

11. Stored product pests

11.1 Official examination of consignments 1998

The DPIL examines consignments of grain and other dried plant products intended for export. Based on the result of these examinations, the Plant Directorate of the Ministry of Food, Agriculture and Fisheries issues a phytosanitary certificate. In 1998 a total of 814 consignments were examined: 169 grain lots, 104 lots of malt, 112 consignments of tobacco, 107 lots of dried peas and 322 consignments of other products, half of them being potato starch. Live insects were found in 1.5% of the consignments, mainly in grain lots. The following pest species were detected:

Number of lots	Pest species
8	<i>Sitophilus granarius</i>
3	<i>Ptinus tectus</i>
1	<i>Tribolium confusum</i>

L. Stengård Hansen

11.2 Allergens from pests in grain stores and milled products

C. Danielsen's Ph.D.-thesis, entitled "Population dynamics of *Lepidoglyphus destructor* (Schrank) (Acarina: Glycyphagidae) and its production of allergens in stored grain" was accepted by the University of Copenhagen on November 12, 1998.

L. Stengård Hansen

11.3 Biological control of the Mediterranean flour moth *Ephestia kuehniella*

The purpose of this five-year project is to identify natural enemies that can be used to control *Ephestia kuehniella* in flour mills. The third year of the project focused on climate and pest monitoring in three mills, a series of trials to elucidate flour moth trap catches in relation to temperature as well

as laboratory investigations of the two natural enemies that have been selected for this purpose.

Temperature and humidity conditions as well as the flour moth populations were monitored for a second year in two industrial flour mills and the programme expanded to include a smaller mill that processes organically produced grain. This information will be analysed to identify the conditions that lead to the increase in moth densities seen in the spring. It will furthermore be used in the process of evaluating the potential of natural enemies.

Laboratory investigations have been greatly disturbed by the presence of a pathogen, the protozoan *Mattesia dispersa* (Gregarinida) in the *Ephestia kuehniella* colony. The following procedure seems to have taken care of the problem: the rearing medium (crushed wheat and dried yeast) is heat-treated at 105°C for 7 hours. Flour moth eggs for colony initiation are immersed in sodium hypochlorite (1%) for 10 minutes. All equipment is disinfected either by UV-sterilization or disinfective liquids.

Investigations on the biology of the egg parasitoid *Trichogramma evanescens* reared on *E. kuehniella* were initiated, starting with determination of the threshold temperature for activity. Single female parasitoids were placed at 5°C and observed. The temperature was raised in steps of 0.5°C until the parasitoid displayed walking activity. The mean threshold temperature was approximately 10°C (range 7.0°-13.0°C). Furthermore the effect of temperature on the development period of *T. evanescens* was studied. The investigations were carried out at 15°, 20°, 25° and 30°C. Developmental durations ranged from 33 days to 7 days at the temperatures used. A pilot study revealed that although some development occurs at 10°C (the parasitized eggs turn black and thus reach the third larval stage), no parasitoids emerge after 6 months at this temperature. Investigations on the fecundity, longevity and host feeding rate of *T. evanescens* were initiated late in the year and will continue in 1999.

The investigations of the predation rate of the predatory mite, *Blattisocius tarsalis*, on eggs of *E. kuehniella* have continued. The relationship between temperature, prey abundance and predation rate of adult female mites has been studied in the laboratory at temperatures of 15°, 21°, and 27 °C and with prey densities of 3, 5, 10, and 15 eggs per mite. At low prey densities (3 eggs per mite) each mite devoured 2 eggs, whereas at high prey densities (15 eggs per mite) 3-7 moths eggs were destroyed by each mite.

The percentage of flour moths eggs killed by the predatory mite decreased with increasing prey density. Investigations on the developmental rate and fecundity of *B. tarsi* were also initiated and will continue in 1999.

The results of laboratory investigations on the effect of temperatures (12.5° to 30°C) on the proportion of flour moths caught in pheromone traps are now being analysed. The range of male moths caught in the traps was <1-47%, highest at 20°C.

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11.4 Implementation of IPM (Integrated Pest Management) in Danish flour mills

In the past the Danish flour mills have relied on a pest control strategy, which includes fumigation with methyl bromide, typically once a year, in order to prevent problems with various insect pest species. In Denmark the use of methyl bromide was prohibited on the 1st January, 1998.

This project has dealt with the insect pest control situation in three Danish flour mills. The purpose was to increase the knowledge of technically and environmentally acceptable prevention and control methods on insect pests in flour mills, at an acceptable price.

The present investigation shows that flour mills in Denmark have replaced methyl bromide fumigation by increased efforts in sanitation. By the use of regular shutdowns in production combined with cleaning, they have been able to manage pest problems. Danish flour millers continue to gain experience as to how to operate without fumigation with methyl bromide.

The two main pest species in the mills are the Mediterranean flour moth *Ephestia kuehniella* Z. and the confused flour beetle *Tribolium confusum* Duval. Other pest species are only causing local or minor problems, although these problems are sometimes of economic importance. Progress in the millers' handling of pest problems can be achieved, and this work yields the framework for further improvement of the IPM systems, without the reliance on methyl bromide fumigations.

P. Sejerø Nielsen

11.5 Investigation on the possibilities of using the IPM concept for pest control in Scandinavian flour mills

This project has dealt with the insect pest control situation in a Danish and a Norwegian flour mill. Both mills were large, handling above 100,000 tonnes of grain per year. The situation in Denmark and Norway was compared according to climate, structure of buildings, demands on hygiene, pest control procedures, etc. The use of IPM is believed to be a way of managing pest problems in flour mills without fumigations, and this investigation evaluated the present use. It can be concluded that the production conditions, climate and pest species in Denmark and Norway are very much the same, except that Norway is still using methyl bromide. Progress in the millers' handling of pest problems can be made and this investigation yielded a number of recommendations for further improvement of the IPM systems, without the reliance on fumigation with methyl bromide. It is concluded that IPM is a possible alternative to fumigation with methyl bromide.

P. Sejerø Nielsen

11.6 Ecological constraints and spatial distribution of an introduced agricultural pest, *Prostephanus truncatus*, in natural habitats of West Africa

The larger grain borer *Prostephanus truncatus* (Bostrychidae) is a wood dwelling insect that is able to develop on other dry plant material, e.g. stored maize and cassava. It was recently introduced into Africa and has become an economically important pest in large areas. In conjunction with ongoing activities conducted by the Stored Product Pest Management Group at the International Institute of Tropical Agriculture, Cotonou, Benin, a Ph.D. study was initiated in May 1998 to study certain aspects of *P. truncatus*'s ecology in woody habitats.

Tree species from forest and savanna areas were tested for their susceptibility to *P. truncatus* under lab conditions. As yet we have been unable to culture these beetles on either wood that was dead at the time of collection or on fresh wood. Moisture content and especially collection time have been found to be important for the reproduction success. The effect of the time of collection is probably associated with biochemical