

- Monthly total beetle counts used to trigger fumigations of entire warehouse section stock.
- Pheromone-based Serrico-Trap, used according to strict monthly SOP.

#### Beetle-proofing

Fully mesh-proofed inspections shed alongside rail loading platform The shed is Serrico trapped continuously to ensure it is beetle-free prior to, and after, each Tobacco inspection by the customer(s). Completely beetle-proofed RDS inspection shed with north light glazed roof. Mangalagiri Warehouse, fitted with beetle-proofed aeration meshes to allow opening swivel windows for dried tobaccos. Note also the proofed outer doors, closed manually, over the internal thief-proof metal doors. Making hard-wood hinged beetle-proofed doors.

#### Fumigation standardisation – Floors Sheeting, Sandsnakes, Case poly-liners, Gas measuring/recording

- Gas readings with Uniphos PH3 tubes.
- Bedford PH3 readings from stack (now replaced by Uniphos electronic meters).
- Careful gas sampling of cases for final graph of fumigation.
- Successful but disruptive green leaf pre-fumigation.
- Multi-stack coverage with joined sheeting.
- Very neat corners and safety barrier tape.
- Dosage 1.5 gPH3/M3 for 8 days.
- Metal trays for tablet placement.
- Post-Fumigation protection using cotton cloth shrouds and extra sandsnakes.
- Cotton cloth sheeting left on AFTER fumigation.
- Every shipment was fumigated at the export port in sealed containers, for 100% assurance during Year 4 (2001).
- ZERO re-fumigation charges imposed by receiving customers across Europe.

## **22 - Status and recent development in stored product protection in Denmark**

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### **Abstract**

Situated in the northern temperate region, Denmark has relatively few problems with stored product pests. In grain stores the major pest is the granary weevil *Sitophilus granarius*. No recent surveys have been conducted, but it is considered to be widespread throughout the country. Other insect species are occasionally found in grain stores as well. Pests only rarely develop high densities in grains stores, partly due to the fact that grain is cooled to a target temperature of 5°C as soon as possible after harvest. The main problem occurs when live insects are found in grain that has been loaded into a ship prior to export, in which case fumigation is necessary. However, this situation can easily change soon, as the last insecticide for direct treatment of grain, malathion, is no longer available in Denmark. The only options now are fumigation with hydrogen phosphide or treatment with inert dust. In addition, possible future climate change with higher temperatures and higher humidity will probably lead to increased problems due to pests. The pests found in other stored products in the processing chain are similar to the rest of Europe, as temperature and humidity conditions are less correlated with out door conditions.

### **Introduction**

**Grain stores:** Situated in the northern temperate region with cool, humid winters, Denmark has relatively few problems with pests in stored grain. The major pest is the granary weevil *Sitophilus granarius*. No recent surveys have been conducted, but it is considered to be widespread throughout the country. Other insect species are occasionally found in grain stores as well; *Oryzaephilus surinamensis*, *Cryptolestes ferrugineus*, *Tribolium confusum*.

Pests only rarely develop high densities in grains stores, partly due to the fact that grain is aerated to a target temperature of 5°C as soon as possible after harvest. Good hygienic practice conducted in the stores is also important for the low pest densities. The main problem occurs when live insects are found in grain that has been loaded into a ship prior to export, in which case fumigation is necessary. However, this situation can easily change

soon, as the last insecticide for direct treatment of grain, malathion, is no longer available in Denmark. The only options now are fumigation with hydrogen phosphide or treatment with inert dust. Possible future climate change with higher temperatures and higher humidity may lead to increased problems due to pests in stored grain.

Flour mills: The pests found in other stored products in the processing chain are similar to the rest of Europe, as temperature and humidity conditions are less correlated with outdoor conditions. In flour mills the main pests are *Ephestia kuehniella* and *Tribolium confusum*. Pest problems are managed by a combination of sanitation and application of residual pesticides and pyrethrin fogs. Heat treatment and application of inert dusts are not used very much.

Wholesale and retail stores: In this sector the pests are the same as in other EU countries. However, during recent years *Plodia interpunctella* has become more common in private households. The consequences of this on human health are unknown, but it could represent a problem due to adverse effects of fragments from *Lepidoptera* (allergies resulting from presence of wing scales and fragments in the immediate environment and human food).

A description of the pest situation in stored products in several EU countries can be found in the proceedings from several meetings of COST Action 842, WG IV: Bio-control of arthropod pests in stored products, available at <http://cost842.csl.gov.uk/>

## 23 - Stored Product Protection Perspectives in Spain

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### Abstract

There is an important food industry in Spain that represents the main industry sector, accounting 16.2% of net product sales and 14.6% of industrial employment. Consumption of many types of cereals, dried fruits and nuts, legumes and spices in Spain is very high as they are a component of our traditional food. A number of these food products could be stored after the harvest season for more than 3 months, and be processed little by little during the year. The storage of imported commodities is similar except for those products with high demand that are commonly processed in a period of 1-month or less. Both silos and warehouses are used for the storage of raw material and final food products. A number of pest species can affect both commodities and processing facilities, among them several Coleoptera, Lepidoptera, Psocid and Mite species. Chemical control based on residual insecticides and fumigants is the most common pest control method used. In Spain, there are a limited number of active compounds that are allowed to use for stored pest control. As a consequence pesticide resistant insect strains are already present in some areas. Treatments are concentrated in summer when temperatures are optimal for insect development. Among pesticides, phosphine has replaced in most cases the use of methyl bromide after its phase out. There is an increasing use of prevention, hygiene, monitoring of pests and alternative control methods. HACCP protocols and IPM are followed by a number of companies. Other methodologies in use are Modified Atmospheres for both fumigation or packaging and, CO<sub>2</sub> at high pressure for treating spices and herbs. Biological control is not used and still not known as an alternative control method by the agro-food industry.

Keywords: Stored Products, Pest control, Chemical Control, IPM.

### Introduction

Value of market including imports and exports: There is an important food industry in Spain that represents the main industry sector, accounting 16.2% of net product sales and 14.6% of industrial employment (Ministerio de Medio Ambiente y Medio Rural y Marino, 2009a). Consumption of many types of cereals, dried fruits and nuts, legumes and spices in Spain is very high as they are a component of our traditional food.

In Spain there are about 220 mills and 15,000 bakeries. The number of mills has gradually decreased during the last 10 years due to a reorganization of the sector and the merge of companies trying to re-duce competitiveness. Milling capacity of the Spanish industry is approximately 27,000 tons of wheat per day. However, flour production is about 2,7 millions of tons per year, thus only 40% of the total milling capacity. This low productive capacity is caused by sales and exports cuts during the last years. The consumption of bread per capita (58 kg approximately) has also decreased during the last 20 years. There is also an important dried fruit industry in Spain. The main commodities produced are almonds, hazelnuts, chestnuts, figs and carobs (Table 1). Spain is the second largest almond exporter (45,000t/year) and the fourth largest hazelnut exporter (4,600t/year) in the world. Both commodities represent a trade value of more than 200 million euro. There is a high quantity of imports of dried