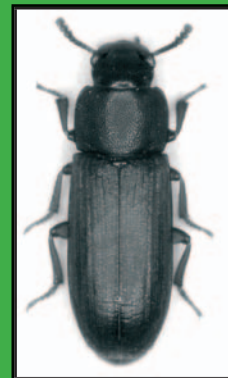




IOBC WPRS (OILB SROP) Working Group

BOOK OF ABSTRACTS

CONFERENCE OF
IOBC/WPRS WORKING GROUP
*„INTEGRATED PROTECTION
OF STORED PRODUCTS“*



EDITED BY
VÁCLAV STEJSKAL, ZUZANA KUČEROVÁ AND ZUZANA PAŽOURKOVÁ

PRAGUE
CZECH REPUBLIC
SEPTEMBER 20-23, 2005



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Conference

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IOBC WPRS (OILB SROP) WORKING GROUP

on

INTEGRATED PROTECTION OF STORED PRODUCTS

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Václav STEJSKAL, Zuzana KUČEROVÁ & Zuzana PAŽOURKOVÁ

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ORAL PRESENTATIONS



FOOD SAFETY AND ON-FARM GRAIN STORAGE

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Abstract

According to European guidelines on food safety 178/2002 and hygiene 852/2004, harvested plant products for human consumption and animal feed are considered as food. For on-farm storages, the adaptation to such regulations may be a great challenge. As found in a small non-representative survey in the German regions of Brandenburg, Sachsen-Anhalt and Mecklenburg-Vorpommern, many farms sell their grain directly after harvest. In farms storing grain, these products are often stored in multi-purpose buildings for periods of 3-9 months. These buildings are no barrier to the immigration of insects, mites and vertebrates. Grain may not be cleaned from dust, husks and other contaminants due to the lack of equipment. Cracks and crevices in walls and floors, wooden beams and high roofs with a multitude of dust collecting surfaces complicate cleaning prior to storing the new harvest. This allows many pest species to establish permanently. Grain cooling with ambient air blowers and air ducts may or may not be available.

Among the pests found in grain samples from on-farm storages were mites, dustlice, *Oryzaephilus surinamensis*, *Pyralis farinalis*, *Sitophilus granarius*, *Typhaea stercorea*, *Tenebrio molitor* and *Cryptolestes ferrugineus*. Moulded grain could be found close to walls, doors, openings, aeration ducts, in cracks or metal profiles. Poorest storage conditions were found on farms specialised on market crops other than grain and farms storing grain for feeding life-stock. It is concluded that on-farm storage may pose a risk to grain quality down the grain processing chain that it may be advisable to define and control minimum storage quality standards, and to provide a better incentive for high-quality storage. A significant improvement could be the definition of a standard of gas-tightness for European grain silo bins.

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IMPROVING THE RELIABILITY OF HEAT TREATMENTS IN FOOD INDUSTRY

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Abstract

Heat disinfestation for structural treatments are an alternative to the use of toxic fumigants such as methyl bromide and sulfur dioxide. A German flour mill was treated in August 2005 with heated air. The heated air was blown into different parts of a 10-floor-flour mill building through air hoses. The building consisted of an old flour mill built in 1989 and a new mill adjacent to it. Connected to both mills was a packaging area, with just a first floor included into the 7 m high hall where finished products such as flour, food pellets, and bran were stored.

50 samples of *Rhizopertha dominica* containing adults and all developmental stages were distributed in the building. The cages were placed into a sealed cotton bags and every second bag was supplied with a data logger recording temperature and moisture content in 15 min intervals. IR-thermographic pictures were taken during the treatment from outside and inside the building to detect areas of heat loss or cold bridges, respectively.

Not all test insects were killed in the treatment, the top floor and areas in the cellar did not reach temperatures above 50°C. An obstacle to the treatment was that the mill had not been cleaned prior to the treatment, but contained bag stacks with flour, wooden beams, piles of rags, garbage bags and a bucket with water. These materials allowed survival of *Tribolium confusum* and *Cryptolestes ferrugineus* beetles. It is concluded that it is crucial for the success to make food industry management aware of the prerequisites of a heat treatment. IR-thermography and data loggers are good tools to determine the efficacy of a treatment.

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PHEROMONES AND KAIROMONES FOR DETECTION AND CONTROL OF INDOOR PYRALID MOTHS

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Abstract

Three pyralid moths, the Mediterranean flour moth (*Ephestia kuehniella*), the almond moth (*Ephestia cautella*) and the Indian meal moth (*Plodia interpunctella*), infest food products all over the world and cause severe problems in factories, shops and households. For health and environmental reasons chemical control becomes more and more restricted. We here present some promising results offering efficient detection and control of these species based on semiochemicals. The pheromone mating disruption technique (MD) was employed in three mills, a chocolate factory, a pet shop and in a pet food warehouse during 7-21 months, including localities with infestations of all three species. Catches of monitoring traps decreased instantaneously and measured air concentrations of the main pheromone component, released from the MD-dispensers, increased immediately. Fewer moths were observed in the localities and the number of complaints from customers of mill products decreased. In the chocolate factory, it was possible to use traps baited with water to obtain an additional and independent measurement of the *E. cautella* population level. Catches in these traps showed a decrease in population density. From the MD-experiments we can conclude that this technique has a large potential for controlling all three moth species. For more efficient monitoring and evaluation of control measures, we have done a series of studies to improve pheromone traps and to make trapping of *E. kuehniella* and *P. interpunctella* females possible (*E. cautella* females are readily caught by water traps). Improved pheromone baits for *E. cautella* and *P. interpunctella* and potential female attractant blends will be presented.

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INSECT PEST MANAGEMENT IN STORED PRODUCTS USING REDUCED-RISK INSECTICIDES

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Abstract

In recent years there has been increased interest throughout most developed countries in replacing older conventional neurotoxic insecticides used in pest management programs, including those used for stored products. Registrations for older compounds are being wither withdrawn completely or altered to be applied in reduced application rates in combination with other insecticides. During the last decade in the United States, there have been several new or revised registrations for insecticides used on raw grain and in food storage facilities. Examples of these insecticides include inert dusts, insect growth regulators, bacterial pathogens, and new insecticides that affect metabolic pathways and receptors specific to insects.

Research today includes not only the identification of potential new insecticides that can be used in stored-products, but also a through examination of the factors that can affect efficacy of these new insecticides. Physical and environmental factors, differences among target insect species, insecticidal formulations and methods of application, and the economics involved in determining effective application rates are just a few examples of these factors. In addition, some of these new insecticides can be combined for increased effectiveness, and can be specifically targeted for a particular insect species.

Data from personal research studies will be used to illustrate concepts and ideas relevant to the diverse stored-product environments, from raw grain to urban storages. Topics for discussion include physical and environmental factors that affect insecticidal efficacy, methods of targeted applications, research with new insecticides, and new directions for insect pest management programs.

For curriculum vitae and contact see page 39

DIATOMACEOUS EARTH SURFACE TREATMENT FOR STORED WHEAT

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Abstract

Diatomaceous earth (DE) can be used as a surface treatment in stored wheat to control pest infestations. However, it is not known how the thickness of the DE-treated wheat layer or grain temperature impacts effectiveness. When adult *Rhyzopertha dominica* (F.), lesser grain borers, were released in experimental towers containing untreated wheat or wheat admixed with DE to a surface layer depth of 15.2, 22.9 or 30.5 cm, they were able to penetrate all DE layers and oviposit in the untreated wheat below. However, survival was significantly reduced in adults exposed to DE. Survival decreased both with increasing depth of the DE-treated wheat and with exposure interval. Temperature had no effect on adult survival, but significantly more progeny were produced at 32 than at 27°C. Progeny production was inversely correlated with the depth of the DE-treated layer. Vertical distribution patterns of parental beetles were not significantly different among treatments or exposure intervals; however more insects were found at greater depths at 32 than at 27°C.

Key words: lesser grain borer, *Rhyzopertha dominica*, diatomaceous earth, wheat, control, movementz

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THE COMPARISON OF POPULATION GROWTH OF STORED PRODUCT MITES (ACARI: ACARIDIDA) UNDER VARIOUS TEMPERATURES

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Abstract

Stored product mites are of economical and medical importance, their feeding damaged grain and their allergens are dangerous for farmers, food industry workers and also for urban population. The pest potential of stored product mites depends on their population density and their reproduction rate. Temperature is one of the most important abiotic factor influencing reproduction rate.

In this study we compare of population growth of three species (*Acarus siro*, *Tyrophagus putrescentiae*, *Aleuroglyphus ovatus*) under temperatures in range from 5 to 35°C at 85% humidity. The start population was 20 individuals and final population was recorded after 21 days or after 42 days. The experiment was terminated by extraction of mites in modified Tullgren-Berlese funnels and counting the final population density. The population growth was influenced by the temperature, the response was Logan curve with broad optima from 20 to 30°C and the curves were similar for all tested species. The population growth was minimal at temperatures under 32.5 and below 15°C. These results indicate that for multiplication of mite population in stored grain are the most critical temperatures in the range from 20 to 30°C.

This work was supported by the grant MZE - 000-2700063.

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INSECTICIDAL EFFECT OF DIATOMACEOUS EARTH APPLIED ALONE OR IN COMBINATION WITH *BEAUVERIA BASSIANA* AND BETA CYFLUTHRIN AGAINST *SITOPHILUS GRANARIUS* ON STORED WHEAT

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Abstract

The efficacy of three diatomaceous earth (DE) formulations (SilicoSec, PyriSec and Insecto) against adults of the granary weevil, *Sitophilus granarius* (L.) (Coleoptera: Curculionidae) was examined in laboratory bioassays in stored wheat. Two tests were carried out; in the first each DE was applied alone (at 500 ppm) or in combination with dry conidia of the fungus *Beauveria bassiana* (at 1000 ppm), and in the second, these DEs were applied alone (at 250 ppm) or in combination with the pyrethroid beta-cyfluthrin (at the dose rates of 0.2 and 0.8 ppm). Mortality of the exposed weevils was measured after 24 h, 48 h, 7 d and 14 d of exposure in the treated substrate. Both tests were conducted at 25°C and 70 % rh. After the termination of this interval, all adults were removed and the treated wheat was checked 45 d later for progeny production.

In the first test, mortality was significantly increased on wheat treated with the fungus +DE combination in comparison with the wheat treated with DEs or the fungus alone. In addition, progeny production was significantly increased in the case of wheat treated with *B. bassiana* alone, in comparison with the other treatments. The additive effect of DEs on the fungal efficacy was similar for all formulations examined. In the second test, the simultaneous presence of DEs with the pyrethroid significantly increased weevil mortality, but only in the lowest dose rate. Similarly, the presence of DEs significantly suppressed progeny production in comparison with wheat treated with 0.2 ppm of beta cyfluthrin, but not in the case of 0.9 ppm. Our results suggest that, under certain circumstances, the use of DE may notably increase the insecticidal effect of *B. bassiana* or beta cyfluthrin against the granary weevil in stored wheat.

For curriculum vitae and contact see page 40

INTERPRETATION OF PHEROMONE MONITORING PROGRAMS FOR STORED-PRODUCT INSECTS

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Abstract

Effective integrated pest management programs are needed for food processing and storage facilities and this requires improvements in our ability to monitor pest populations and use this information to target interventions in both time and space. The use of pheromone traps to monitor pests is increasing in the food industry, but adoption has been hampered by lack of information on how to effectively implement and interpret pheromone-monitoring programs. In this presentation, how factors such as landscape structure, and pest behavior and ecology, impact pheromone trapping and the targeting of pest management will be discussed. Critical factors include determining temporal dynamics of pest populations, spatial distribution of subpopulations in the landscape, and pest movement patterns. How these factors can be assessed in the field will be discussed and their impact illustrated using data collected in and around food processing facilities.

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INSECTS POPULATION DYNAMIC IN A FEED FACILITY FOR HORSES IN PORTUGAL

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Abstract

Trials were carried out in a feed facility for food horses from 7 January 2004 to 20 January 2005 in order to identify the insect species and to study pest populations. Several type of traps unbaited and baited with pheromones and food lures were used: Dome traps for crawling insects, Thinline, funnel and Lasio traps for flying insects and probe traps for insects developing within the stored products. From surveys, 47 insect species were identified, some of them were caught all over the year others were seasonal.

Considering that the products after the micronizer were free of insects, probes were used for sampling horse-bean stored in bulk, after cross the micronizer, and black oat, which is not processed and stored in big bags.

The results demonstrated that the feed facility presented important infestations of several insect species. High populations of *Ephestia* spp. were presented all over the year and it seemed the major risk should be their development within the machinery than attacking the stored products. Although the micronizer can provide a product free of insects, the horse-bean stored in bulk after a while presented populations of several stored insect species. The most important insect pests caught in the stored products were *Oryzaephilus surinamensis* and *Sitophilus zeamais*. Also eight species of parasitoids were identified and the existence of these natural enemies may encourage the development of a biological control program.

Key words: stored product, feed facility, sampling, pests, beneficials

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IMPLICATIONS FOR INTEGRATED STORAGE STRATEGIES OF FOOD CONTAMINANTS LEGISLATION

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Abstract

Contaminants of grain in storage have been the subject of recent EU legislation and others are likely to come under scrutiny. Pesticide residues and mycotoxins are examples of the former and insects and mites are examples of the latter. Maximum residue levels may limit the efficacy of some pesticides and determine the mode of application. For instance, top-dressing may be questionable, which puts greater reliance on physical control. Regulatory levels for mycotoxins in food have focused attention on ochratoxin A as the most important quality determinant for safe storage times for damp grain. This determines how long it may be held in harvest backlogs before it is passed through a hot-air dryer or before a drying front is completed using an ambient air drying system. A UK project seeks to integrate an EU-funded model of OTA production with an established British drying model. This will determine under which conditions the new quality criteria can be observed using current design parameters and how these may be improved. EU regulations for food hygiene require that farmers adopt procedures to minimise risk of biological, chemical and physical contamination. Feed businesses must comply with specific microbiological criteria and adopt procedures to meet specific targets including a permanent written procedure based on HACCP procedures. This could be applied through national guides to good practice, such as HGCA's „Grain storage guide“. However determination of contaminants depends on accurate sampling and knowledge of distribution of the contaminants in bulks, that requires further research.

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THE IMPORTANCE OF FOOD SUPPLEMENTS ON PARASITOIDS OF STORED PRODUCTS PESTS: THE CASE OF *VENTURIA CANESCENS* (HYMENOPTERA: ICHNEUMONIDAE)

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Abstract

Laboratory studies were conducted on the effect of honey-feeding on progeny production and longevity of adults of *Venturia canescens* Gravenhorst (Hymenoptera: Ichneumonidae) parasitizing larvae of the Mediterranean Flour Moth *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae). Experimental adults lived under various temperature regimes (15, 20, 25, 30°C) with access to hosts (full-grown larvae). Provision of adult parasitoids with honey resulted in a significant increase in production of total offspring at 15°C (75.8%), 20°C (352.9%), 25°C (258.8%) and 30°C (112.3%). Highest mean fertility of honey-fed wasps was recorded at 20°C followed, in decreasing order, by 25, 30 and 15°C. Honey-fed adults lived significantly longer than their starved counterparts at all experimental conditions. Food supply resulted in almost three times increase of longevity at all temperatures. The experimental findings are analyzed with the objective of improving the effectiveness of *V. canescens* as a biological control agent of stored product pests.

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FIRST EVALUATION OF THE EFFICIENCY OF A PHEROMONE TRAP A MONITORING TOOL

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Abstract

The foundation of a successful integrated pest management (IPM) program is an effective monitoring system that supplies accurate information on the size and changes in pest populations over time. For many important stored-product insects, pheromones have been isolated and traps are now commercially available. However, many questions remain about the use of these traps as a monitoring tool, from the very practical issues such as how many traps are needed and which types work best, to the fundamental issues concerning the relationship between pheromone trap captures and actual pest population density, distribution, and level of product infestation.

In this communication we present for the first time preliminary data evaluation of pheromone trap efficiency under controlled laboratory settings. In order to achieve controlled conditions a 170 x 65 x 45 cm olfactometer was designed and built with a vent producing a 0.1-0.3 m/second wind velocity. The traps were attached to the wall below the vent.

Two insect species were tested: the cigarette beetle (*Lasioderma serricorne* F.) and the tropical warehouse moth (*Cadra (Ephestia) cautella* (Walker)) using three commercial pheromone traps. For the moth we used „Gachon“ from „Fuji“ and „Biostop“ traps and for the cigarette beetle we used „New Serrico“ from „Fuji“ traps. The preliminary results indicate that the capturing efficiency of the traps in a mixed population of 100 females and male tropical warehouse moths after 24 h averaged about 10% and after 72 h it increased to 30%. In all tests, male and also females were captured in a ratio of 2:1 up to 5:1 males to females. For the cigarette beetle the capturing efficiency was about 25% on average after 72 h. Different levels of capturing efficiency were obtained when the position of the cigarette beetle traps was changed. The capturing efficiency increased to about 40% when the traps were located on the floor 30 cm from the vent wall and decreased to about 10% when the traps were hanging in the air 30 cm from vent.

These preliminary results indicate that additional studies are needed to evaluate the efficiency of available commercially traps in order to use them effectively as a monitoring tool for the reliable indication of size and changes of a pest population over time.

Key words: monitoring, pheromone trap, IPM, storage pest, *Ephestia cautella*, *Lasioderma serricorne*

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EUROPEAN NETWORK ON BIOLOGICAL CONTROL OF PESTS IN STORED PRODUCTS - COST ACTION 842, WG 4

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Abstract

In June 2005 the final meeting of the European COST Action 842 was held. COST (an intergovernmental framework for European CO-operation in the field of Scientific and Technical research) has made it possible for a group of researchers to meet on a regular basis during the 5½ years this action has been running.

COST 842 had the title „Biological control of pest insects and mites with special referenceto Entomophthorales” and was originally derived from two applications, one on the subject mentioned in the title, and one on biocontrol of storage pests, initiated by Eva Zdarkova, CZ.

This last subject was covered by Working Group 4 „Biological control of arthropod pests in stored products”. WG 4 had 6 meetings during its lifetime, most of the meetings with 20-25 delegates. Each of the meetings focused on a specific sector in the chain of storage from grain store and through processing. The possibilities of developing biological control against the main pests in each sector were discussed and evaluated. Other aspects were discussed, e.g. legal aspects related to application of biocontrol in food stores and registration of biocontrol agents. A final resolution was prepared that specifies WG 4’s opinion of research priorities in this field. It will be distributed to policy makers and the research community.

Proceedings from each of the meetings are available. These proceedings contain valuable reviews of biocontrol against pests in e.g. grain stores, of dried fruit, spices, and in food processing facilities. A website is being planned to facilitate access to this information. Because of continued interest in this field a new COST action is being prepared.

For curriculum vitae and contact see page 48

CONTROL OF *SITOPHILUS GRANARIUS* IN GRAIN USING A COMBINATION OF PARASITOIDS AND ENTOMOPATHOGENIC FUNGI - PRELIMINARY RESULTS -

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Abstract

Several studies have investigated the potential of larval parasitoids for control of *Sitophilus granarius* (Coleoptera: Cucurli-
onidae) in stored grain. However, as the longevity of the adult weevils, and thus the oviposition period, is very long, efficient
control of *S. granarius* necessitates a strategy that will target both the adult weevils and the larvae. The presentation will report
on preliminary results of a „semi-field” study involving a combination of larval parasitoids and entomopathogenic fungi against
S. granarius.

A wide range of isolates of entomopathogenic fungi have been screened for their impact on *S. granarius* imagines. An isolate
of *Beauveria bassiana* has been selected for further studies. Two species of larval parasitoids have been included in the study:
Lariophagus distinguendus and *Anisopteromalus calandrae* (both Hymenoptera: Pteromalidae). A trial has been set up to simu-
late an infestation in a grain store using plastic containers each containing 9 kg of wheat infested with *S. granarius*. The trial
involves the following: **i)** addition of *L. distinguendus*, **ii)** addition of *A. calandrae*, **iii)** addition of *B. bassiana*, and different
combinations of the natural enemies. The trial will run for a total of 24 weeks.

Preliminary results of the first sampling sessions will be presented.

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EFFECT OF SOFT-ELECTRON AND GAMMA IRRADIATION ON DNA DAMAGE IN PHOSPHINE RESISTANT AND SUSCEPTIBLE STRAINS OF LESSER GRAIN BORER *RHYZOPERTHA DOMINICA* (F.) ASSESSED USING COMET ASSAY

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Abstract

The soft-electron beam and gamma radiation sensitivity in phosphine resistant (PHR) and susceptible (PHS) strains of adults *Rhyzopertha dominica* (F.) was studied, with particular reference to DNA damage assessed using single cell electrophoresis (comet assay). Analysis of DNA damage, following 40 & 160 Gy gamma radiation, was carried out using cells obtained from PHR and PHS strains. Gamma irradiated adults of both strains showed typical DNA fragmentation, compared to cells from non-irradiated ones which showed more intact DNA. Investigations using the comet assay showed that tail length, moment, olive tail moment, % tail DNA and % DNA damage were all greater in PHS strain compared to either PHR strain or control insects. Results also showed that the extent of DNA damage caused remained at a constant level for up to 24 h after irradiation.

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ESTIMATION OF RESIDUES OF ATRAZINE AND ISOPROTURON ON WHEAT GRAINS STORED IN THE STORAGES OF FAISALABAD DISTRICT, PAKISTAN

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Abstract

The study was conducted for the estimation of residues of atrazine and isoproturon herbicides in stored wheat grains. Samples were collected from different godowns located in Faisalabad district in the month of June 2004. Wheat grains were exhaustively extracted with ethyl acetate, cleaned up with Gel Permeation Chromatography (GPC) and extract was separated with High Performance Thin Layer Chromatography (TLC). On the basis of extent of inhibition of the Hill reaction, herbicide residues in wheat samples were calculated to range from 0 to 0.028 µg/kg for atrazine and 0 to 0.024 µg/kg for isoproturon. Thus, the values were below the maximum residue limit (MRL) of 100 µg/kg for atrazine and 2200 µg/kg for isoproturon. This study showed that the residues of both these herbicides were negligible in stored wheat, and as such the wheat was fit for human consumption.

Key words: Residues, atrazine, isoproturon, wheat grains, Pakistan

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THERMAL CONSTANTS FOR INSECTS DEVELOPMENT

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Abstract

The lecture concerns recent developments in the theory of thermal time and predicting insect development: (i) rate isomorphy and (ii) interspecific variation in thermal constants. The problems are discussed with particular respect to their practical importance. Supported by grant no. QC 50081 of the National Agency for Agricultural Research.

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THE COMPARISON OF ALLERGEN CLASSES IN STORED-PRODUCT AND HOUSE-DUST MITES (ACARI: ACARIDIDA)

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Abstract

Nowadays, 467 Ig-E binding components have been investigated (www.allergen.org) from all groups of allergen producing organisms. The allergens derived from the arthropods cover about 25% of these compounds. Among arthropods, mites are the serious producers of allergens covering about 9% of total allergens. Up to the present time, 19 classes of allergens and 42 IgE binding compounds have been described in house dust (*Dermatophagoides pteronyssinus*, *D. farinae*, *D. microceras*, *Euroglyphus maynei* and *Blomia tropicalis*) and stored product mites (*Glycyphagus domesticus*, *Acarus siro*, *Lepidoglyphus destructor* and *Tyrophagus putrescentiae*). The dual functionality of allergenic proteases increasing their importance has been discovered recently. Except passive allergen reaction, the cysteine (Der p 1, Blo t 1, Der f 1) and serine (Blo t 3, Der p 3, Der f 3, Blo t 6, Der p 6) proteases are able to provoke allergic reaction due to their enzymatic activity. These enzymes participate in mite digestion of both groups stored product and house dust mites and are immobilized in faeces in a high amount. In the faeces, proteases are still active and stable, because their decomposition rate is very low during time in the house conditions. The spectrum of mites occurring in stored products is substantially wider. Apart from the named species, the protein fractions of many other species are known to bind IgE of sensitive patients. Although biochemical characterization of their allergens is lacking, the unique IgE epitopes for their allergens probably exist.

This work was supported by grants MZE-000-2700603 and COST 1P04OC853.003.

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EFFECTIVENESS OF OZONE GASEOUS ALONE AND IN COMBINATION WITH LOW PRESSURE OR CARBON DIOXIDE AGAINST *EPHESTIA KUHNIELLA* (ZELL.) (LEPIDOPTERA: PYRILIDAE)

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Abstract

Toxicity of initial concentration of 1000 ppm ozone gaseous either alone or combined with a low pressure of 100 mm Hg and 92% CO₂ against all life stages of *Ephestia kuhniella* (Zell.) at short exposure time (2 hours) was studied. Results indicated that a remarkable difference in corrected mortalities of the treatments for each life stage. For the larvae, adults and pupae, treatments of ozone alone and all in combination with vacuum and CO₂ resulted in complete mortalities except ozone treatment in combination with CO₂ for the pupae by the mortalities ranging from 79.3 to 91.4%. However, although ozone alone had a higher mortality on the eggs by 85.1% than all other treatments any of the treatments did not give complete mortality. Clearly it indicated that the adults and larvae were the most easily killed, followed by the pupae and finally the eggs, which were the most tolerant to ozone treatments. There were very limited mortalities of all stages except the adults (21.9% to 100%), when exposed to either 100 mm Hg or 92% CO₂ for 1, 2 and 4 hours. Ozone alone was found to be effective against all the life stages of the common stored-product insect, *E. kuhniella*, at high initial concentration (1000 ppm) and short exposure time (2 hours). However, the use of a low pressure of 100 mm Hg, or 92% CO₂ did not a synergistic effect on this species as evidenced by no significant decrements in mortalities for all life stages. These results indicate that ozone alone is sufficient to have potential alternative to methyl bromide fumigation for rapid disinfestation of commodities.

Key words: Ozone, fumigation, quarantine, toxicity, carbon dioxide, vacuum, *Ephestia kuhniella*

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OVICIDAL ACTIVITY OF VARIOUS ESSENTIAL OILS AGAINST CONFUSED FLOUR BEETLE, *TRIBOLIUM CONFUSUM* JACQUELIN DUVAL, (COLEOPTERA: TENEBRIONIDAE)

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Abstract

In this study, the ovicidal activity of vapour of various essential oils from laurel (*Laurus nobilis*), fennel (*Foeniculum vulgare*), oregano (*Origanum dubium*), onion (*Allium sepa*), yarrow (*Achillea millefolium*), peppermint (*Mentha piperita*), juniper berry (*Abies balsamea*), eucalyptus (*Eucalyptus globulus*), fir needle (*Juniperus communis*), garlic (*Allium sativum*), nutmeg (*Myristica fragrans*), citronella (*Cymbopogon winterianus*), pine (*Pinus sylvestris*), anise (*Pimpinella anisom*), rosemary (*Rosmarinus officinalis*), turmeric (*Curcuma longa*) were evaluated against the eggs of confused flour beetle (*Tribolium confusum*). A dose of 100 µl/liter air of all essential oils was exposed to the eggs of *T. confusum* for exposure periods of 24, 48 and 72 hours. Vapours of laurel, yarrow, peppermint, juniper berry, eucalyptus, fir needle, nutmeg, citronella, pine, rosemary and tumeric essential oils were found to have a low ovicidal toxicity to the eggs of *T. confusum* at all exposure times by >20% of corrected mortality. Whereas, garlic, onion, fennel, anise and oregano essential oils indicated a strong ovicidal activity by varying from 42.2% to 100 at 24 hours exposure time. Probit analysis data on the eggs of *T. confusum* resulted in LT₉₀ values of 1.1, 13.82, 22.1, 22.4, and 51.1 hours at a dose of 100 µl/liter air for garlic, oregano, onion, anise, and fennel respectively. On the basis of LT₉₀ values, toxicity of vapours of essential oils to the eggs of *T. confusum* in descending order was: garlic < oregano < onion < anise < fennel. Based on the Ct products (mg h/liter), garlic essential oil (110 mg h/litre) was more toxic to the eggs of *T. confusum* than the most commonly used commercial fumigant, methyl bromide.

Key words: Essential oils, ovicidal activity, egg, fumigant toxicity, *Tribolium confusum*, bio-fumigant

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AMYLASE INHIBITOR IS WITHOUT ANY ADVERSE EFFECT ON PARASITOID *VENTURIA CANESCENS*

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Abstract

The amylase inhibitors (AI) are suitable candidates for transgenic plants to increase their resistance to insect pests. Detail study of suppressive effects of AI on target and non-target insects is necessary before their incorporation into GMO plants. Therefore we tested the effect of selected AI inhibitor (acarbose) on pest flour moth (*Ephestia kuehniella*) and its parasitoid wasp (*Venturia canescens*) in laboratory experiments. Various concentrations of AI were incorporated into diet for larvae of *E. kuehniella* and their mortality was observed to find sublethal doses of AI. The larvae influenced by sublethal concentrations of AI (0.001 and 0.0001%) were parasitized by the wasp. The morphological parameters of the wasps treated by AI and control were compared. The AI in the range from 0.1 to 0.01% caused 100 % mortality of *Ephestia kuehniella* larvae, the concentration AI 0.001% suppressed larval weight increase and prolonged developmental period. We did not observe any suppressive effect of AI on *Venturia canescens*; but we found differences in morphological parameters between wasps treated on (i) control larvae and on larvae fed on 0.001 % AI and (ii) 0.0001% AI. Measured parameters of the wasp influenced by AI 0.0001% were in most cases significantly higher (i.e. weight, hind tibia length and wing size). These results demonstrate the possibility of the combination of biocontrol and AI that would provide higher pest control efficiency than these methods used individually.

This work was supported by the grants GACR 522/04/1286, COST-1P04OC842.20 and MZE-000-2700063.

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DETECTION OF *TYROPHAGUS PUTRESCENTIAE* BY IMMUNOCHEMICAL METHODS – PRELIMINARY RESULTS

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Abstract

Tyrophagus putrescentiae is a widely distributed species inhabiting agriculture soil, nests of birds and rodents, stored food and house dust. This species is of medical importance. The recent detection techniques of this species are based on classical methods such as extraction of Tullgren-Berlese funnels mainly, but there is an acute need for rapid detection techniques. Therefore we developed polyclonal antibodies (Pabs) for the detection of *T. putrescentiae*. Two Pabs (anti-Tyr-putK60 and anti-Tyr-putK61) were prepared against an antigen in the form of protein fraction from whole body homogenates of the mite. Specificity and sensitivity of the purified Pabs were evaluated by PTA-ELISA in a range of working concentration of Pabs 0.01 to 1 µg/ml. Both Pabs have identical detection limit 50 ng of antigen proteins/ml (approx. 3 individuals) in working concentration 1 µg of IgG/ml. The Pabs showed strong cross-reactivities to mites of Acaridae, Carpoglyphidae and Glyciphagidae family. No cross-reaction was found out for family Pyroglyphidae, stored product insects, micro-fungi, the rearing diet of mites (yeast and wheat diet) and extracts from wheat kernels. The obtained antibodies enabled to detect (i) the mites; (ii) their faeces and (iii) mite remnants in the gut of their predators. The potential of the obtained antibodies for rapid detection in the environment will be discussed.

This work was supported by the grant of Czech Ministry of Agriculture - No. 1B 53040.

For curriculum vitae and contact see pages 52 and 54

CHARACTERIZATION OF POLYCLONAL ANTIBODIES FOR DETECTION OF RED FLOUR BEETLE *TRIBOLIUM CASTANEUM*

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Abstract

The red flour beetle, *Tribolium castaneum* (Coleoptera: Tenebrionidae) is an important pest of stored grain that has had a long association with human stored food. This species is known as an allergen producer and in addition it produces chinol substances with carcinogenic potential. Therefore there is an urgent need to improve the detection and monitoring of this species. Immunochemical techniques based on polyclonal antibodies (Pabs) seem to be perspective for the detection of stored product pests.

We prepared polyclonal antibodies (Pabs) anti-*TriCasK51* and anti-*TriCasK52* against an antigen in the form of protein fraction of whole body homogenates of *Tribolium castaneum* larvae. Specificity and sensitivity of the purified Pabs were evaluated by PTA-ELISA in the range of working concentration of Pabs from 0.1 to 1 µg of IgG/ml. Both Pabs had similar detection limit - 50 ng of antigen proteins/ml at working concentration of 1 µg of IgG /ml. The Pabs showed no cross reactivities to stored product mites, moths, micro-fungi, and extracts from wheat kernels. Cross reactivity to other *Tribolium* species (*T. destructor*, *T. confusum*) was significant.

The obtained antibodies enable to detect adults, larvae and eggs as well as the faeces with different sensitivity. The potential of the obtained antibodies for rapid detection in the environment is discussed.

This work was supported by the grant of the Czech Ministry of Agriculture - NAZV No. QF4071.

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AGE SPECIFIC FECUNDITY AND SURVIVORSHIP OF *CEPHALONOMIA TARSALIS* IN DIFFERENT TEMPERATURES

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Abstract

The saw-toothed grain beetle, *Oryzaephilus surinamensis* (Linnaeus) (Coleoptera: Silvanidae), is a cosmopolitan stored-product secondary pest whose adults and larvae cause damage. This pest is considered as a key pest of stored and processed grain in Czech Republic. Fumigants and contact biocides are recommended and broadly used in control programs of this pest. Nevertheless because of a ban of methylbromid, resistance, toxicity and residues of biocides, there is a run for alternative control means. One of possible alternatives is use of natural enemies. *Cephalonomia tarsalis* (Ashmead) (Hymenoptera: Bethyridae) is both a predator and an ectoparasitoid of larvae and pupae of sawtoothed grain beetle, *Oryzaephilus surinamensis* (L.) (Coleoptera: Silvanidae). This parasitoid is studied in our laboratory with an aim to assess its suitability for biological control program. Age specific fecundity of mated females of *Cephalonomia tarsalis* and survivorship of both males and mated females of *Cephalonomia tarsalis* was studied at different constant temperatures of 18°C, 21°C, 24°C, 27°C, 30°C, 33°C and 36°C in temperature controlled chambers. Newly emerged males and females of *Cephalonomia tarsalis* were placed in a plastic jar containing 10 g of wheat and provided by 10 fourth-instar *O. surinamensis*. The preoviposition period, number of laid eggs, number of paralyzed and parasitized hosts and survivorship of males and females of *C. tarsalis* was recorded daily. Hosts were renewed (replacement of parasitized hosts) daily until the female died. It was found that adult longevity was temperature and sex dependent. Adults lived longer in lower temperature and females lived longer than males. Detailed results will be presented.

This work was supported by grant GACR No. 522/04/P169.

For curriculum vitae and contact see page 55

USE OF BIOGENERATED ATMOSPHERES OF STORED COMMODITIES FOR QUALITY PRESERVATION AND INSECT CONTROL, WITH PARTICULAR REFERENCE TO COCOA BEANS

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Abstract

Biogenerated atmospheres can be achieved in hermetically sealed storage systems that are based on the generation of oxygen-depleted and carbon dioxide-enriched interstitial atmosphere as a result of the respiration of the living organisms. Intermediate moisture contents (at equilibrium air relative humidities (ERH) of 65 to 75%) of stored commodities are inevitable in tropical climates due to the difficulties in achieving safe moisture content (ERH <60%) for long-term storage. Stored commodities with intermediate moisture contents generate modified atmospheres due to the respiration of the microflora and the commodity.

We present for the first time, preliminary data for insect control as a methyl bromide alternative, and for quality preservation of stored cocoa beans utilizing a novel approach of biogenerated modified atmospheres. Unfermented cocoa beans from Makassar, Sulawesi, Indonesia, were used for determining their respiration rate under laboratory conditions. Initial insect populations found in these cocoa beans samples were *Carpophilus* spp., *Ahasverus advena*, *Cryptolestes* spp., and Psocids. Respiration of cocoa beans at ERH of 59, 68, and 73% was determined at 26°C in jars of 1 L capacity containing 500 g commodity. The respiration of the cocoa beans depleted the oxygen concentration to <1% and increased the carbon dioxide concentration to 23% within six days, at ERH of 73%. To obtain similar oxygen depletion for cocoa beans with 68% ERH, under the same conditions, exposure of 23 days was required. The lowest oxygen concentration observed for cocoa with 59% ERH after 23 days, was only 10.8%.

Under field conditions carried out in a cocoa bean storage facility in Makassar, Indonesia, a hermetically sealed flexible structure containing 6.7 tonnes of cocoa beans at 7.7% moisture content (72.2% ERH) was monitored for oxygen concentration and quality parameters of the beans. Initial tests showed a decrease in oxygen concentration to 0.3% after five days. These results indicate the possibility of utilizing biogenerated atmospheres in integrated pest management (IPM) for the quality preservation (by preventing development of FFA, molds, and mycotoxins), and insect control of cocoa pests.

Key words: cocoa beans, respiration rate, modified atmospheres, methyl bromide alternatives, IPM, storage pest control

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EFFICACY OF *PLECTRANTHUS GLANDULOSUS* AND *STEGANOETAENIA ARALIACEA* LEAF POWDERS FROM CAMEROON AS POST-HARVEST GRAIN PROTECTANTS AGAINST *SITOPHILUS ZEAMAI* MOTSCHULSKY (COLEOPTERA: CURCULIONIDAE)

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Abstract

Powdered leaves from *Plectranthus glandulosus* and *Steganotaenia araliacea*, collected in the Adamawa province of Cameroon, were tested under laboratory conditions for their ability to protect stored maize from attack by *Sitophilus zeamais* Motschulsky. Maize grains were admixed with the powders at four rates (0.5, 1, 2 and 4% (wt/wt) for the assessment of mortality over a 32-day period, as well as for F₁ progeny production, population increase and damage evaluation. Repellency bioassay involved the food preference test at dosages of 0.01, 0.05, 0.1 and 0.5% (wt/wt), for 24-h interval. Weevil mortality increased over time for the two plant powders at all concentration levels. A maximum 100% mortality was recorded only for *P. glandulosus* at concentrations of 4 and 2% at 16 and 32 day post exposure, respectively. 16-day LC₅₀s were 0.86% for *P. glandulosus* and 1.72% for *S. araliacea* and their LT₅₀ values were 12.3 and 19.5 days, respectively at the concentration level of 1%. The two powders considerably reduced F₁ progeny production, population increase and grain damage, with complete protection of the grains provided by *P. glandulosus* at concentrations of 1% or higher. Overall, *P. glandulosus* was slightly repellent while *S. araliacea* showed no repellent effect towards the weevil. These results suggest that powdered leaves of *P. glandulosus* and *S. araliacea* may be of great value in grain storage against insect pests, especially in subsistence agriculture where the plants are locally available to farmers with little resources to meet the high cost of pesticides.

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MATING DISRUPTION OF STORED PRODUCT MOTHS: TOWARD COMMERCIAL DEVELOPMENT

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Abstract

Mating disruption (MD) of the Indianmeal moth was suggested and proven on a small scale in the laboratory more than 30 years ago, but no commercial scale treatments have been demonstrated. We studied mating disruption of *Plodia interpunctella* in a controlled field situation in which ZETA was loaded into high release-rate bags that were distributed throughout the test site to disrupt male orientation and mating. A „switching” experiment was done using two similar chicken houses in which adult moths were released weekly and monitored by trapping with virgin females. Reproduction was monitored with oviposition dishes. MD was implemented in one house while the other remained as an untreated check during the 4-week treatment period. Male responses to females and reproduction were significantly suppressed by MD. Mean male trap catch during MD was 1.6 (\pm 7.2 SE) vs. 44.6 (\pm 5.3 SE) in non MD checks. The mean larval count in oviposition dishes during the four week period before the MD was 181.8 (\pm 26.3 SE), whereas the mean larval count during MD was 82.5 (\pm 35.4 SE). Subsequent experiments to test efficacy in commercial food facilities were conducted in warehouses located around the U.S. Each location had pairs of non-mating disruption (control) and mating disruption (treatment) buildings. Infestations of almond moth, *Cadra cautella*, and Mediterranean flour moth, *Ephesia kuehniella*, were also studied. Most treated locations displayed significant decreases in moth activity after on set of MD, while untreated buildings showed typical seasonal increases. Migration of moths into treatment facilities from other areas may account for lower treatment effects. Testing continues on deployment density of MD lures while commercial partners pursue government registration.

BIOLOGY OF *HABROBRACON HEBETOR* AND *TRICHOGRAMMA EVANESCENS* - A DIGITAL VIDEO FILM -

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Abstract

The behaviour of two parasitoids which are commercially released in Europe to control stored-product moths is shown, namely the larval parasitoid *Habrobracon hebetor* (Say) (Hymenoptera: Braconidae) and the egg parasitoid *Trichogramma evanescens* Westwood (Hymenoptera: Trichogrammatidae).

The larvae of all stored-product moths of economic importance in the subfamily Phycitinae are suitable hosts for *H. hebetor*. *H. hebetor* is a gregarious ectoparasitoid. In this film, the interaction with the Mediterranean flour moth *Ephesia kuehniella* Zeller is shown. Details of mating and parasitism are illustrated, including host examination, paralyzation, oviposition and host feeding.

Parasitoids of the genus *Trichogramma* are parasitising the eggs of numerous species of Lepidoptera, including stored-product moths. Within the egg of *E. kuehniella* usually only one individual of *T. evanescens* develops. Host examination, oviposition and host feeding of *T. evanescens* is shown.

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EVALUATION AND CHARACTERIZATION OF DAMAGE PRODUCED BY INSECT PESTS IN PACKING FILMS

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Abstract

Packaging of food products has an important role as a barrier for insect pest and plastics films are among the most effective materials. In this work, the penetration ability to different plastic films of *Rhyzopertha dominica*, *Sitophilus oryzae*, *Oryzaephilus surinamensis* and *Lasioderma serricornis* was assessed. The plastic films studied were Polypropylene, Polyethylene, and Polyester, and a multilayer film (paper, Polyethylene, aluminium and Polyethylene). Damages observed in each material were evaluated under binocular. All four species were able to penetrate the films tested. *Rhyzopertha dominica* was the species with the highest penetration ability in polyethylene films, but no significant differences were observed among species for the other type of films studied. Considering film thickness for Polypropylene and Polyethylene, penetration by *R. dominica* decreased as thickness increase in Polyethylene, but not in the Polypropylene films studied. In the multilayer film, *R. dominica* showed a similar penetration ability independently on the film side exposed to the insect, since the aluminium foil was the layer acting as a barrier to avoid the penetration of this species.

Key words: insect pests, food packaging, penetration, damage

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INSECT FRAGMENTS IN FLOUR: RELATIONSHIP TO LESSER GRAIN BORER (COLEOPTERA: BOSTRICHIDAE) INFESTATION LEVEL IN WHEAT AND RAPID DETECTION USING NEAR-INFRARED SPECTROSCOPY

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Abstract

The grain milling industry routinely checks wheat flour for insect fragments to determine whether the number found is below the U.S. Food and Drug Administration (FDA) defect action level of 75 fragments/50 g flour. However, the standard chemical extraction method used to detect insect fragments in flour is costly and time-consuming; thus, a rapid detection method is desirable. In addition, little is known about differences in the number of fragments produced from different stages of different insect species. In this study, we determined that wheat infested with a single pre-emergent adult lesser grain borer, *Rhyzopertha dominica* (F.), contributed 28 times and 10 times as many fragments as wheat infested with a single larva or pupa, respectively. Using regression models that we developed from these data, we predicted that 1-kg samples of wheat with more than 20 kernels infested with pre-emergent adult borers would be above the FDA defect action level for insect fragments. Similarly, it would take an infestation level of 300-500 kernels (in a 1-kg sample) containing larvae or pupae to exceed the defect action level. We also determined the accuracy and sensitivity of near-infrared spectroscopy (NIRS) for detecting insect fragments in flour using three different NIR-spectrometers. The number of insect fragments predicted by NIRS was correlated with the actual number of fragments in test samples. NIRS was less precise than the standard flotation method, but it has the advantages that it is rapid, non-destructive, does not require extensive sample preparation, and can be automated for a more sophisticated sampling protocol for flour.

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CONTRIBUTION OF SPATIAL ANALYSIS FOR PRECISION IPM OF BEETLE PESTS IN A SEMOLINA-MILL

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Abstract

By utilizing of food-bait traps, we evaluated the presence and the spatio-temporal distribution of insect-pests in an industrial semolina-mill, with particular attention to the adults of rust-red flour beetle *Tribolium castaneum* (Herbst), confused flour beetle *Tribolium confusum* J. du Val., and hairy fungus beetle *Typhaea stercorea* (L.).

The observations were conducted between the second half of May 2003 and the first half of April 2004, in Apulia Region, Southern Italy. The semolina-mill was a large building of 18,000 m³ with seven floors, processing 500 tons of hard wheat *Triticum durum* Desf. per day.

During the experiment, from 85 to 66 food-bait traps were placed in the mill to monitor insect populations. A total of 1474 insect specimens were found in the traps, belonging to 14 taxa, mainly Coleoptera. Most abundant species was *T. confusum* (with 1019 adults trapped), followed by *T. stercorea* (with 167 adults trapped) and *T. castaneum* (with 125 adults trapped).

The confused flour beetle was collected on all the sampling dates, with two main peaks in the second half of June-beginning of July and in the first half of August. The presence of the rust-red flour beetle had a main peak in June. The hairy fungus beetle was most abundant from the second half of May to the beginning of July and in the first half of September.

After the annual fumigation of the mill, carried out in the second half of August utilizing methyl bromide, only a small number of captures of the two *Tribolium* species occurred till the end of the sampling period; in contrast *T. stercorea* remained to colonize the mill till the end of November.

The contour maps drawn to represent the spatial distribution of *T. confusum* before the fumigation treatment showed that the highest abundance foci of adult population were confined to the corners of the milling area and in the base of the adjacent walls of every floor, where a big amount of dust and debris usually accumulate. Almost the same distribution was found for *T. castaneum*, but this species was observed only in the upper floors of the mill, especially in the VI floor. Adults of *T. stercorea* were confined in the I and the II floors, the main moisture areas of the mill contaminated with mould.

The indications obtained by spatial analysis and representation of spatio-temporal distribution were used in optimizing pest management procedures (precision IPM) after the fumigation, based essentially on the improvement of good sanitation practices. Furthermore, the initial monitoring plan was adapted, decreasing the number of food-traps (from 85 to 66 traps) and optimizing the trap positions in the structure.

With these measures, insect pests presence was maintained to a lower level during the following months, compared to the previous years.

Key words: Spatial analysis, precision IPM, beetle pests, semolina-mill

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KERNEL-KERNEL COMMUNICATIONS AND BEHAVIOUR OF *SITOPHILUS ZEAMAI* MOTSCHULSKY

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Abstract

Laboratory kernel-kernel interaction experiments were carried out in order to assess the influence of mechanically damaged, insect damaged, and intact maize kernels on the behaviour of adults of the maize weevil, *Sitophilus zeamais* Motschulsky.

Three series of experiments (with olfactometer assays in arena) were conducted, all at 27±1°C with 70% relative humidity (r.h.). In the first, three traps (three-choice tests) were placed in arenas, containing kernels mechanically damaged, insects damaged, and intact, respectively.

In this experiment, the kernels were conditioned in a plastic box with two caps: one containing 2 gr of a certain “kernel status” (mechanically damaged, insect damaged, or intact kernels), and the other cap with 2 gr of whole kernels. Five duration of conditioning was assessed: 0, 1, 2, 7 and 14 days.

In the second experiment, two trap-devices were placed in the arenas, containing each of the aforementioned whole kernels conditioned in all possible combinations. The conditioning duration tested in this case was 1 and 7 days.

In the third test, two choice tests were placed in the arenas, containing fresh or stored whole kernels conditioned, or mechanically damaged, or insect damaged kernels in pairs. Conditioned tests were carried out as above in boxes with plastic capsules containing 2 gr of fresh maize (~ 8 months after harvest) or 2 gr of stored maize (~ 20 months after harvest).

According to our results adults of *S. zeamais* are strongly attracted by the insect damaged kernels or by the conditioned kernels damaged by insect, in comparison with the other two-conditioned kernel categories considered. In addition, the conditioned kernels mechanically damaged are more or less attractive than the conditioned intact kernels. About the possible indirect defence adopted by conditioned whole kernels, there is not clear evidence for this mechanism, but whole kernels conditioned by allelochemicals coming from mechanically damaged kernels revealed less attractiveness if compared to the conditioned insects damaged kernels or to the conditioned intact kernels.

Key words: Kernel-kernel interactions, *Sitophilus zeamais*, behavioural responses, Stored maize

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THE USE OF CONTROLLED ATMOSPHERES FOR STORED PRODUCT PEST CONTROL

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Abstract

Insects and other pests in commodities need to be controlled to meet customer requirements. Methyl bromide and Phosphine fumigants that have been widely used in the past as disinfestation agents have well-documented environmental and other problems. These problems have been overcome in the Netherlands through the commercialisation of controlled atmospheres, heat, and heated controlled atmospheres. These treatments that can be accommodated within the logistical requirements of many import products are safe, affordable, effective, residue-free, and environmentally-friendly alternatives to MB. Developed in the Netherlands, these treatments are now being replicated in other locations in Europe and elsewhere to meet the requirements for decentralised disinfestation of food and non-food items.

Key words: Stored product pest control, controlled atmospheres, heat, disinfestation, post harvest, environmentally-friendly, methyl bromide, Phosphine

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COMPARATIVE EFFICACY OF DIFFERENT GRAIN PROTECTANTS AGAINST *TRIBOLIUM CASTANEUM* UNDER TWO SETS OF TEMPERATURE AND HUMIDITY

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Abstract

Experiment was conducted to compare the efficacy of different grain protectants viz. cypermethrin, deltamethrin, neem leaf extract and *Acorus calamus* oil at the concentrations of 100, 100, 1000 ppm and 30 µl against *Tribolium castaneum* under two sets of temperature and humidity viz. 28 and 35°C; 55 and 68%. Mortality of *Tribolium castaneum* was observed for different exposure periods viz. 24, 72 and 168 hrs. Results showed that maximum mortality was observed against deltamethrin at 28°C and 68% r.h. at exposure period of 168 hrs. followed by cypermethrin. *Acorus calamus* oil was proved to be least effective at 35°C and 55% r.h. at an exposure period of 24 hrs. Results further showed that overall effect of humidities was non-significant on the mortality of *Tribolium castaneum*.

Key words: Grain protectants, temperature, humidity, *Tribolium castaneum*

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CONTROL OF *SITOPHILUS ORYZAE* (COLEOPTERA: CURCULIONIDAE), *RHYZOPERTHA DOMINICA* (COLEOPTERA: BOSTRICHIDAE) AND *TRIBOLIUM CASTANEUM* (COLEOPTERA: TENEBRIONIDAE) BY MODIFIED ATMOSPHERE CREATED BY PADDY HUSK COMBUSTION

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Abstract

The smoke generated from paddy husk combustion, was evaluated for its toxicity against adults of Rice Weevil *Sitophilus oryzae* L. (Coleoptera: Curculionidae), Lesser Grain Borer *Rhyzopertha dominica* F. (Coleoptera: Bostrichidae) and Red Flour Beetle *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae) under laboratory conditions. Adults of these species were put into cloth sacks hung in sealed bottles which were later filled with smoke generated from paddy husk combustion. Insects prepared in the same manner were kept as the control without being exposed to smoke. After different periods of exposure to smoke, response of insects was evaluated in terms of mortality.

A significant mortal effect of the paddy husk combusted gas was observed on the adults of all three insect species tested compared to the untreated control. Adult mortality of 100% was achieved for *Sitophilus oryzae*, *Rhyzopertha dominica* and *Tribolium castaneum* at 14, 13 and 18 hours of exposure respectively, compared to 5-6.6% mortality in the relevant controls.

The experiments were conducted by changing the Carbon dioxide and Carbon monoxide concentrations separately. It was revealed that Carbon monoxide was directly related to the mortality of the target insects. The recorded mortality was brought about by 5000- 6000 ppm of carbon monoxide. This study shows the application of smoke enriched with carbon monoxide generated from the partial combustion of paddy husk as an insect pest management strategy for the insect pests of stored paddy instead of complete combustion and thus saving energy.

Key Words: *Sitophilus oryzae*, *Rhyzopertha dominica*, *Tribolium castaneum*, smoke, paddy husk, carbon monoxide

Acknowledgement: The financial assistance by the Sri Lanka Council for Agricultural Research Policy (CARP- 12/ 540/ 411) is acknowledged.

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INSECTS IN FOOD IN THE JEWISH RELIGION AS A MOTIVE FOR PEST CONTROL

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Abstract

Judaism forbids the consumption of most types of animals with the exception of a restricted number of species which are specifically mentioned in the Bible. There is a strict injunction against eating insect-infested food, as written in the Bible "And every creeping thing that creepeth upon the earth shall be an abomination; it shall not be eaten" (Leviticus XI, 41). In the Christian religion there are no "forbidden foods". Islam forbids the consumption of pork, but there are no references in the Koran concerning insect-infested food. However, we can assume that both Islam and Christianity would clearly regard infested food as inedible. The strict Jewish prohibition against eating infested food is a powerful motive for pest control operations in the whole system of food production acceptable by Judaism, particularly in Israel. The purpose is to supply food free from insects and insect fragments. Amongst the Jewish people there are several main streams of religion: secular, traditional, orthodox and ultra-orthodox, but concerning insect-infested food there is a consensus with the ultra-orthodox who desire to obtain food absolutely free of insects and insect fragments. Most of the public in Israel consume kosher food, which has a rabbinic authorization according to Jewish dietary laws. Consequently these religious authorities are very powerful in controlling the food industry and the marketing system. In recent years, a monitoring system has been implemented using dozens of religious inspectors who have been specially trained in entomology. This control system is demanded in order for the food plants to obtain a kashrut certificate. In most of the large factories the inspectors are permanent employees, while for each of several smaller factories there are inspectors who visit them regularly. The range of known control methods are not sufficient and some are unsuitable for achieving the minimum expected level of infestation. Judaism, which relies on a Biblical verse "Take ye therefore good heed unto yourselves" (Deuteronomy IV, 15), is very aware of human health and the risk of using chemical insecticides. Therefore, pest control is mainly by monitoring, the crops from the field, the post-harvesting to the acceptance of the raw materials in the food factories, to prevent inclusion of insects into the food process. In the food industry, the insect monitoring is carried out throughout the production, packaging and storage. If food industries throughout the world want to receive a kashrut certificate to export their raw and processed products to Israel, the same monitoring processes need to be carried out. The combination of monitoring by inspectors with the essential professional knowledge and the motivation, from deep religious convictions, with the increasingly sophisticated monitoring systems brings good results in achieving clean food with negligible infestation, acceptable by kashrut authorities.

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DETECTION OF MITE *ACARUS SIRO* BY POLYMERASE CHAIN REACTION (PCR)

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Abstract

Mites are very important pests of stored products. Their excrements contain some enzymes which can act as potent allergens. Mites can be easily determined on grains of cereals by classical methods but after desintegration of grains (and also of mites) by grinding it is no more possible. That is why a PCR method for detection of *Acarus siro* has been developed. DNA from groups of individuals and also from flour was extracted by phenol – chloroform extraction. Primers were designed on the basis of published rDNA of *A. siro*. Forward primer TGAGGTCGAAGGTTAACACCAG is identical with bases 16 – 38 and reverse primer CGGGCCACCTTTAAACTACTAC is complementary to the bases 378 - 358 of rDNA fragment, respectively. Predicted product length is 362 bp. *A. siro* DNA was readily amplified in PCR and product of predicted length was generated in positive controls whereas no product appeared in negative controls. Amount of DNA from one individual is sufficient to give easily visible product. Wheat flour spiked with certain number of previously homogenized individuals was also tested. The detection limit is 5 individuals/g of flour. Until now we were able to detect *A. siro* DNA in flour stored at laboratory temperature at least 4 weeks after its spiking.

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POSTER PRESENTATIONS



THE BACTERIA AS FOOD FOR STORED-PRODUCT MITES (ACARI: ACARIDIDA)

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Abstract

Stored product mites have been considered as grammi or fungi-vorous, feeding on grain debris, fungi and yeasts growing in the grain ecosystems. The bacteriophagy (e.g. feeding on bacteria) represents an alternative feeding strategy in the grain ecosystems; however it has not been reported in stored product mites yet. We analyzed whether bacteria could serve as a food source for stored-product mites. The analyses were based on the (i) activity of lysozyme and (ii) increase of population growth of mites on diets enriched by bacteria.

Lysozyme (EC 3.2.1.17) is an enzyme catalyzing the hydrolysis of cell walls of many bacteria, causing cell death lysis, cell wall degradation and enables digestion of bacterial cells. The increase of population growth was observed on the control (rearing) diet and the diet enriched by *Micrococcus lysodecticus* (5% in the diet). Among tested species the lysozyme activity was highest in middle acid pH (optima from 4 to 5). Based on the observed enzymatic activity we distinguished three levels: (i) high lysozyme activity: *Caloglyphus redickorzevi*, *Tyroborus lini*, *Tyrophagus brevicrinathus*, *Acarus gracilis*; (ii) intermediate lysozyme activity: *Aleuroglyphus ovatus*, *Glycyphagus domesticus*, *Tyrophagus putrescentiae*; (iii) low lysozyme activity: *Carpoglyphus lactis*, *Acarus siro*, *Lepidoglyphus destructor*. The population growth of *Tyroborus lini* and *Caloglyphus redickorzevi* was higher on the diet enriched by *Micrococcus lysodecticus* in comparison to control, while we observed no differences in population growth of *Acarus siro* and *Lepidoglyphus destructor*.

We conclude that species with high lysozyme activity (*Tyroborus lini* and *Caloglyphus redickorzevi*) are able to utilize bacteria as a food source and bacteriophagy seems to be another alternative feeding strategy in stored grain ecosystem.

This work was supported by the grant COST 1P04OC853.003.

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FUMIGANT ACTIVITY OF MONOTERPENOIDS AGAINST THE RICE WEEVIL, *SITOPHILUS ORYZAE*

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Abstract

Results of the assays on fumigant activity of 6 major monoterpene constituents of essential oils from aromatic plants grown in Turkey namely, carvacrol, 1,8-cineole, menthol, γ -terpinen, terpinen-4-ol and thymol against adults of the rice weevil, *Sitophilus oryzae* (L.) are presented. Doses between 5.8-184.8 mg/l air and exposure periods of 24-96 h were used. All 6 constituents showed fumigant activity in varying degrees against tested insect species. The most active constituent was γ -terpinen and achieved 100% mortality at 46.2 mg/l air and an exposure of 96 h. This was followed by thymol and carvacrol which achieved 99.2 and 96.4% mortalities, respectively, at the same dose and exposure period. While terpinen-4-ol caused mortalities of 99-100% at 184.8 mg/l air and exposures of 24-96 h, the constituents 1,8-cineole and menthol could achieve mortalities upto 95 and 61%, respectively, at any dose and exposure time.

Key words: monoterpene, stored-product insect, fumigant activity, *Sitophilus oryzae*

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ESSENTIAL OIL ACTIVITY AGAINST POST HARVEST PATHOGENS

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Abstract

Many plants and their extracts, also those usually used to flavour foods, are known to have antifungal activity; for this reason, they are potentially alternative to synthetic fungicides. Natural plant compounds could be employed themselves or used as a lead to synthesize analogous molecules.

In this research, the antifungal activity of 8 essential oils, extracted from plants belonging to *Geraniaceae*, *Graminaceae*, *Lamiaceae*, *Lauraceae* and *Mirtaceae*, was investigated. Oils were tested against *Botrytis cinerea* and *Penicillium* sp. strains, isolated from strawberry and apple showing postharvest rots. The protocol proposed by RABOSO *et al.* (1995) to assess fungicide activity was employed, which allows to test many compounds and concentrations at the same time.

The results indicated that all the tested compounds inhibited the growth of *B. cinerea* and *Penicillium* sp. The most effective were the oils extracted from *Cymbopogon martinii* L. (palmarosa), *Pimenta dioica* L. (allspice) and *Syzygium aromaticum* L. (clove).

To verify the actual effect of essential oils on the development of *Botrytis* and *Penicillium* hyphae, investigations by means of scanning electron microscope were carried out on colonies of the pathogens, grown on polycarbonate membranes in presence of different concentrations of oils.

Most of the tested oils caused morphological alterations, both in *Botrytis* and in *Penicillium*. Hyphae, generally, appeared collapsed, frequently flexuose, and showed surface alterations. Modifications affected mostly hyphal tips that were frequently swollen and misformed. In proximity to hyphal tips, in some cases evident increase of branching was also observed.

A peculiar effect was seen in *Botrytis cinerea* hyphae exposed to the essential oil of *Cymbopogon martinii* L. (palmarosa): close to the tips they showed heavy swelling and typical bean-shaped apex. These kind of alterations could be caused by damages induced on membrane structure.

SITOPHILUS GRANARIUS (CURCULIONIDAE) - OUTDOOR OCCURRENCE IN THE VICINITY OF A GRAIN STORE

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Abstract

The aim of this work was to explore the frequency and abundance of primary pest, *Sitophilus granarius* occurring outside the grain store. Wheat bait-traps were used for pest monitoring. Bait-traps exchange was done monthly during the year. Exposed bait traps were analysed in the laboratory. Each bait was separately sieved; the beetles were then removed and counted. The analysed baits were stored for subsequent adult's incubation from hidden infestation (27°C, 75% r. h.) for 1 month.

The outdoor occurrence of *S. granarius* was documented in Czech Republic for the first time. This highly mobile internal grain feeder was the most frequent and abundant pest in comparison to 6 other species of Coleoptera found outside the grain store. Pest abundance and frequency were in high correlation. The population of granary weevil in baits from hidden infestation (eggs) increased 10 - 50 times after 1 month of incubation period compared to primary infestation.

The research is supported by the Ministry of Agriculture of the Czech Republic, Project No. MZE 0002700603 - "Výzkumný záměr".

Key words: *S. granarius*, grain bait traps, outdoor occurrence, hidden infestation

For curriculum vitae and contact see page 53

NYMPH'S MORPHOLOGY OF *DORYPTERYX DOMESTICA* (PSOCOPTERA)

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Abstract

Dorypteryx domestica is an expansive psocid often occurring in synanthropic localities. So far only adults and eggs were possible to identify, since the description of nymphs was not available. The study reported here is focussed on external morphology of nymphs and is a part of the project of the comparative morphology of developmental stages of stored – product psocids aimed at facilitating their identification. Morphological study deals with overall appearance and size measurements of particular instars. Five developmental instars are distinguished and described. Morphological characters include mainly number of flagellar segments, number of ommatidia in compound eyes, and level of wing development. Morphological details are illustrated with scanning electron microscope micrographs and digital photos.

The study reported here is supported by the programme of international cooperation No. 1P05ME733 - Kontakt.

Key words: *Dorypteryx domestica*, psocid, nymphs, morphology, SEM micrographs

For curriculum vitae and contact see page 53

AN INFLUENCE OF DELTAMETHRIN ON *CEPHALONOMIA TARSALIS*

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Abstract

Contact insecticides and fumigants are broadly used in stored product pest management. One of commonly used contact biocid in stored product and processing facilities is deltamethrin. Due to resistance, toxicity and residues risk of biocides, there is a run for alternative control means. Biological control is an alternative to chemical control. *Cephalonomia tarsalis* (Ashmead) (Hymenoptera: Bethyridae) is both a predator and an ectoparasitoid of sawtoothed grain beetle, *Oryzaephilus surrinamensis* (L.) (Coleoptera: Silvanidae). This parasitoid is naturally present in stored products in Czech Republic and is considered as promising natural control agent. The aim of our study was to assess an influence of deltamethrin (K-Othrin 25W) on *Cephalonomia tarsalis* with a purpose to determine lethal concentrations (LC₁₀-LC₉₉) and corresponding lethal times (LT₅₀). Males and females were exposed (dipping) individually to different concentration of deltamethrin (0.01%, 0.05%, 0.1%, 0.5%, 1%, 1.5% and 2%) and checked for mortality. Data were analysed using probit analysis of PoloPlus software for Windows. There was found different influence of deltamethrin on males and females of *C. tarsalis* – males were more susceptible than females. LC₅₀ for males was 0.476% (95% CI=0.283, 0.8701; n=120) and LC₅₀ for females was 1.139% (95% CI=0.737, 2.242; n=200). Dependence of lethal time (LT₅₀) on concentration of deltamethrin was described by regression equation for males $y = -7.2358\ln(x) + 27.256$ (R²=0.976) and for females $y = -8.3573\ln(x) + 22.842$ (R²=0.855).

This work was supported by grant ZAMER MZe 0002700603 and SBIRKA E-95-3140-0066.

For curriculum vitae and contact see page 55

ANTIFUNGAL ACTIVITY OF PLANT EXTRACTS

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³ *University of Lisbon, Science Faculty, Edificio C2, Campo Grande, 1149-016 Lisboa, Portugal*

Abstract

The use of natural products with therapeutic properties is as ancient as human civilisation. Nowadays, there is a growing concern and awareness by the public opinion in relation to the use of synthetic pesticides and to the presence of their residues in food. These facts lead to the search for new forms of food protection against contamination by microorganisms. In this work we evaluate the importance of natural products, especially those derived from plants, in the control of stored products fungi. Results are presented and discussed.

Key words: natural products, fungi, natural pesticides, fungicides

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FUNGI DETECTION ON PADDY AND BROWN RICE AT FARMERS AND RICE MILL STORAGE

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Abstract

Studies were conducted in producer owned paddy rice warehouses and one rice mill, from November 2002 to date. The studies were undertaken in order to detect fungi species and to determine the insect species associated with stored rice and their abundance, using several sampling methods.

From the results, it may be considered that moisture content may be the major factor that affects paddy at farm storage allowing fungal production as the main insects caught were fungus-feeding while at the rice mill were commodity-feeders. Rice samples were taken and treated to be incubated at the laboratory in order to detect and identify fungus presence. The mycotoxin producing fungi *Aspergillus niger*, *A. flavus*, *A. candidus*, *Penicillium islandicum* and *Fusarium* sp. were identified.

Key words: stored rice, fungi, *Aspergillus*, *Penicillium*

For curriculum vitae and contact see page 42

THE SECRETORY CELLS OF DIGESTIVE TRACT OF *TRIBOLIUM CASTANEUM* (COLEOPTERA, TENEBRIONIDAE) LARVAE

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Abstract

Red flour beetle, *Tribolium castaneum* (HERBST, 1797), is widely distributed secondary pest of grain and cereal products. In the Czech Republic, it belongs to the most abundant and frequent storage pest that is hardly to be controlled by pyrethroid insecticides due to tolerance to them. This is why the new insecticides against this pest are developed. They are target against midgut (*Bt* toxins, inhibitors of insects amylases and proteases). To understand the effect of insecticide on the midgut in this study, we explored and described the structure of secretory cells of midgut of *Tribolium castaneum* larvae using optical microscopy.

The larvae, approximately 3 weeks old, were fixed in Bouin-Dubouque-Brazil fluid, embedded in paraplast, sectioned (thickness 5-7 µm) and stained in Masson's triple stain. The histological preparates were observed under Axioskop Zeiss.

The digestive tract of the larvae of *Tribolium castaneum* composes of 3 parts: stomodaeum (foregut), mesodaeum (midgut) and proctodaeum (hindgut). Stomodaeum forms short and dilated pharynx and narrow oesophagus extends towards the swollen mesodaeum. Mesodaeum of the larval *Tribolium castaneum* is rather simple tube, without any caeca or diverticula. Proctodaeum is divisible into 3 sections. Very small and conical „pyloric chamber“ at the anterior end followed by the ileum which forms an S-shaped bend and spindle-shaped rectum. In the middle part of mesodaeum there are the cylindrical cells. Short middle zone secretes no enzymes. Multi-layer peritrophic membrane is present.

The secretory cells were localized into (i) anterior mesodaeum and (ii) posterior mesodaeum. The anterior part of mesodaeum contains tall and columnar cells and the membrane on the luminal side forms microvilli. The apical extrusions at the apical parts of the cells release into gut lumen. The cells of posterior mesodaeum create multicellular crypts and apical extrusions can be also observed here. Both the cells in anterior and posterior mesodaeum contain large nuclei and they are strongly vacuolized indicating strong secretory activity. The described situation corresponds to model species *Tenebrio molitor*. The function of secretory cells as well as the potential for suppressive compounds is discussed.

The study was supported by the grant of MŠMT 1P05ME758.

For curriculum vitae and contact see page 49

MONITORING OF BRUCHIDS (COLEOPTERA: BRUCHIDAE) IN STORED BROAD BEANS (*VICIA FABA* L.)

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Abstract

Samples of threshed dried broad beans (*Vicia faba* L.) were collected in different places of Portugal and bruchids (Coleoptera: Bruchidae) infesting those seeds were identified. *Bruchus rufimanus* was the dominant species, independently of the geographic location. Parasitoids were also found inside the seeds. Eight varieties of broad beans were cultivated in a random block design, and the number of infested seeds, already in storage, was compared in order to detect differences in the attack. Results are presented and discussed.

Key words: bruchids, broad beans, *Bruchus rufimanus*, *Vicia faba*

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THE INFLUENCE OF TEMPERATURE ON RESPIRATION OF RICE WEEVIL (*SITOPHILUS ORYZAE*)

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Abstract

We studied the dependence of respiration of *Sitophilus oryzae* on temperature. The intensity of CO₂ production of rice weevil adults was measured under constant temperatures: 5°C, 10°C, 15°C, 20°C, 25°C, 30°C, 35°C, 40°C, 45°C and 50°C. The dated values were expressed in $\mu\text{l CO}_2\cdot\text{g}^{-1}\cdot\text{h}^{-1}$. The intensity of respiration of the granary weevil increased with temperature from 5°C to 40°C. The reached mortality was 45% at 45°C and 100% at 50°C.

For curriculum vitae and contact see page 58

SCIENTIFIC COMMITTEE ON PHYTOSANITARY AND ENVIRONMENT

ZUZANA PAŽOURKOVÁ* AND VÁCLAV STEJSKAL

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Abstract

The significance of the „safe food“ topic has been increasing in Europe. European Commission has achieved a fundamental reorganization of the whole system of food safety due to several significant crises (see BSE scandal, mycotoxins, etc.). The instrument of new European policy became an independent European Food Safety Authority (EFSA), its main objective is providing independent consultant service (on scientific basis) to the European Union in the sphere of food safety. The Authority's activity includes independent consultant service, information gathering and analysis, direct communication with the consumers. Members of EU were called to co-operate with EFSA and to create consecutive security systems. The Czech Republic was asked to establish a national system of food safety in connection with its induction to the EU. A Coordinative Group and Scientific Committees have been established as a part of the national system relate to the existing government establishment and authorities of public health protection.

The Committee solves problems relate to: **1.** agricultural production, import and export of agricultural crude or products and the phyto-quarantine; **2.** food safety problems rising as a consequent disturbances of the environment.

For curriculum vitae and contact see page 58

**SUSCEPTIBILITY OF *TRITICUM POLONICUM* L., *T. DURUM* DESF., *T. SPELTA* L.
TO POST-HARVEST INFESTATIONS BY *SITOPHILUS ZEAMAI*S MOTSCHULSKY
(COLEOPTERA: DRYOPHTHORIDAE, RHYNCHOPHORINAE)**

SARA SAVOLDELLI

Istituto di Entomologia agraria, Università degli Studi di Milano, Via Celoria 2, 20133 Milano, Italy

Abstract

T. polonicum L. (Polish wheat, or Kamut) is a tetraploid wheat, with a high content in protein, vitamins and minerals, less allergenic than other ones; so its cultivation is increasing in Italy.

The development of *Sitophilus zeamais* Motschulsky on Polish wheat is examined in laboratory trials at a fixed temperature and relative humidity. Results are compared with the development on *T. durum* Desf. (Durum wheat) and *T. spelta* L. (Spelt wheat). Tests are carried out with 100 adults of mixed sex in 30 g of kernels, removed from jars after 5 days. New generation adults was checked every day, counted and removed.

A greater number of emerged adults is observed on *T. durum*, the lowest on *T. spelta*. The beginning of emergence starts earlier on *T. durum* and *T. polonicum* than on *T. spelta*.

**DEVELOPMENT OF *ARAECERUS FASCICULATUS* DE GEER
(COLEOPTERA, ANTHRIBIDAE) ON *PANAX GINSENG* ROOTS**

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Abstract

Araecerus fasciculatus De Geer is a beetle of considerable economic importance. Its occurrence is cosmopolitan, though it is more common in the tropical and subtropical countries.

In this experiment it is studied the development of coffee bean weevil on two different kinds of ginseng roots, compared with data obtained on corn and coffee grains. Tests are carried out under laboratory condition at a fixed temperature and relative humidity.

It is observed that the development time is very similar on corn, coffee and spindle-shaped, bipartite ginseng roots; the number of emerging adults is higher on corn and coffee grains. Secondary ginseng roots do not allow development of *A. fasciculatus*.

SUSCEPTIBILITY OF DIFFERENT KINDS OF POWDERED MILKS TO THE ATTACK OF PYRALID MOTHS

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Abstract

The susceptibility of four different kinds of powdered milk (mixture of milk and other components), used in human nourishment and zootechnic field, has been tested for to value the attack by *Cadra cautella* (Walker), *Corcyra cephalonica* (Stainton), *Ephestia kuehniella* (Zeller) and *Plodia interpunctella* (Hübner).

100 eggs, 24-48 hours old, were placed on the substrates (50 g); tests were carried out in a thermostatic room ($26\pm 1^{\circ}\text{C}$; $70\pm 5\%$ R.H.; 16:8 L:D). For each substrate were carried out 3 replications. At the end of each test the mean number of emerged adults, the mean developmental period and the mean susceptibility index was calculated. Results were subjected to analysis of ANOVA and to the Duncan's multiple range test (SPSS 11.5 for Windows).

All species tested were able to complete their development on soya milk; on this substrate 50-60 individuals were observed except for *C. cephalonica* where the adults emerged were 19.0 ± 1.00 . *E. kuehniella* and *C. cautella*, instead, were not able to complete their development on the human nourishment milk (soya and nurslings milk) while only few individuals were able to reach the adult instar on whole milk.

C. cephalonica adults were observed not only on soya milk but even on the others substrates (whole milk: 1.7 ± 1.00 ; nurslings milk: 40.7 ± 3.84 ; zootechnic milk: 32.0 ± 2.00). This moth shows the ability to use, as an energetic source, lactose; this sugar, in fact, is toxic for the most part of the moths and beetles of stored products.

THE INFLUENCE OF ENVIRONMENTAL STRUCTURE ON PEST TRAP EFFICACY IN FOOD PRODUCTION FACILITIES

VÁCLAV STEJSKAL* AND RADEK AULICKÝ

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Abstract

The effect of structural complexity on the dispersion behavior of the German cockroach, *Blattella germanica* L., was estimated by means of the Lo line - Cockroach trap (Agris-sense + DDD servis). The experiments were performed in the isolated chamber 3 x 2 m with controlled atmosphere and regulated dark-light regime. Cockroach shelter was located at the edge of the chamber while Lo line - Cockroach traps were placed in the center of the chamber. The increasing complexity of environment was simulated by installation of various numbers of wooden boards between trap and cockroach shelter. The catch of cockroaches in traps was recorded either for 24 hrs or 48 hrs. Increasing complexity decreased No. of catches dramatically. In some cases traps even falsely indicated zero presence of cockroach pests in the testing chamber. The practical implication of the results is discussed.

This work was supported by grant No. MZE-000-2700603.

For curriculum vitae and contact see page 60

INJURIOUS CAPACITY OF STORAGE PESTS TO LEGUMES: A CASE HISTORY FROM NAMIBIAN SEED STORE

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Abstract

Unusually high pest injury (i.e. seed loss via feeding) on seed of cowpea (*Vigna unguicula*) and stored in Namibia is reported. We inspected 100 seeds per each of the total of textile bags (500 g) of *Vigna unguicula* (n=50) and *Arachis hypogea* (n=30). We found that (i) 100% of seeds was infested (ii) 100% injury of germs (100 % loss of germinability) in both crop seeds. The estimated loss of internal content of seeds of *Vigna unguicula* was more than 95%. Symptoms of combined injury caused by pyralid moth (*Corcyra cephalonica*) and bruchid beetles (*Callosobruchus subinnotatus*) are described and photo-documented.

This work was supported by the projects MSMT/B - No 40/03-05/ (Holešovská) and MZE -000-2700603 (V. Stejskal).

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CURRICULUM VITAE



CORNEL S. ADLER

Position:

Researcher and deputy director of the BBA Institute for Stored Product Protection since 1993, senior scientist since 2002, advisor for stored product protection in organic farming



Education:

- ☞ Dr. rer. nat. (Freie Univ. Berlin, 1993)
- ☞ Diplom-Biologe (Freie Univ. Berlin, 1987)
- ☞ Master of Science (Tulane Univ., New Orleans, USA, 1984)

Research interests:

Biology of stored product pest insects, improved methods for stored product protection, efficacy of extreme temperatures, pest prevention by hermetic structures or controlled aeration; attractive, repellent, or toxic effects of plant extracts; biological control with parasitoids and predators, efficacy of controlled or modified atmospheres.

Membership in professional bodies:

- ☞ International Organisation of Biological Control (IOBC/ WPRS), 1996-2001: convenor of IOBC working group (WG) „Integrated Protection of Stored Products“;
- ☞ German Society for General and Applied Entomology (DGaaE)
- ☞ German Phytomedical Society (DPG), convenor of DPG-WG „Stored Product Protection“ since 2002.
- ☞ Special tasks; Lecturer in Stored Product Entomology at the Freie Univ. Berlin
- ☞ Short-term expert for United Nations Industrial Development Organization (UNIDO) on MeBr-Alternatives
- ☞ Short-term expert for the Gesellschaft für Technische Zusammenarbeit (GTZ),
- ☞ Evaluator for EU Marie-Curie-fellowships,
- ☞ Trainer on stored product integrated pest management for pest control operators and food industry
- ☞ Peer reviewer for scientific journals
- ☞ Co-operation with scientists from Cameroon on phytochemicals (funded by German Academic Exchange Service and the Alexander von Humboldt Foundation)
- ☞ Co-operation with scientists from China on non-chemical stored product protection (funded by Chinese and German ministries of agriculture)

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OLLE ANDERBRANT

Born:

1956 in Tärnaby, Sweden.

Education:

- ✂ Appointed Docent at Lund University in 1992, and Professor of chemical ecology in 2003.
- ✂ PhD 1988 in Animal Ecology (thesis: „Reproduction and competition in the bark beetle *Ips typographus*“).
- ✂ Basic training in natural sciences and mathematics at Lund University 1975-1979.



Research interests:

Has worked on several aspects of bark beetle biology, e.g. development and spread of infestations in aggressive species and ecology of the Dutch Elm Disease vectors, *Scolytus* spp.

Started in 1988 work on chemical communication of pine sawflies (Diprionidae), including basic aspects of pheromone production, perception and released behaviour as well as development of pheromone-based monitoring and population control.

Current projects also include development of semiochemical-based methods for monitoring and control of stored product pest insects (mainly pyralid moths), and chemical ecology of the carrot psyllid (*Trioza apicalis*).

Publications:

Has published about 70 scientific articles and book chapters.

Involved in teaching at all levels and in administration, currently as deputy head of the Department of Ecology.

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FRANKLIN H. ARTHUR

Position:

Leads a diverse and productive research group that is refining approaches to insect pest management in stored products, developing alternative control strategies, and identifying new reduced-risk insecticides that can be used to replace older compounds used for insect control. He is responsible for planning, coordinating, and developing an independent research program on insect pest management in stored raw agricultural commodities and processed food warehouses.



Education:

Received a B. S. in Forestry and Wildlife Ecology from the University of Florida (1976), and a M. S. (1982) and Ph. D. (1985) in Entomology from North Carolina State University. In March of 1986 he joined USDA-ARS Stored Product Insects Research and Development Laboratory in Savannah, GA. as a Research Entomologist, and was transferred to the Grain Marketing and Production Research Center in Manhattan, KS when the Savannah Lab closed in November 1994.

Research interests:

Evaluation of new reduced-risk low-toxicity insecticides for use in post-harvest environments, identification of the physical, biological, and environmental factors that affect insecticide efficacy, determining how these factors affect control programs, and promoting integrated pest management strategies to manage insect pests in raw bulk grain and processing facilities. Cooperates with private industry and with State and Federal regulatory agencies on petitions regarding insecticide registration, and works agricultural chemical companies to evaluate new insecticidal products to control insect pests in raw commodities and processed food warehouses. Dr. Arthur is also a co-Principal Investigator (PI) on several grant-funded research projects. Has authored more than 115 research publications and has given 102 presentations, including 46 special invitations, at professional meetings, research symposia, and technology transfer meetings. He is recognized internationally for his research program.

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CHRISTOS G. ATHANASSIOU

Position:

Lecturer

Education and Professional Experience:

- ✂ 2004-today: Lecturer, Agricultural University of Athens
- ✂ 2002-2004: Agronomist in Plant Protection and Phytosanitary Inspector, Ministry of Rural Development and Food
- ✂ 2001-2002: Post Doctorate, Teaching and Research Assistant, Agricultural University of Athens
- ✂ 2000-2001: Researcher and Adjunct Lecturer, University of Thessaly
- ✂ 1999: Ph.D. Entomology, Agricultural University of Athens
- ✂ 1993: B.Sc. Agronomy, Agricultural University of Athens



Research Interests:

- ✂ Physical, Biological and Chemical control of stored-product insects
- ✂ Sampling and population dynamics in stored-product and field insect pests
- ✂ Trapping and Semiochemicals in stored-product and field insect pests
- ✂ Taxonomy, Zoogeography and Phylogenetic analysis of Aphidiinae (Hymenoptera)
- ✂ Population and Metapopulation ecology of predators and parasitoids (with emphasis in predators and parasitoids of aphids)

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JAMES F. CAMPBELL

Position:

In 1999, he joined the United States Department of Agriculture, Agricultural Research Service, as a Research Entomologist stationed at the Grain Marketing and Production Research Center in Manhattan Kansas.

Education:

Received B.S. (Environmental Science) and M.S. (Entomology) degrees from Rutgers University and a Ph.D. in Entomology from the University of California-Davis.

Research interest:

Research program focuses on the behavior and ecology of stored product pests and their natural enemies and how to use this information to improve pest management. He is also an adjunct associate professor of entomology at Kansas State University, where he serves as advisor to graduate students and on graduate student committees.

Has authored 54 peer-reviewed journal articles and book chapters and one co-edited book, and has made more than 80 presentations including 27 invited symposium presentations and 28 invited technology transfer presentations. As a co-principal investigator, he has obtained extramural support from sources such as NSF, USDA, and EPA.

Awards:

Recipient of the 2004 USDA ARS NPA Early Career Research Scientist of the Year award.

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MARIA OTILIA CARVALHO

Position:

Researcher

Birth place and date:

Lisbon, Portugal 10. 2. 1959

Education:

- ☞ PhD on Agronomic Engineering [Technician University of Lisbon (UTL)]
- ☞ MSc on Integrated Pest Management (UTL)
- ☞ Degree on Tropical Agronomy (UTL)
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DEAN COOK

Position:

Since September 2004, he has been on internal seconded to CSL's Commercial Department as Commercial Development Manager. The focus of Dean's current role is to explore opportunities for CSL in the agri-environment and food sectors.

Research interests:

Has worked and published on a diverse range of projects including cooling and drying strategies, storage invertebrate ecology, and non-chemical alternatives to organophosphorous pesticides. His most recent research interests include; novel methods for controlling mites, automated store management technologies and knowledge transfer.



Professional Experience:

Applied biologist, working in the area of grain storage.

Specialising in Integrated Pest Management Since August 2003, Dean has been CSL's account manager for the Home Grown Cereals Authority (HGCA), with responsibility for co-ordinating CSL's programme of research with this industry body.

Memberships:

He currently sits on the British Standards Committee for Cereals, Pulses and Oilseeds which gives UK representation at ISO/TC 34/SC 4. He is responsible for co-ordinating CSL's bidding into the „European Framework“ research program and the EU „Twinning“ program.

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PANAGIOTIS A. ELIOPOULOS

Position:

Entomologist

Education:

- ✂ Ph.D. of Agricultural Science in Entomology; University Agricultural University of Athens, Department of Plant Production, Laboratory of Agricultural Zoology & Entomology (16/03/2000-15/05/2003) **These:** Study of the parasitoid *Venturia canescens* (Hymenoptera: Ichneumonidae) as a biocontrol agent against lepidopterous pests of stored products
- ✂ M.Sc. in Plant Protection with specialization in Agricultural Entomology and Zoology; University Agricultural University of Athens, Department of Plant Production (01/09/1998-31/08/2000) **These:** Study on the morphology and taxonomy of predatory mite family Cheyletidae (Acari : Prostigmata)
- ✂ B.Sc. of Agricultural Engineering with specialization in Plant Protection & Environment; University Agricultural University of Athens, Department of Plant Production (23/10/1992 - 21/ 03/1998).



Research interest:

- ✂ Morphology, Biology, Ecology, Systematics and Control of stored product pests
- ✂ Biology and Ecology of Hemiptera (Coccids, Aphids, Aleyrodids etc)
- ✂ Biology and Ecology of Coccinellidae (Coleoptera)
- ✂ Biological Control of stored products pests

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TOMÁŠ ERBAN

Position:

Undergraduate student

Date of birth:

23.7.1978

Place of birth:

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School address:

Department of Zoology, Charles University
Viničná 7, 128 44 Prague 2

Employer address:

Research Institute of Crop Production
Drnovská 507, 161 06 Prague 6, Czech Republic

Education:

Since 2001 Student at Department of Zoology, Charles University
Thesis topic: „The digestive enzymes of acaridid mites“

Main Field of Interest:

- ☞ Acaridid mites
- ☞ Digestive enzymes
- ☞ Digestion
- ☞ Gut physiology



FEDAI ERLER

Position:

Associate Professor

Birth-place:

Çengel (Geyve/Sakarya), Turkey

Education:

- ☞ since 2005 Akdeniz University, Faculty of Agriculture, Plant Protection Department, Antalya - Associate Professor
- ☞ 2002-2005 Akdeniz University, Faculty of Agriculture, Plant Protection Department, Antalya Assistant Professor
- ☞ 2000-2002 Akdeniz University, Faculty of Agriculture, Plant Protection Department, Antalya Research Assistant (Dr.)
- ☞ 1995-2000 Akdeniz University, Graduate School of Natural and Applied Sciences, Department of Plant Protection (Entomology), Antalya – PhD, **Thesis:** Investigations on the using potential of essential oil components in the control of insects and mites. Akdeniz University, Graduate School of Natural and Applied Sciences, Department of Plant Protection/Entomology, 120 pages.
- ☞ Akdeniz University, Graduate School of Natural and Applied Sciences, Department of Plant Protection (Entomology), Antalya – MSc, **Thesis:** Faunistic studies on the armoured scale insect species (Homoptera: Diaspididae) and their natural enemies in Antalya province. Akdeniz University, Graduate School of Natural and Applied Sciences, Department of Plant Protection/Entomology, 100 pages.
- ☞ Ankara University, Faculty of Agriculture, Plant Protection Department, Ankara – BSc



Research interest:

- ☞ Armoured scale insects (Homoptera: Diaspididae) and their natural enemies
- ☞ Effects of essential oils and their constituents on insect and mite pests
- ☞ Fruit pests
- ☞ Stored-product pests

Scholarships:

ARO (Agricultural Research Organization), Volcani Center, Betdagan-Israel (1996).

Memberships:

- ☞ Turkish Biological Control Society
- ☞ Turkish Entomological Society

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SIMCHA FINKELMAN

Position:

Over the last year Simcha Finkelman has acted as head of research in the Eitan Amichai Ltd. company has been leading an international project on the development of remote control sensors for insect and rodent monitoring in the food industry.

Professional Experience:

Has been working at the Agricultural Research Organization of Israel during the last five years on problems related to stored product conservation and more specifically on novel environmentally friendly approaches to insect control in the food industry. Of these approaches, three are currently being applied as alternatives to the use of methyl bromide.



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LISE STENGÅRD HANSEN

Position:

Senior scientist

Research interest:

Insect population dynamics and biological control of insect pests. Stored product pests, food safety aspects, detection and control, with special emphasis on development of biological control methods. Other projects deal with non-chemical control of insect pests in museums.

Professional Experience:

She has been employed as senior scientist at the Danish Pest Infestation Laboratory, Danish Institute of Agricultural Sciences, since 1994.

Memberships:

She is currently chair of an EU COST Action working group concerning biological control of stored product pests and treasurer of IOBC (International Organisation of Biological Control) Global.

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JAN HUBERT

Position:

Researcher

Date of birth:

25.12.1972

Education:

- ☞ 1996 - 2004 Postgraduate student, Charles University, Prague
- ☞ Master of Sciences, Charles University, Prague

Professional experience:

- ☞ Since 1999 Research Institute of Crop Production

Research nterests:

- ☞ Insect and mite digestion
- ☞ Digestive enzymes, inhibitors
- ☞ Microanatomy of the digestive tract

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JANA KAUFNEROVÁ

Position:

Undergraduate student

Date of birth:

13.10.1979

Place of birth:

Rokycany, Czech Republic

School address:

Charles University, Department of Ecology
Viničná 7, 128 44 Prague, Czech Republic

Employer address:

Research Institute of Crop Production
Drnovská 507, 161 06 Prague 6, Czech Republic

Education:

2003 Bc. Environmental protection, Ústí nad Labem

Main Field of Interest:

- ☒ Influence of insecticidal proteins on target moth *Ephestia kuehniella*
- ☒ and nontarget wasp *Venturia canescens*
- ☒ Synergic effect of combined control



NICKOLAS GERASSIMOS KAVALLIERATOS

Position:

Agronomist-Entomologist

Place and date of birth:

Athens, 13.5.1969

Education:

- ✎ 01/02/2002 – Today: Associate Research at Benaki Phytopathological Institute
- ✎ Ph.D. Dissertation at Faculty of Plant Production, Agricultural University of Athens (2001): “Study of systematics and frequency of appearance of Aphidiidae parasitoids in Greece”
- ✎ Graduated on Faculty of Plant Production, Agricultural University of Athens (1989 - 1994). **Thesis:** “Study of *Cacopsylla pyri* (L.) in pear trees in Attica” with average mark



Research interest:

Taxonomy and Ecology of Aphidiinae, Population and Metapopulation Ecology, Sampling. Since now, he has published 45 papers in international journals, 6 full papers in proceedings of international and national congresses and 38 abstracts in books of abstracts and proceedings of international and national congresses.

Professional Experience:

Has participated on the projects named: 1) “Aphids and viruses transmitted by aphids” (The General Secretariat for Research & Technology of the Greek Ministry for Development and the Ministry of Science, EPET II 453, 2) “Sustainable control of Lepidopterous pests in olive groves-integration of egg parasitoids and pheromones” (ICA4-CT-2001-10004 TREPHELIO, of the EU).

Head of the following programs: 1) “Uncultivated plants as reservoirs of parasitoids (Hymenoptera: Braconidae: Aphidiinae) for citrus cultivation” (Benaki Phytopathological Institute); 2) “Control of *Palpita unionalis* (Hübner) (Lepidoptera: Pyralidae)” (Ministry of Agriculture: General Directorate of Plant Produce Protection, Directorate of Plant Produce Production); 3) “*Vitex agnus castus* L. Verbenaceae and *Euphorbia characias* L. ssp. *wulfenii* (Hoppe ex Koch) A. R. Sm. Euphorbiaceae as reservoirs of aphid parasitoids (Hymenoptera: Braconidae: Aphidiinae)” (Grand number: 405, State Scholarships foundation); 4) “Control of stored products insects” (Ministry of Agriculture: General Directorate of Plant Produce Protection, Directorate of Plant Produce Production)

Memberships:

- ✎ Hellenic Entomological Society (esimou@aua.gr)
- ✎ Japanese Society of Applied Entomology and Zoology
- ✎ Entomological Society of America

Citations:

He has 40 citations.

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ANDREA KLAUDYOVÁ

Position:

Undergraduate student

Date of birth:

21.9.1979

Place of birth:

Rakovník, Czech Republic

School address:

Charles University in Prague, Faculty of Science
Albertov 6, 128 43 Praha 2, Czech Republic

Employer address:

Research Institute of Crop Production
Drnovská 507, 161 06 Prague 6, Czech Republic

Education:

Since 2001 Student at Department of Zoology, Charles University

Thesis topic: "The enzymatic allergen of stored product mites"

Main Field of Interest:

- ☒ Storage mites and their faeces
- ☒ Digestive enzymes
- ☒ Mites and allergens
- ☒ Immunological detection of mites



ZUZANA KUČEROVÁ

Position:

Senior scientist
Responsible person for Referential diagnostic laboratory of SPP department

Education:

- ☞ Course in stored-product pests organized by the British Council (1993)
- ☞ Post-graduate course in the technology of grain storage, Czech University of Agriculture (1977-1979)
- ☞ Czech University of Agriculture (1970-1975)



Professional experiences:

- ☞ Research Institute of Feed Industry, Prague (1975-1978)
- ☞ Food Research Institute (1978-1995)
- ☞ Research Institute of Crop Production (1995-present)

Research interests:

Morphology, biology, ecology and ethology of stored-product pests (Psocoptera, Coleoptera, Acarina), pest monitoring, detection and diagnostic

Stays:

1999 Central Science Laboratory, MAFF, York, Great Britain
1994 Danish Pest Infestation laboratory, Lyngby, Denmark

International co-operation:

Czech – China project on morphology of stored product psocids (2005-2007)

Membership:

International Organisation of Biological Control (IOBC/WPRS)

Special tasks:

Lecturer on stored product pest courses for pest control operators, agriculture and food industry workers

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IVA KUDLÍKOVÁ

Position:

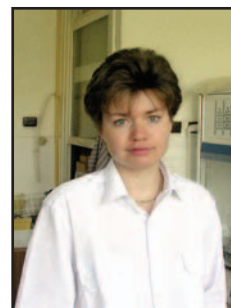
Researcher

Date of birth:

20.11.1971

Education:

- ☞ Master of Sciences, Charles University, Prague
- ☞ Postgraduate student, Czech University of Agriculture in Prague



Research interests:

- ☞ Food safety, traceability of contaminants in food product (i.e. mite allergens, mycotoxins) Diagnostics and detection of pathogens and pest infestation by immunochemical methods
- ☞ Preparation and purification of antibodies (mono-, polyclonal), immunochemical methods (ELISA, immunoprint, dot-blot, immunofluorescence)
- ☞ Evaluation of reliability of diagnostics protocols for routine tests based on immunochemical and molecular methods

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JAN LUKÁŠ

Position:

Researcher

Date of birth:

11.11.1972, Prague

Education:

- ☞ 2003: PhD., Czech University of Agriculture in Prague
- ☞ 1996: Ing., specialization – plant medicine (protection), Czech University of Agriculture in Prague



Professional Experience:

- ☞ Nov/Dec 2004 (6 weeks): research fellowship; Swiss Federal Institute of Technology ETH, Zurich; (Prof. S. Dorn), Switzerland
- ☞ From 2004: National represent in Management Committee of COST action 842;
- ☞ From 2002: Responsible for national collection of stored product pests, mites and fungi;
- ☞ Oct/Nov 2002 (1 month): research fellowship; Laboratory of insect ecology and ethology - Université Claude Bernard - Lyon I (DR. C. Bernstein), INRA - Antibes (DR. L. Lapchin), France
- ☞ Aug 2001 (1week): Preparation of the research project Barrande; INRA – Antibes, Laboratoire de l'Université Claude Bernard - Lyon I, France
- ☞ From May 2001: Researcher - biological control; Research institute of crop production – Dep. of stored product pest control, Prague
- ☞ March/April 2001: Researcher – IPM – apple orchards; RICP – Prague – Dep. of entomology

Others:

- ☞ Postdoc grant of Czech grant agency (2004-2006) – Biological control of *Oryzaephilus susinamensis* by *Cephalonomia tarsalis*
- ☞ International research grant COST (2004-2006)
- ☞ Certificate of the participation in 17th Nordic postgraduate course - “Emergy analysis“ (Sweden, 1995/1996)

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SHLOMO NAVARRO

Position:

Dr. Shlomo Navarro, Ph.D. is a Principal Scientist in the Agricultural Research Organization (ARO), Volcani Center, Bet Dagan, Israel.

Professional Experience:

Dr. Navarro was instrumental in organizing the Department of Stored Products, and has served as Head of the department. He has chaired numerous professional and scientific committees at the ARO including the Research Projects Evaluation Committee on Food Technology, and the Stored Products Advisory Board of the Ministry of Agriculture. He fulfilled numerous positions, among them Director for Academic Affairs, Director for International Cooperation, and Deputy Director at the ARO.

Currently, he serves as chairman of the Committee for Promoting Commercialization of R&D Applications and Deputy Director for International Relations, ARO. He has conducted post harvest research in tropical and subtropical countries of the world. In 1972, he was co-founder of the Permanent Working Committee for the International Conference on Controlled Atmosphere and Fumigation (CAF). He has been Secretary of CAF since its inception. He has edited four books of proceedings of the CAF Conferences and one book of the International Conference on Stored Product Protection. His Handbook of *Aeration in sub-tropical Climates* for the Food and Agriculture Organization (FAO), United Nations was the leading authority for aeration in tropical and sub-tropical grain stores and was the forerunner of the book *The Mechanics and Physics of Modern Grain Aeration Management* published by CRC Press in 2002. In 2005 has submitted for publication the review chapter on *Modified Atmospheres for the Control of Stored-Product Insects and Mites*, for the American Association of Cereal Chemists, and the chapter on *Innovative Environmentally Friendly Technologies to Maintain Quality of Durable Agricultural Produce* for CRC Press. He has authored or co-authored 329 technical articles in scientific journals, conference proceedings, and books. He holds 10 Patents on developing storage structures and technologies. Dr. Navarro is the leading authority on hermetic storage in semi-permanent plastic storage structures for use with grains, seeds, dried fruits and other stable bulk products.



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ELIAS NCHIWAN NUKENINE

Position:

Entomologist

Education:

- ✎ M.Sc., PhD. Entomology, University of Ibadan, Nigeria
- ✎ B.Sc. Zoology, University of Yaounde, Cameroon

Position:

Senior Lecturer, University of Ngaoundere,
Visiting Scientist/Humboldt Fellow, BBA, Institute of Stored Product Protection, Berlin, Germany



Research Interests:

- ✎ Economic entomology and pest management: pest management of insects of stored maize with emphasis on grain resistance and phytochemical control;
- ✎ Ecology and management of field arthropods of cassava;
- ✎ Ecology and control of malaria vectors (mosquitoes).

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ZUZANA PAŽOURKOVÁ

Position:

Since 2005: Secretary of the Scientific Committee on Phytosanitary and Environment

Date and place of birth:

20.7.1979, Třebíč

Education:

- ☞ 2003: Ph.D. student, Czech University of Agriculture, Prague, Faculty of Agrobiolgy, Food and Natural Resources. **Thesis:** The Influence of Temperature on Physiological Processes and Behavior of Stored Product Pests.
- ☞ 2000 – 2003: Czech University of Agriculture, Prague, Plant Protection. **Thesis:** Thermal Requirements for the Development of *Pieris brassicae* and *Pieris rapae*.
- ☞ 1997 – 2000: Czech University of Agriculture, Prague, Gardencraft.



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JORDI RIUDAVETS

Position:

Senior scientist

Date of birth:

29.8.1965, Nationality: Spanish

Education:

- ☞ PhD. 1995, University of Lleida
- ☞ B. Sc. in Biology 1988, University of Barcelona



Professional experience:

Entomologist with experience in research, development and transfer of integrated pest management (IPM) programs for stored products and horticultural crops. During the last 15 years, he has been participating in several research projects with public funding (EU, National Government) and in research contracts with several private companies.

Research interest:

Main fields of expertise are biological control, biology of pests and natural enemies, monitoring of pests, rearing of insects, methyl bromide alternatives for the control of stored product pest and modified atmospheres.

Memberships:

He is member of the permanent committee of the Spanish Society for Applied Entomology, the Controlled Atmospheres and Fumigation Organization, and vice-convener of IOBC WG on Integrated Protection of Stored Products.

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VÁCLAV STEJSKAL

Position:

Head of the department

Date of birth:

16.12.1963

Professional experiences:

- ☞ 1989 - 1995: Food Research Institute - Prague
- ☞ Since 1995: Research Institute of Crop Production

Education:

- ☞ 1993 - 1999/2000: Charles University, Faculty of Science
- ☞ 1980 - 1986: Czech University of Agriculture - Prague

Stays and Courses:

- ☞ 1999: Central Science Laboratory, MAFF, York, Great Britain

Memberships:

- ☞ Member of ESA - Entomological Society of America (USA)
- ☞ Member of Czech Pest Control Association - Prague Member of CEPA (Brussels)
- ☞ Member of Organising Committee of Int. Conf. ICUP 1999 (Prague)
- ☞ Member of Editorial Board of DDD-Journal

Publications:

9 books and textbooks, more than 100 scientific and technical papers

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JAMES E. THRONE

Position:

Dr. Throne is Research Leader of the Biological Research Unit at the USDA-ARS Grain Marketing and Production Research Center in Manhattan, Kansas, and Adjunct Professor of Entomology at Kansas State University. He is internationally recognized for his research program on ecology and management of insect pests, the application of simulation modeling to entomological research, and the development of statistical methods for life sciences research.



Education:

- ✍ Ph.D., Cornell University, Entomology, 1983
- ✍ M.S., Washington State University, Entomology, 1978
- ✍ B.S., Southeastern Massachusetts University, Biology, 1976

Professional experience:

- ✍ 1997 – present, Research Leader, Biological Research Unit, USDA-ARS GMPRC, Manhattan, KS
- ✍ 1995 – present, Adjunct Professor, Dept. of Entomology, Kansas State University
- ✍ 1994 – 1997, Research Entomologist, USDA-ARS GMPRC, Manhattan, KS
- ✍ 1985 – 1994, Research Entomologist, USDA-ARS Stored-Product Insects Research & Development Laboratory, Savannah, GA
- ✍ 1983 – 1985, Postdoctoral Research Associate, Department of Entomology, North Carolina State University, Raleigh, NC

Selected research accomplishments:

- ✍ Simulation Models
- ✍ New Probit Analysis Method
- ✍ Entomological Applications of Near-Infrared Spectroscopy (NIRS)
- ✍ Maize Weevil Model

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PASQUALE TREMATERRA

Position:

Since 2000 - Full professor in General and Applied Entomology disciplines at the Faculty of Agriculture, University of Molise, Campobasso, Italy. Full professor in General and Applied Entomology.

Research interest:

Current work and main responsibilities: biology and ecology of insect pests; application of new methods in the control of insect pests; integrated Pest Management of insect pests in orchards; researchs about stored product pests and stored product protection; faunistic and systematic studies of Lepidoptera Tortricidae in Mediterranean areas.



Publications:

Wrote about 280 papers on systematic and applied entomology, 120 of which on problems related to monitoring and control of insect pests by new methods alternative to chemicals methods.

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NICO VROOM

Position:

He joined EcO2 BV with his extensive knowledge and practical experience in stored product protection against insect pests through participation at international meetings, research experience, collaboration and project development.

Professional experience:

Conducted his experience in pest control from his former job as a technical pest control advisor/specialist for Terminix International for 10 years.

Further more he has detailed knowledge of chemical, non-chemical and organic fumigation alternatives to Methyl Bromide applied for Post Harvest uses. Through his background as a pest control specialist and in the field of stored product protection through Controlled Atmosphere, Heat treatment and QPS treatment (ISPM 15), Nico Vroom has the ability to commercialize research-based systems for stored product protection. On this moment a team of 25 educated people are working daily to implant the EcO2 techniques world-wide.



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WAQAS WAKIL

Position:

November 2001 to now serving as Lecturer in Department of Entomology, University of Arid Agriculture, Rawalpindi, Pakistan

Date of Birth:

21.9.1972

Education:

- ☞ Ph.D. Agricultural Entomology, Department of Agricultural Entomology, University of Agriculture, Faisalabad, Pakistan. **Thesis:** Management of *Helicoverpa armigera* (Hüb.) in chickpea (*Cicer arietinum* L.) under rainfed areas of Punjab, Pakistan.
- ☞ Master of Science (Hons.) Agricultural Entomology, Department of Agricultural Entomology, University of Agriculture, Faisalabad, Pakistan (overall result 83%). **Thesis:** Evaluation of different insecticides against rice stemborers and rice leaf folder
- ☞ B.Sc. (Hons.) Agriculture, Department of Agricultural Entomology, University of Agriculture, Faisalabad, Pakistan (overall result 72%)



Awards:

- ☞ Merit scholarship holder throughout Master of Science (Hons.) Agricultural Entomology program at University of Agriculture, Faisalabad, Pakistan
- ☞ Awarded a merit stipend under the scheme „Support to Scientific Talent“ for the year 1997-98 by the University Grants Commission, Government of Pakistan

Professional experiences:

February 1999 to November 2001 - Served as Agricultural Consultant (Research and Development) in M/S Sunder Seed Product at Toba Tek Singh, Pakistan

Memberships:

- ☞ The Entomological Society of Pakistan
- ☞ The Zoological Society of Pakistan

Publications:

Member Board of Advisors of the book entitled “Basics of Agriculture”. 19 Extension Articles, 20 abstracts, 21 Research projects.

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LEANAGE KANAKA WOLLY WIJAYARATNE

Position:

Research Officer

Education:

- ✍ B.Sc. in Agriculture (specialized in Entomology), University of Ruhuna, Sri Lanka - 1999
- ✍ M.Sc. in Agriculture with specialization in Entomology, Post Graduate Institute of Agriculture (PGIA), University of Peradeniya, Sri Lanka - 2002

Research interest:

Research, training, advisory and consultancy work related to post harvest entomology.

Current research:

Control of Stored Product Insect Pests by using Smoke Generated from Paddy Husk Combustion.

Professional experience:

- ✍ Carried out a research on „Identification of *Liriomyza* Species (Diptera: Agromyzidae) in Sri Lanka“ at Horticultural Crops Research & Development Institute (HORDI) of the Department of Agriculture, Sri Lanka for the partial fulfillment of the requirements of the basic degree. (May, 1999 - December, 1999)
- ✍ Worked as a Research Assistant for one year in a collaborative research between University of Sri Jayawardenepura and Sugarcane Research Institute, Uda Walawa, Sri Lanka investigating the transmission of Cassava Mosaic Virus by Whitefly *Bemisia tabaci* G. (February, 2000 - January, 2001)
- ✍ Worked as a Research Assistant for six months in the Department of Agric. Biology of the University of Peradeniya, Sri Lanka and investigated the biological control of Aphids and Whiteflies by Coccinella beetles (Coleoptera: Coccinellidae). (July, 2001- December, 2001)
- ✍ Served as a member of editorial board of Post Harvest News Bulletin of Institute of Post Harvest Technology, Sri Lanka. (2003)
- ✍ Conduct lectures for the students of the faculty of Agriculture of Universities of Ruhuna, Peradeniya and Rajarata, Sri Lanka.

Foreign training:

- ✍ International Course on Research and Development in post harvest practices. Volcani Centre, Israel, 21.2.2005 - 17.3.2005

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AMOS WILAMOWSKI

Position:

Medical Entomologist at the Entomology Laboratory, Ministry of Health, Jerusalem

Date of Birth:

1945, Israel

Education:

- ☞ 1974: Graduated from Hebrew University, Jerusalem, with M.Sc. in Zoology.
Thesis subject: Rearing of fish in freshwater ponds
- ☞ 1968: Graduated from Tel Aviv University, with B.Sc. in Biology
- ☞ 1971-1975: Research assistant in Hebrew University, working on reptiles of Israel



Research interests:

Vector diseases in Israel, insects causing damage to property, insects in food and food production plants

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BOOK OF ABSTRACTS, CONFERENCE OF THE IOBC/WPRS WORKING GROUP
„INTEGRATED PROTECTION OF STORED PRODUCTS“

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