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Insects of stored plant products in Lithuania

Henrikas Ostrauskas, Loreta Taluntytë

Lithuanian State Plant Protection Service Pelesos 85, LT-11351 Vilnius, Lithuania
E-mail: vaathe@vaat.lt; vaatlo@vaat.lt

In Lithuania, during 1997–2000 there were investigated company-owned and private warehouses (n = 46) by applying pheromone traps for *Trogoderma granarium* (140 traps) and by product sampling (n = 26, 45 samples). Imported plant products were investigated by product sampling (664 samples). In warehouses, insects of 5 orders (Psocoptera, Homoptera, Coleoptera, Lepidoptera, Diptera), 15 families, 21 species were found. Pests were found to have attacked 32% of the warehouses. In warehouses, 10 pest species were found, with *Sitophilus granarius* as the most frequent one. *Rhizopertha dominica* and *Sitophilus oryzae* were registered for the first time in Lithuania warehouses. The highest diversity of pests (7 species) was established on wheat (among 20 kinds of products stored in warehouses). In imported products, insects of 5 orders (Psocoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera), 19 families, 24 species were detected, including 16 pest species. *Sitophilus zeamays, Caryedon gonagra, Ahasverus advena, Tribolium indicum, Echocerus maxillosus, Cadra cautella* were recorded for the first time in Lithuania. The highest diversity of pests (11 species) was found on imported maize (34 kinds of stored products were checked). In total, both in warehouses and imported products, insects of 7 orders, 24 families and 35 species were determined, among them 17 pest species. *Trogoderma granarium* was not found during the present survey.

Key words: species, registration, relative infestation of pests, stored plant products

INTRODUCTION

The diversity and importance of pests depend mainly on the climatic conditions (Закладной, Ратанова, 1973), and the latter vary in different countries. Some insect species are usually pointed out as economically important pests in temperate zone warehouses. These are *Ptinus fur*, *Orizaephilus surinamensis* and *Cryptolestes ferrugineus*, *Tribolium confusum* and *Palorus ratzeburgi*, *Sitophilus granarius, Sitophilus oryzae*, *Rhizopertha dominica*, *Ephestia kuehniella* and *Plodia interpunctella* (Закладной, Ратанова, 1973; Pileckis, Monsevièius, 1995; Zubrys, 1967; Справочник..., 1999; Pileckis, Monsevièius, 1997; Загуляев, 1965). Psocopterans can be found in warehouses on grain stored for a long period and covered with dust or mould. These insects can injure products, but psocopterans are known as secondary pests (Закладной, Ратанова, 1973).

The Khapra beetle, *Trogoderma granarium*, is an economically important pest in warehouses (Закладной, Ратанова, 1973; Варшалович, 1963). Because of its biological features and distribution, experts have given khapra the status of a quarantine pest (Никритин и др., 1995; Quarantine…, 1997). According to the European Plant Protection Organization, there exists a high risk to introduce this species with imported products or untreated packing material and transport from the countries where *Trogoderma granarium* occurs (Quarantine…, 1997). The Khapra beetle has not been recorded in Lithuania (Pileckis, Monsevièius, 1995), but this species was included into the quarantine pest list (Lietuvos…, 2000). Barak (Barak, 1989) and Smetnik (Сметник и др., 1987) described a search of *Trogoderma granarium* with pheromone traps.

E. Zubrys investigated insects of stored products in Lithuania earlier (Zubrys, 1967). *Tenebrio molitor* was mentioned as a frequent insect species in warehouses, but *Sitophilus granarius* was pointed out as a much more dangerous pest in this country. *Tenebrio molitor* was reported as a warehouse pest in Poland in 1985–1988 (Pradzyñska, 1989) and in Belgium in 1986–1988 studies (Schiffers et al., 1988), but not in the latest reports (EPPO…, 1997–2000). In East Germany insects were found in 11% (1976) and 1.2% (1986) of warehouses (Reuter, Bahr, 1988). The main species were *Orizaephilus surinamensis* and *Cryptolestes* (50% of attacked warehouses), *Sitophilus granarius* and *S. oryzae* (25% of at-

tacked warehouses), and the frequency of *Typhaea stercorea* and *Ahasverus advena* became higher.

Some data on beetles imported with plant products were presented in Fauna of Lithuania (Pileckis, Monsevièius, 1995; 1997). So, a comparison of earlier studies with recent data is of great interest. On the other hand, the international trade forces to monitor pests in stored products.

The aim of this study was to determine warehouse insects in stored products and to search for *Trogoderma granarium* in Lithuania.

MATERIALS AND METHODS

Trapping. Traps (n = 140, AgriSense company) and pheromone lure for *Tr. granarium* were used in Lithuanian warehouses during investigations in the period 1997–2000 (Table 1). Attraction of insects to pheromone lures was guaranteed for one month after the placement of dispensers in a warehouse. One dispenser was used per one trap. The majority of traps were placed in June (when a small amount of stored grains was left after the sowing time), and the rest in October and November (after placing a new harvest in warehouses). The traps were operated in warehouses of 18 companies and owners in 1997, 11 in 1998, 13 in 1999, and 10 in 2000, in total 46 during the four years of investigations in 20 administrative districts of Lithuania. In the warehouses, stored crops were as follows: wheat, barley, maize, rice, buckwheat grains, cacao and coffee beans, soy-beans, hazel nuts, walnuts, groundnuts, sunflower seeds and crumbs, rape seeds and mixed grains.

Sampling. Samples (from 0.3 to 3 kilograms) were taken from imported products and stored plant material in 26 warehouses of the country: 90 imported product samples and 10 samples from warehouses in 1997, 217 and 15 in 1998, 185 and 1 in 1999, 172 and 19 in 2000, in total 664 and 45 samples during four years of investigation. The sampling was random when insect traces were not evident (Руководство..., 1972). The following imported products from 37 countries were checked: haricot, broad beans, pea, barley, rye, wheat, wheat-flakes, oat-flakes, buckwheat, rice, soy-bean, soy-bean-cake, maize, maize-cake, grain medley, sunflower seeds, sunflower seeds-cake, nuts, cacao nibs, rape seeds, linseeds, lupine seeds, vegetable and spices seeds (tomato, cucumber, capsicum, carrot, red beet, lettuce, mustard, pumpkin, poppy, caraway, coriander), flower seeds, tobacco, cotton. The products originated from countries of different parts of the world: Europe – 16 countries; Asia – 12; North America – 2; Central and South America – 3; Africa – 3; Australia – 1. The majority of samples presented maize from the Ukraine. Warehouses, where sampling was carried out, contained stored crops: wheat, barley, rye, oat, beans, lupin seeds, rape seeds, linseeds, split buckwheat and its cleaning remains, buckwheat husks, poultry fodder. The samples of the products (each separately) were shaken out from plastic bags on the tray and put under a lamp – heath and light induce known moving reaction of insects (Bûda, Plepys, 1996).

Identification. All insects found were collected. Alive adults were killed by ethyl acetate, and larvae were boiled, then fixed into alcohol liquid with a glycerine drop. Genitalia were prepared using standard method (Ivinskis, 1996; Комарова и др., 1983). To determine insect species special keys were used (Справочник..., 1999; Определитель..., 1964; 1965; 1986; 1978а; 1978б; 1981; 1969). The species classification system was as that presented in the checklists (Catalogue…, 1996; Lepidoptera…, 1996) and for insect orders – as in the keys mentioned above.

Evaluation. Relative occurrence of insects and/or infestation of pests (%) was counted as a ratio of the number of warehouses in which insects or pest species were trapped to the number of ware-

Table 1. **The number and type of traps used in the present survey of Lithuania's warehouses**
1 lentelë. **Gaudykliø, naudotø Lietuvos sandëliuose, kiekis ir tipas**

Trap	Lure and it's dealer	*n*	Year
Sticky insert of Delta trap	L 128, AgriSense company (US)	35	1997
Sticky insert of Delta trap	L 128, AgriSense company (US)	11	1998
Pitfall cone	L 128, AgriSense company (US)	14	1998
Grain probe	L 128, AgriSense company (US)	8	1998
Sticky insert of Delta trap	Pyatigorsk Republican Quarantine Laboratory (Russia)	3	1999
Pitfall cone	Pyatigorsk Republican Quarantine Laboratory (Russia)	29	1999
Grain probe	Pyatigorsk Republican Quarantine Laboratory (Russia)	12	1999
Sticky insert of Delta trap	Pyatigorsk Republican Quarantine Laboratory (Russia)	12	2000
Pitfall cone	Pyatigorsk Republican Quarantine Laboratory (Russia)	11	2000
Grain probe	Pyatigorsk Republican Quarantine Laboratory (Russia)	5	2000

houses investigated. The efficiency of trapping (%) on a crop was counted as a ratio of the number of traps containing insects of a single species and the total number of traps used in the same crop. The efficiency of insect and/or pest (%) sampling on a crop was counted as a ratio of the number of samples containing insects or pests species to all samples of the same crop. The Menhinick index (R) for evaluation of species abundanc and the Sørensen coefficient (S) for evaluation of the similarity of species composition were used (Ludwig, Reynolds, 1988).

RESULTS AND DISCUSSION

Trapping in warehouses. Insects were caught in 27% of traps and were found in 54% of the firms investigated. Insects from 5 orders, 14 families, 20 species were trapped in warehouses (Table 2).

Psocoptera were found on four kinds of stored products: hop, sunflower seeds, buckwheat, grain medley. They were caught with all kinds of traps, but the efficiency of trapping varied from 14% (wheat, grain probe trap) to 100% (wheat, pitfall cone; barley, sticky insert).

Table 2. **Insects found in Lithuanian warehouses in 1997–2000**
2 lentelë. **Vabzdþiai, nustatyti Lietuvos sandëliuose 1997–2000 metais**

Insects	Number of specimens	Locality	Trapping			Product sampling
			Sticky insert	Grain probe	Pitfall cone	
Psocoptera	64	Panevëþys, Varëna, Marijampolë, Utena, Tauragë, Alytus	+	+	+	
Homoptera						
Aphididae	17	Utena, Panevëþys	+			+
Cicadellidae	1	Panevëþys	+			
Coleoptera						
Calathus melanocephalus L.	1	Velþys (Panevëþys district)	+			
Staphylinidae	2	Tauragë		+		
Rhizopertha dominica F.	7	Joniškis, Marijampolë				+
Ptinus fur L.	21	Kretinga, Plungë, Joniðkis, Utena, Jaðiûnai (Ðalèininkai district)	+	+		+
Orizaephilus surinamensis L.	45	Marijampolë, Varëna		+	+	+
Cryptolestes ferrugineus Stph.	21	Marijampolë, Varëna		+	+	+
Cryptophagus dentatus Hbst.	1	Utena		+		
Lathridius sp.	1	Tauragë		+		
Dienerella filiformis Gyll.	1	Kaunas		+	+	
Dienerella filum Ab.	6	Degaièiai (Telðiai district)		+		
Dienerella ruficollis Mrsh.	1	Utena	+			
Stephostethus rugicollis Ol.	1	Utena		+		
Mycetophagus quadripustulatus L.	6	Alytus	+			
Typhaea stercorea L.	1	Ðilutë	+			
Palorus ratzeburgi Wssm.	1	Ðilutë	+			
Tribolium confusum Jcq.	25	Utena, Panevëþys	+			
Sitophilus sp.	2	Vilnius	+			
Sitophilus granarius L.	36	Ðilutë, Kretinga, Palanga, Alytus, Marijampolë, Utena, Joniškis	+	+	+	
Sitophilus oryzae L.	5	Kretinga, Marijampolë	+		+	+
Lepidoptera						
Haplotinea ditella Prc. et Djk.	1	Ðvenèionëliai	+			
Nemapogon granella L.	10	Tauragë, Ðvenèionëliai	+			
Nitidinea fuscella L.	3	Ðvenèionëliai	+			
Plodia interpunctella Hb.	3	Kaunas	+			
Ephestia sp.	1	Kaunas		+		
Ephestia kuehniella Zll.	3	Palanga	+			
Diptera						
Psichodidae	900	Panevëþys	+			

Homoptera. Some Aphididae species attack cereals in the field, and aphids were random in warehouses (only in fresh harvest).

Coleoptera. There were found beetles from 10 families. The Carabidae species *Calathus melanocephalus* trapped in cereals is known as a predator (Pileckis, Monsevièius, 1997), sometimes phytophagous in fields (Атонюк, 1973). In warehouses the insect was occasional found once. Some Staphylinidae beetles are known as predators, some species feed on plant remains (Pileckis, Monsevièius, 1995), but this family is not included into the list of warehouse pests (Закладной, Ратанова, 1973; Справочник..., 1999). The efficiency of trapping for Staphylinidae on wheat was low with a grain probe (14%). The ptinidae species *Ptinus fur* was found in three kinds of stored products, and the efficiency of trapping was the highest with a sticky insert on grain medley (100%), less on winter wheat (50%) and the lowest on barley with a grain probe (20%). The species of Cryptophagidae, Lathriidae, Mycetophagidae families caught by traps usually reside on products attacked by moniliaceous fungi or inhabit disordered plant remains (Закладной, Ратанова, 1973; Справочник..., 1999). For Lathriidae, the efficiency of trapping was the highest on cacao beans with a grain probe and pitfall cone (100%), on barley with sticky inserts (100%), but it was low with a grain probe on barley (20%) and wheat (14%). For Mycetophagidae, the efficiency of trapping using a sticky insert on grain medley ranged from 50% to 100%, and for Cryptophagidae on barley with the grain probe it was low (20%). Cucujidae beetles usually occur in complex with other warehouse insects, mainly *Sitophilus* spp. from the family Curculionidae, but *Cryptolestes ferrugineus* can live separately when the moisture of grains is above 16% (Закладной, Ратанова, 1973). For Cucujidae, the efficiency of trapping was high on wheat with pitfall cone (100%) and on barley with grain probe (100%); it was lower on buckwheat with grain probe (50%). Different species of false wireworms recorded from traps can inhabit the same crop (Справочник..., 1999), but in our case they occurred separately: *Tribolium confusum* was found on barley and *Palorus ratzeburgi* on grain medley; the efficiency of trapping was very high (100%). The efficiency of trapping for *Sitophilus granarius* on barley with sticky inserts and grain probe, on wheat with sticky inserts and pitfall cone was very high (100%), on grain medley with sticky inserts varied (50–100%), and on winter wheat it was 50%. The efficiency of trapping for *Sitophilus oryzae* on grain medley with sticky insert and on wheat with pitfall cone was very high (100%). It is important to point out that the Dermestidae species *Trogoderma granarium* was not trapped.

Lepidoptera. Three Tineidae species were caught with sticky inserts on grain medley. The efficiency of trapping for these insects ranged from 33% to 100%. *Tinea granella* and *Nitidinea fuscella* are known as species living on stored cereal products (Загуляев, 1965). *Haplotinea ditella* was caught in a Palanga bakery (the western part of Lithuania) (Ivinskis, Mozûraitis, 1995), although this species inhabits bird nests (Ivinskis, 1993). The Pyralidae species *Ephestia kuehniella* and *Plodia interpunctella* were trapped on a few kinds of stored products: wheat, buckwheat, rice, cacao beans and nuts. The efficiency of trapping of these insects varied from 33% to 100%.

Diptera. Psichodidae larvae and adults feed on disintegrated plant remains (Определитель..., 1969). The efficiency of trapping on cereal grains was very high (100%).

Diversity. The highest diversity of insects was found in traps with sticky inserts as compared with those in Grain probe and Pitfall cone traps. Some Staphylinidae, Cucujidae, Cryptophagidae, Lathridiidae species were caught with grain probe and pitfall cone traps. The size of a beetle was not important (both the biggest *Sitophilus* and the smallest Psocoptera were trapped); maybe the placing of a trap in the warehouse had more influence, as grain probe and pitfall cone traps were inserted deeper into the layers of products.

Sampling in warehouses. Analyses of product samples revealed less taxa of insects (2 orders, 4 families, 4 species) in comparison with those caught with traps (Table 2). The efficiency of insect sampling on a crop was low (11%), probably due to a good storage of products as well as the escaping of some insects during sampling. Pests were present in 15% of warehouses. *Rhizopertha dominica* was an extra species (and family Bostrychidae) of coleopterans found in Lithuania's warehouses. It is interesting to note that this species was not caught using the method of trapping.

Total analysis of warehouses. In total, insects of 5 orders, 15 families, 21 species were registered in Lithuania's warehouses. The most often attacked products in Lithuanian warehouses and the diversity of pests were determined basing on joined results obtained both by trapping and sampling: 7 pest species on wheat, 4 on barley, 3 on grain medley, 3 on buckwheat and its cleaning remains, 1 on cacao beans, 1 on nuts, 1 on rye, 1 on rice, 1 on lupine. Insect pests attacked 32% of 72 warehouses checked during 1997–2000. The relative infestation was 12.5% for *Sitophilus granarius*, 6.9% for *Ptinus fur*, 4.2% for both *Orizaephilus surinamensis and Sitophilus oryzae*, 2.8% each for *Cryptolestes ferrugineus, Tribolium confusum, Plodia interpunctella* and *Ephestia*

kuehniella, 1.4% for both *Rhizopertha dominica and Palorus ratzeburgi. Rhizopertha dominica* and *Sitophilus oryzae* should be included into the list of Lithuania's fauna as they are able to survive in warehouses where no phytosanitary measures are applied.

Comparing the data of trapping and sampling, it should be noted that the trapping lasted for a long time (four weeks), and the sampling only for a few minutes. This might explain the differences in the results obtained by both methods.

Sampling in imported products. Insects were found in 64 samples (9.6% of the total number of samples checked). (In some samples products were damaged by insects, however, neither living nor dead insects were found.) Insects of 5 orders, 19 families and 24 species were found (Table 3).

Table 3. **Insects found in samples of plant products imported to Lithuania in 1997–2000**
3 lentelë. **Vabzdþiai, aptikti importuotuose á Lietuvà produktø mëginiuose 1997–2000 metais**

Insects	Number of specimens	Imported from	Crop
Psocoptera	13	Germany, Belgium, Denmark	Split almond, tobacco, beet seeds
Hemiptera			
Pyrrhocoris apterus L.	1	Ukraine	Sunflower
Miridae	1	Ukraine	Beans
Coleoptera			
Carabidae	1	Ukraine	Buckwheat
Amara sp.	1	Ukraine	Beans
Elateridae	1	Argentine	Ground nuts
Attagenus pellio L.	1	China	Soy-bean packages
Rhizopertha dominica F.	17	China, Russia, Ukraine, Moldova	Soy-bean packages, grain medley, maize
Ptinus fur L.	2	Ukraine	Sunflower
Tenebroides mauritanicus L.	5	Vietnam, Ukraine	Rice, maize
Ahasverus advena Wlt.	1	Ukraine	Maize
Orizaephilus surinamensis L.	19	Vietnam, Ukraine, Pakistan, Moldova	Rice, maize
Cryptolestes ferrugineus Stph.	23	Vietnam, India, Russia, Ukraine	Rice, grain medley, maize, ground nuts
Lathridiidae	2	Russia	Weed seeds
Mycetophagus quadriguttatus Mll.	16	Ukraine	Sunflower
Typhaea stercorea L.	1	Ukraine	Maize
Echocerus maxillosus F.	1	Ukraine	Maize
Tribolium castaneum Hbr.	22	Pakistan, Vietnam, Ukraine, Moldova	Rice, maize
Tribolium confusum Jcq.	58	Russia, India, Moldova, Slovakia	Grain medley, ground nuts, maize
Tribolium indicum Blr.	2	India	Rice
Bruchus rufimanus Bh.	2	Russia, UK	Grain medley, haricot
Acanthoscelides obtectus S.	6	Poland, Ukraine	Beans
Caryedon gonagra Ol.	1	India	Ground nuts
Sitophilus sp.	1	China	Walnut
Sitophilus granarius L.	33	Russia, Ukraine, Moldova	Grain medley, maize
Sitophilus oryzae L.	125	India, Russia, Ukraine, USA, Moldova	Rice, grain medley, maize
Sitophilus zeamays Mts.	3	USA	Maize
Lepidoptera			
Phyllonorycter populifoliella Tr.	1	USA	Maize
Gelechiidae	2	China	Soy-bean package
Homoeosoma sp.	2	Ukraine	Sunflower
Plodia interpunctella Hb.	58	Ukraine, India, Turkey, Poland	Maize, hazelnut, ground nuts, sunflower
Ephestia sp.	1	Estonia	Cacao beans
Ephestia kuehniella Zll.	7	Ghana, Ukraine	Cacao beans, walnut
Cadra cautella Wlk.	1	India	Ground nuts
Hymenoptera			
Eurytomidae	4	Russia, Vietnam	Rape seeds, rice
Ichneumonidae	4	Ukraine	Maize

Psocoptera. The efficiency of insect sampling on crop was very high (100%) on all three kinds of imported products: split almond, tobacco and beet seeds.

Hemiptera. *Pyrrhocoris apterus* (Pyrrhocoridae) and *Miridae* were found, however, they are not related to stored plant products and should be considered as occasional.

Coleoptera. Some Carabidae species, especially of the genus *Amara, Bembidion, Calathus, Harpalus, Ophonus, Pterostichus, Zabrus*, are phytophagous and can attack grain in fields (Атонюк и др., 1973), so the presence of this family of beetles in stored products was not common. The efficiency of insect sampling was low on maize for *Rhizopertha dominica* (2–4%), *Tenebroides mauritanicus* (2%), Cucujidae (2–6%), Tenebrionidae (2–9%, except *Echocerus maxillosus,* 33%), for *Typhaea stercorea* (2%), Curculionidae (2–20%); on sunflower for *Mycetophagus quadriguttatus* (17%), *Ptinus fur* (20%); on grain medley for *Bruchus rufimanus* (8%), *Sitophilus granarius* (8%); on rice for *Sitophilus oryzae* (5%); on ground nuts for *Tribolium confusum* (20%), *Caryedon gonagra* (20%). The efficiency of insect sampling on rice was higher for *Tenebroides mauritanicus* (33%), Cucujidae (33–50%); on grain medley for *Rhizopertha dominica* (50%), Cucujidae (58%), Tenebrionidae (25%), *Sitophilus oryzae* (67%); on beans for *Acanthoscelides obtectus* (20–50%); on soy-bean packages for *Attagenus pellio* (50%) and *Rhizopertha dominica* (50%). The efficiency of insect sampling (100%) was very high for Elateridae on ground nuts, for *Sitophilus* sp. on walnut, for *Bruchus rufimanus* on haricot. *Acanthoscelides obtectus, Rhizopertha dominica, Sitophilus oryzae* are known to occurr on imported products (Pileckis, Monsevièius, 1995; Pileckis, Monsevièius, 1997). *Sitophilus zeamays, Caryedon gonagra, Ahasverus advena, Tribolium indicum, Echocerus maxillosus* were caught in imported products for the first time in Lithuania. *Trogoderma granarium* was not found.

Lepidoptera. The efficiency of insect sampling was low for Pyralidae on maize (4–6%), on sunflower (10–17%), varied for *Plodia interpunctella* on ground nuts (20–100%) and on hazelnut (50%), for *Ephestia kuehniella* on walnut (50%), for *Ephestia* sp. on cacao beans (100%), for Gelechiidae on soybean packages (50%). The Pyralidae species *Cadra cautella* was caught in imported products for the first time. The latter species had not been registered in Lithuania (Ivinskis, 1999; 1993), but was known from neighbouring Latvia (Savenkov et al., 1996) and Estonia (Jurivete et al., 2000). The Gracillariidae species *Phyllonorycter populifoliella* mines *Populus* leaves (Ivinskis, 1993), thus adult moth on maize was occasional.

Hymenoptera. Ichneumonidae were present on maize, some species of this family are parasitoids of other insects on immature stages (Определитель..., 1981). The frequency of samples containing *Eurytomidae* varied: on rice it was 33% and on rape seeds 50%.

Basing on the data presented above, we compiled a list of pests in imported products, including the following 16 species: *Ptinus fur, Rhizopertha dominica, Orizaephilus surinamensis, Cryptolestes ferrugineus, Tribolium indicum, Tribolium castaneum, Tribolium confusum, Echocerus maxillosus, Caryedon gonagra, Bruchus rufimanus, Sitophilus granarius, Sitophilus oryzae, Sitophilus zeamays, Plodia interpunctella, Ephestia kuehniella, Cadra cautella.* Stored plant products attacked by warehouse pest species were ranged starting with maize (11 species) and followed by rice (6), grain medley (6), nuts (6), sunflower seeds (2), soy-bean packages (1), cacao beans (1 species), beans (1) and haricot (1).

Comparative data on insects occurring in imported stored plant products and warehouses in Lithuania. Insect species abundance in the warehouses (R = 1.49) and in imported products (R = 1.19) differs not much. The similarity of insect species composition of the two groups was not high (S = = 0.4). Imported products contained 3 species and 4 families more as compared to warehouses. The difference in taxa composition in warehouses / imported products was as follows: 11/14 species, 6/10 families, 2/2 orders. This is due to the higher diversity of imported products.

The insect pest species abundance in warehouses (R = 0.77) and in imported products (R = = 0.82) differs less than in total insect species. The similarity of pest species composition (S) equals 0.69.

In total, insects of 7 orders, 24 families and 35 species, among them 17 pest species, were found in stored products during a 1997–2000 survey in Lithuania.

CONCLUSIONS

1. In warehouses of Lithuania, in the period 1997–2000 there were revealed insects of 5 orders (Psocoptera, Homoptera, Coleoptera, Lepidoptera, Diptera), 15 families and 21 species, among them 10 pest species with *Sitophilus granarius* as the most frequent. The highest diversity of insect pests (7 species) was found on wheat. Pests attacked 32% of the checked warehouses.

2. In Lithuania, *Rhizopertha dominica* and *Sitophilus oryzae* occurr in warehouses.

3. In imported stored plant products, insects of 5 orders (Psocoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera), 19 families and 24 species

were found. *Sitophilus zeamays, Caryedon gonagra, Ahasverus advena, Tribolium indicum, Echocerus maxillosus, Cadra cautella* were revealed in imported products for the first time in this country. In total, 16 insect pest species were found, most of them (11) on imported maize.

4. In total, insects of 7 orders, 24 families and 35 species, among them 17 pest species, were found in stored products in 1997–2000. *Trogoderma granarium* was not found in the present survey.

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Henrikas Ostrauskas, Loreta Taluntytë

SANDËLIUOJAMØ AUGALØ PRODUKTØ VABZDÞIAI LIETUVOJE

S a n t r a u k a

Lietuvos bendroviø ir savininkø sandëliai (*n* = 46), panaudojus ávairias gaudykles su *Trogoderma granarium* feromonais (140 mëginiø), tiesiogiai paëmus ið sandëliø (*n* = 26) produktus (45 mëginiai) bei importuotø augalø produktus (664 mëginiai), tirti 1997–2000 m. Sandëliuose nustatyti 5 bûriø **(**Psocoptera, Homoptera, Coleoptera, Lepidoptera, Diptera), 15 ðeimø, 21 rûðies vabzdþiai, tarp jø 10 rûðiø kenkëjø, kuriø daþniausi buvo *Sitophilus granarius. Rhizopertha dominica* ir *Sitophilus oryzae* aptikti gyvenantys Lietuvos sandëliuose. Kenkëjai nustatyti 32% patikrintø sandëliø. Didþiausia kenkëjø ávairovë (7 rûðys) ið 20 rûðiø produktø, laikytø sandëliuose, aptikta kvieèiuose. Importo produktuose rasti 5 bûriø (Psocoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera), 19 ðeimø, 24 rûðiø vabzdþiai, tarp jø 16 kenkëjø rûðiø. Vabzdþiai *Sitophilus zeamays, Caryedon gonagra, Ahasverus advena, Tribolium indicum, Echocerus maxillosus, Cadra cautella* uþregistruoti pirmà kartà importuotuose á Lietuvà augalø produktuose. Didþiausia kenkëjø ávairovë (11 rûðiø) ið 34 importo produktø rûðiø nustatyta kukurûzuose. Apskritai sandëliuojamuose produktuose rasta 7 bûriø, 23 ðeimø, 35 rûðiø vabzdþiai, iðaiðkinta 17 kenkëjø rûðiø. *Trogoderma granarium* per paieškos laikotarpá Lietuvoje neaptikta.

Raktaþodþiai: rûðys, registracija, santykinis kenkëjø daþnumas, sandëliuojami produktai