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Overview of present and past and pest-associated risks in stored food and feed products: European perspective



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ABSTRACT

This review provides an account on the published information regarding the historical development of pest status and risk of stored product pest monitoring in Europe over the past 80 years. Additionally, it documents several risks that have been recently identified such as (i) the arthropod filth contamination of flour; (ii) infestation of the locally produced hams and cheeses; (iii) infestation of pet food; (iv) European north-south geographical shift of pasta infestation by *Sitophilus oryzae* and dried fruits by *Car-poglyphus lactis*; (v) outdoor pest refuges; (vi) unattended rodent baits as sources of infestation. Although the reviewed literature identified an increasing mites and psocids as a threat, the quantitative data enabling a statistically-robust evaluation of population trends are missing in most of the European countries. Using several recent examples this review demonstrates the fragmented and methodically non-uniform published information on stored products pests' surveillance in Europe. Additionally, this review highlights the discrepancies between EU and USA in trade food and agricultural commodity quality/safety parameters demonstrated by missing thresholds for arthropod filth fragments in stored food in Europe.

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1. Introduction

Stored product and food industry arthropod pests present a serious economical, phytoquarantine and medical risk to stored food, feed commodities and seeds in European Union (EU). The EU grain annual harvest represents approximately 300 million tonnes that are subjected to risk of infestation and contamination of stored pests during the consequent post-harvest transport, storage and processing in food and feed production facilities. Due to the fact that the EU seed market represents 20% of the world market (<http://www.escaa.org/index/action/page/id/7/title/seed-production-in-eu>), even a small percentage of damage to high added value seeds (Stejskal et al., 2014b) may result in profound monetary losses. Therefore, the storage pests must be systematically controlled in the EU preferably by using a sustainable Integrated Pest Management (IPM) approach. IPM should include both short term and long-term risk assessment. Short-term risk assessment and prediction of deterioration risks in unsafe storage conditions (e.g. Fourar-Belaifa et al., 2011) serves to provide instant

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information enabling the suppression of pests to below economic threshold within a single crop storage season (Stejskal, 2003; Subramanyan and Hagstrum, 1996). Long-term pest assessment is based on the long-term observation of changing pest status or prediction of emerging threats leading to strategic decisions that prevent introduction, such as through quarantine measures. Additional measures include development of new systemic tools that change the overall pest status of the target species. Long-term surveillance programs are necessary prerequisites to analyse changes in pest status, pest risk trends and discover emerging problems. However, only little summary information on stored pests risk analysis is currently available for the EU. Therefore, we decided to prepare the background material that will enable the future initiation of stored product risk analysis in the EU in the future. First, we reviewed the available literature concerning stored pests risks recorded for Europe. Afterwards, we arranged the obtained information into three main sections evaluating pest-risks from the perspective of country, pest group and commodity and source of infestation, respectively. Since there is a significant ambiguity in usage of pest-risk evaluation terminology, we reviewed and discussed separately the notions “emerging risks”, “emerging pests” and “pest status” in relation to stored product entomology in the Appendix 1.

2. Overview of published information on extent of historical and current infestation in grain stores in European countries

This section gives an overview of the percentage and extent of pest infestation of commodity stores in the EU countries for which any published quantitative information was found in the literature; these include Belgium, Croatia, the Czech Republic, Greece, Italy, France, Lithuania and the United Kingdom. The historical literature records revealed that the only long-term systematic monitoring of pest in stored grain and imported commodities was executed when governments owned the food commodities as strategic resources; i.e. during the wartime in the United Kingdom in the 1940s (Aitken, 1975) and during communistic regimes in some countries (i.e. former East Germany and Czechoslovakia) from the 1950s to the late 1980s. Unfortunately, although there had been a regular, extensive and methodically uniform sampling in East Germany and Czechoslovakia, only a “percentage of infestation” has been released for public reports; accurate information on number of stores and samples remained confidential. For most of the remaining countries the information on pests’ surveillance is either missing or is fragmented and based on methodically non-uniform approaches. Consequently, such non-uniform and methodically inhomogeneous trapping and sampling used by various researchers and surveys hampers robust statistical comparisons and evaluation across the EU countries (for reasoning see Stejskal, 1995; Stejskal

et al., 2008, Hubert et al., 2009a; Jian et al., 2014).

2.1. Belgium

In the 1990s, a three-year survey was conducted in Belgium in order to establish the rate of infestation of its grain stores (Letellier et al., 1994). Infestation rate of grain batches from flour and feed mills was determined and, on average, 30% of batches were infested. The average infestation of inspected stores exceeded 50%. Commercial stores were more heavily infested than the farms stores mainly with *Sitophilus granarius* (Linnaeus, 1758), *Oryzaephilus surinamensis* (Linnaeus, 1758), *Tribolium* sp., *Cryptolestes ferrugineus* (Stephens, 1831). *Rhyzopertha dominica* (Fabricius, 1792) occurred in more than 10% of stores. The short-term (1991–1995) survey of stored pests infesting high value imported commodities has also been performed in Belgium (Casteels et al., 1996). The most predominant and therefore risky species infesting cocoa beans were: *Ahasverus advena* (Waltl, 1832), *Carpophilus obsoletus* (Erichson, 1843), *C. ferrugineus*, *Ephestia cautella* (Walker, 1863) and *Tribolium castaneum* (Herbst, 1797). The coffee samples were most frequently infested by *A. advena*, *Ephestia* sp., Psocoptera and Acari.

2.2. Mediterranean countries (Croatia – former part of Yugoslavia, Greece, Italy)

The outcomes of the studies on the mites of stored cereals in Yugoslavia (Pagliarini, 1979) and Greece (Palyvos et al., 2008) are demonstrated in Figs. 1 and 2, respectively. A high level of semolina contamination by insect fragments (originating from the grain

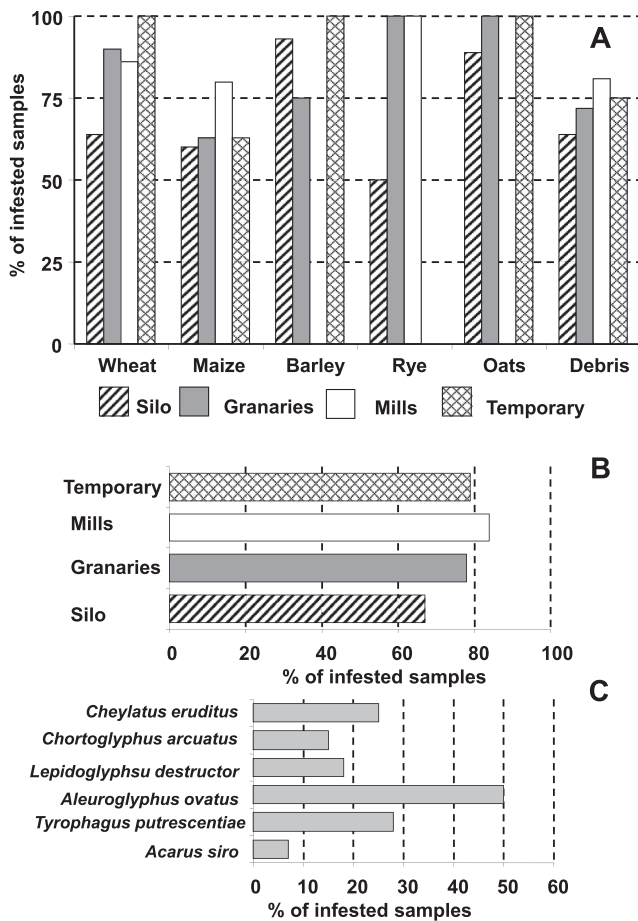


Fig. 1. Relative infestation of stored cereals by stored product mites in the former Yugoslavia (according to Pagliarini, 1979). Years of sampling 1972–1976, N = 353. A – the proportions of infestation in different commodities, B – the proportion of infestation in different types of stores; C – the proportion of infested samples by the most frequent stored product mites.

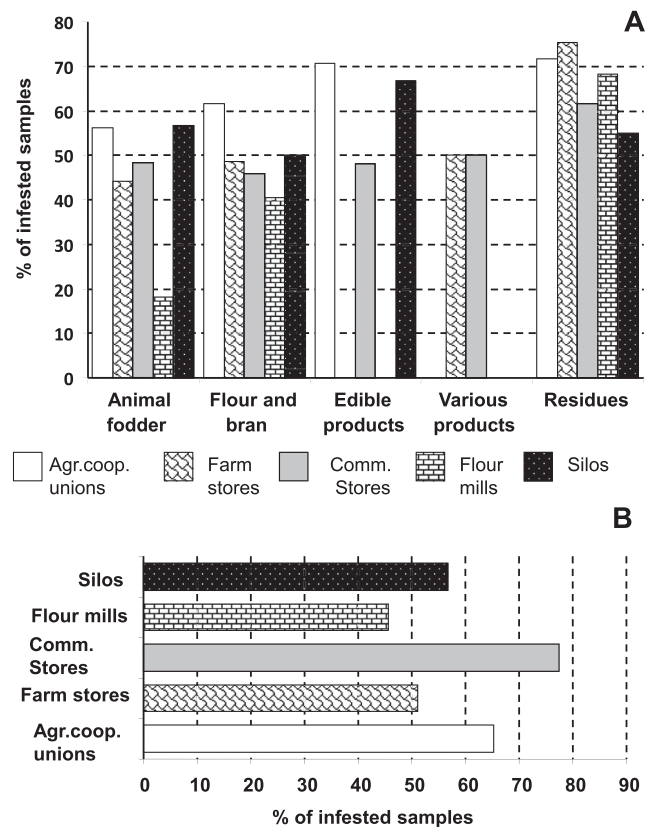


Fig. 2. Relative proportion of mite infestation in various types of storage and production in Greece (Palyvos et al., 2008). Years of sampling 2000–2005, N = 111. A – samples separated according to the type of commodity and B – samples separated according to the type of store.

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