to infest stored grain more often than in previous years (WERNER *et al.* 1998). Psocids deteriorate quality of stored commodities by their presence (live and dead specimens, excrements) and by their distribution of moulds. Their importance as health hazard is as-

sociated with this problem. Certain psocids (liposcelids) are allergenic to susceptible people (TURNER *et al.* 1996). Heavy infestations of these insects can cause discomfort amongst store workers, especially in tropical countries (MILLS *et al.* 1992). Presence of insects in a commodity can cause its rejection for export. Furthermore, psocid infestation can also cause physical damage to stored grain. Psocids are able to readily feed even on grain germ and endosperm which do not have any fungal contamination. MCFARLANE (1982); REES and WALKER (1990) and PIKE (1994) investigated damage caused by some liposcelids to rice and to maize (SHIRES 1982). Some publications provide information on *L. bostrychophila* as pest of grain, but without data on weight losses (GHANI & SWEETNAM 1951; WATT 1965; MILLS *et al.* 1992). KUČEROVÁ (1999) studied differences in reproduction of *L. bostrychophila* in relation to weight losses in whole kernels, caused by psocid infestation on various wheat cultivars under storage in the Czech Republic.

The present work has been undertaken in order to add information in respect of weight losses caused by psocids on broken wheat kernels (endosperm). Broken kernels are found in debris inside most empty grain storage facilities, or in cracks and crevices of structures. Such

particles are potential pest reservoirs that serve as sources of re-infestation of freshly stored crop. *Liposcelis bostrychophila* was used as a model species. It is a cosmopolitan synanthropic psocid, with polyphagous feeding habit and a great reproductive potential because of its asexual reproduction. It is a highly adaptive species that does well in both cold and warm climates.

## MATERIALS AND METHODS

*L. bostrychophila* stock culture was maintained at 26°C and 75% relative humidity (RH) on wheat germs, milled oat flakes and dried yeast. Samples of wheat kernels (Viginta) used for experiments were first broken into rough pieces, separated from small fragments and dust by sieving, and sterilized. Grain samples were stored at 26°C and 76% RH for 6 weeks to obtain stabilized moisture content (conditioning period).

Experiment conditions were 26°C, 76% RH, glass jars (2.5 cm in diameter, 3 cm height). Average moisture content of grain samples was 15.3%. After the conditioning period 30 replicates of wheat samples were weighed (2 g) and then infested with 20 females (1–2 days old) of *L. bostrychophila* per jar. Five replicates without psocids were used as a control for correction of weight losses and determination of grain moisture. Three new infested replicates and 5 controls were always used at individual intervals, sifted and weighed (Mettler AE 240 analytical balance) during the 3 months of experiment to determine weight losses of samples and numbers of adults and nymphs. Any gain or loss in weight of the control samples was used as a correction factor for the infested samples.

## RESULTS

The results of weight losses caused by psocids infestation and their population size are given in Figs 1–3. The population of psocids *L. bostrychophila* increased more than 100 times during the experiment (Fig. 1). The wheat grain damage caused by psocids feeding increased continuously during experiment. The final mean weight loss of grain sample was 0.237 g (11.8% of primary weight) (Fig. 2). The weight losses were positively correlated with progeny production ( $r = 0.91$ ) (Fig. 3).

## DISCUSSION

MCFARLANE (1982) recorded 4–5% weight losses of rice after 6 months of *L. bostrychophila* infestation. PIKE (1994) found weight losses up to 2.9% in lightly milled rice after 3.5 months of *L. paeta* infestation. REES (1994) expected extensive damage to grain commodities, especially seed grain and malting barley, due to psocid preferences for grain germ. KUČEROVÁ (1999) confirmed this presumption when reporting large germ damage to various wheat cultivars under laboratory conditions (6–54%) and 0.5–1.4% weight losses of whole kernels due to 3 months of *L. bostrychophila* infestation. Moisture content of wheat kernels was 11.6–12.6%, and physical damage was concentrated mostly at the germ. Results presented in this paper show both higher psocid population size and weight losses of wheat (9.7%) after the same exposure period of *L. bostrychophila* infestation. In this experiment, psocids fed also on endosperm, which was more easily accessible because of broken kernels and higher moisture content of wheat (15.3%). Despite a different

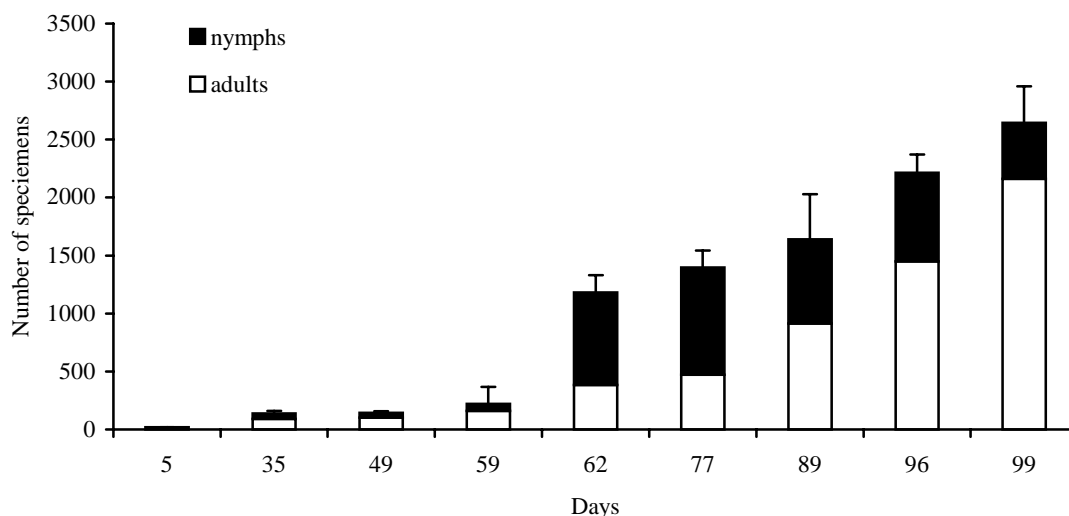


Fig. 1. *Liposcelis bostrychophila* progeny on wheat grains

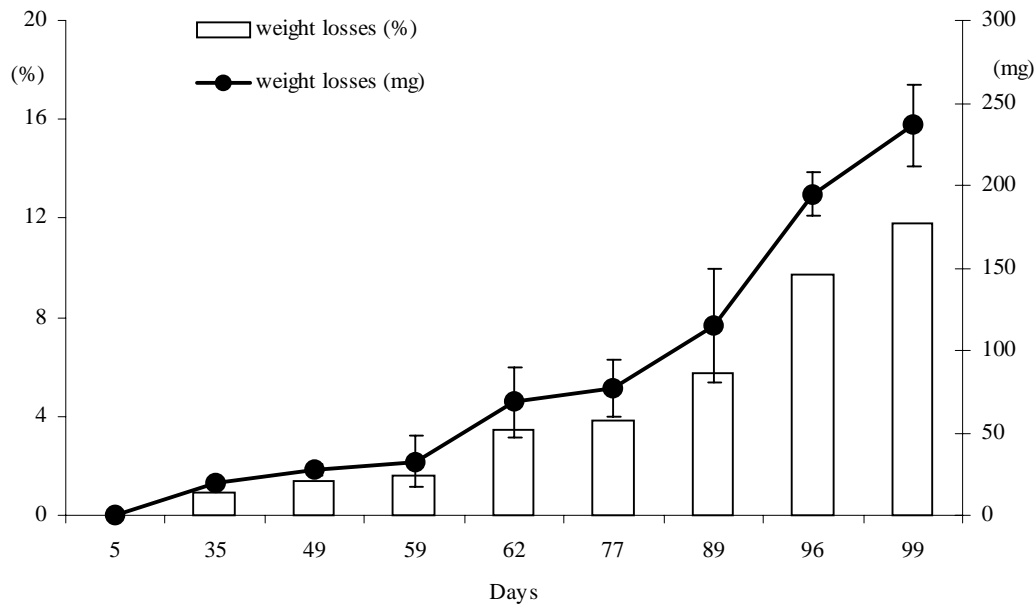


Fig. 2. Weight losses of grain infested with *Liposcelis bostrychophila* population

designs of experiments, all studies clearly indicated that psocids could play an important role in deterioration of stored grain. Deterioration level depends on specific conditions in a store, and mainly on the starting population size, temperature, humidity of stored grain and other environmental circumstances (presence of grain residues and grain dust, moulds, other pests and predators, type and cultivars of stored grain, etc.).

Optimal conditions may cause rapid development of psocid population on grain fragments and their further penetration into whole bulk of stored grain, leading to contamination with unacceptable quantities of both living and dead insects in some years. This contamination may decrease seed germination. In long-term storage it could cause physical damage of endosperm as well.

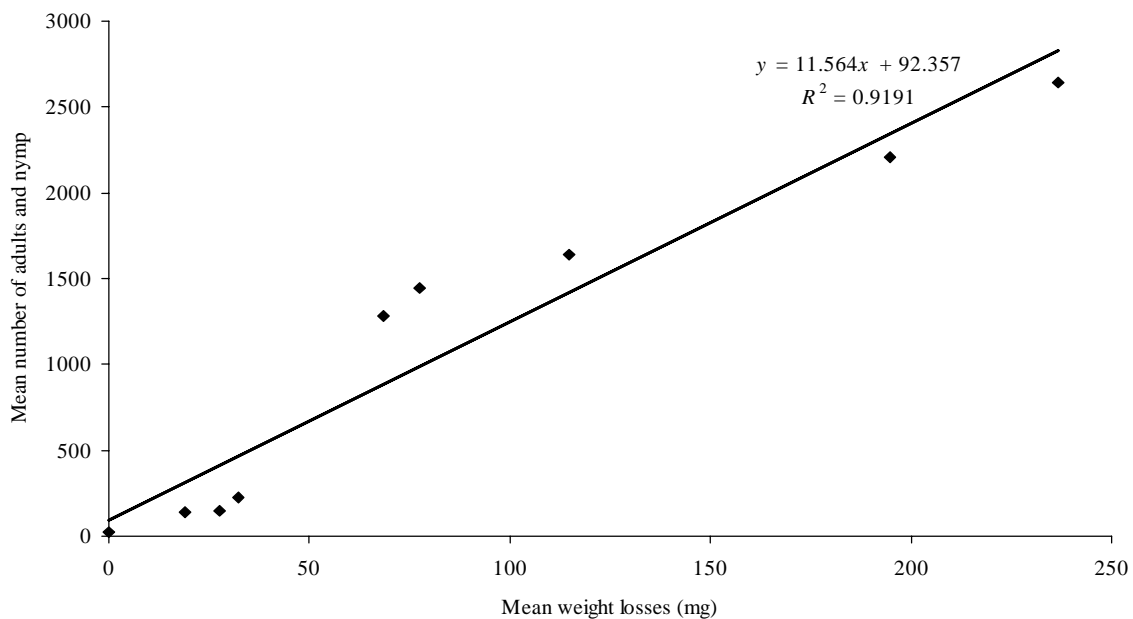


Fig. 3. Relationship between weight losses of wheat and numbers of *Liposcelis bostrychophila* individuals

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**Souhrn**

KUČEROVÁ Z. (2002): **Hmotnostní úbytek pšeničných zrn způsobený požerem pisivek** (*Liposcelis bostrychophila*: Liposcelidae: Psocoptera). Plant Protect. Sci., **38**: 103–107.

Byly zjišťovány hmotnostní úbytky pšeničných zrn působené požerem pisivek. Pisivky jsou běžnými skladištními škůdci vyskytujícími se na zbytcích zrn v prázdných skladech. Napadené úlomky slouží jako zdroj reinfestace nově skladovaného obilí. Průměrný hmotnostní úbytek obilních vzorků způsobený pisivkami druhu *Liposcelis bostrychophila* byl po třech měsících 9,7 %. Hmotnostní úbytky byly v korelaci s velikostí populace pisivek.

**Klíčová slova:** *Liposcelis bostrychophila*; Psocoptera; skladovaná pšenice; hmotnostní úbytky

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