

**[4106] BIORATIONAL APPROACH TO SUPPRESSING AMERICAN COCKROACHES, *PERIPLANETA AMERICANA*, IN SEWAGE SYSTEMS**

M.K. Rust<sup>1</sup> & E.O. Paine<sup>2</sup>, <sup>1,2</sup> Dept. of Entomology, Univ of California, Riverside, CA 92521, USA, E-mail eileen.paine@ucr.edu

American cockroaches, *Periplaneta americana*, are a major pest of sewer and waste water facilities in the western United States. Chemical treatments of sewers are problematic because of the potential contamination of water and pesticide exposure to sewer personnel. In cooperation with the City of Santa Monica, we treated sewers with 0.01% fipronil and 2.15% imidacloprid gel baits, combinations of gel baits and oothecal parasitoid, *Aprostocetus hagenowii*, and the oothecal parasitoid alone. The design of the bait station was important in preventing baits from becoming moldy and allowing cockroaches access to the bait. Strips of evaporative cooling pad glued to the surface of plastic cards provided an excellent matrix to apply the bait. The fipronil and imidacloprid baits provided 87 and 89 % reduction in the number of cockroaches observed at 21 weeks, respectively. Combinations of fipronil and imidacloprid baits with the oothecal parasitoid provided 76 and 92 % reductions at week 18. The amount of alternate food may be in part responsible for the slow but steady decline in cockroaches in the sewers with bait. Monitoring with sentinel oothecae to detect established populations of *A. hagenowii* failed to show parasitoid establishment, after 2 separate parasitoid releases. The parasitoid releases will be re-evaluated after 1 year. *Aprostocetus hagenowii*, fipronil, imidacloprid.

**[4108] MODELLING POPULATION GROWTH OF *RHYZOPERTHA DOMINICA* (COLEOPTERA: BOSTRICHIDAE) ON STORED WHEAT**

A. A. L. da Silva<sup>1</sup>, L. R. D'A. Faroni<sup>1</sup> & R. N. C. Guedes<sup>2</sup>, <sup>1</sup>Dept. de Engenharia Agrícola, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil, E-mail: lfaroni@mail.ufv.br; <sup>2</sup>Dept. de Biologia Animal, Universidade Federal de Viçosa, Viçosa, MG 36571-000, Brazil.

Models are important tools for evaluating, predicting, and understanding the population dynamics in natural ecosystems or on artificial ones created under a variety of environmental conditions and management strategies. Models allow the comparison among different control strategies. These models are particularly useful for predicting the efficiency of non-chemical control methods such as biological control and aeration. New insect monitoring techniques have been recently developed for stored grains and the aim of the present work was the development of suitable population growth models of *R. dominica* for these new monitoring techniques. We tested models based on number of adult insects which could predict the population growth from environmental conditions and the numbers of adult insects per kg grain determined by monitoring systems. *R. dominica* population growth was assessed in wheat at 10.6% of water content, at 32°C temperature and 70% relative humidity. Initial adult insect densities were 0, 2, 4, 6, 8, 10, 12, and 14 insects/1.5 kg wheat and the storage periods were 15, 30, 45, 60, 75, and 90 days. The results obtained provide support for the significant effect of initial population density and storage period. The model  $P = (0.48t^2 - 23.71t) * (-0.12P_0^2 + 1.61P_0) + 600.12$  ( $r^2 = 0.89$ ) provides a population *P* of adults/kg wheat originated from an initial population *P*<sub>0</sub> after *t* days of storage. This model was obtained from malthusian conditions and can be applied in storage studies since storage units provide virtually unlimited food source for stored insect-pests.

Index terms: Lesser grain borer, temperature, initial infestation, storage period.

**[4107] EFFICACY OF PHOSPHINE AND CARBON DIOXIDE TO CONTROL ALL LIFE STAGES OF *SITOPHILUS ORYZAE***

J. P. Santos<sup>1</sup>, D. S. Santos<sup>1</sup> & J. T. Jorge<sup>2</sup>, <sup>1</sup>Embrapa Milho e Sorgo, C. Postal 151, 35701-970, Sete Lagoas, MG, Brazil, E-mail: jAMILTON@CNPMS.EMBRAPA.BR; <sup>2</sup>FEAGRI, Cidade Universitária Zeferino Vaz, UNICAMP, C. Postal 6011. 13081-970. Campinas, SP, Brazil.

The stored grain pests is an important problem to solve especially in the tropics where the infestation starts in the field and multiply very fast during storage because the favorable climate over year. Fumigation with phosphine (PH<sub>3</sub>) is the most employed insect control method. Inadequate structure, poor sealing and insect resistance development are the main operational concern. To increase the chance to overcome these constraints some tests using a mixture of PH<sub>3</sub> and carbon dioxide (CO<sub>2</sub>) were performed aiming to control all life stages of *S. oryzae*. Fumigation chambers measuring 25 cm high x 30 cm diameter were built with PVC tubes. Valves for injection and exhaustion of gases were mounted low on the side and on top, respectively. The experimental chambers were filled with wheat grain at 13.5% moisture and infested samples with all developmental life stages (eggs, 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, pupa and adults insects) were individually involved in soft cloth and placed inside the chambers. Fumigation tests were conducted for 48, 72 and 96 hours under a combination of 100, 200, 400 and 600 ppm PH<sub>3</sub> in an atmosphere saturated with 10, 20, 30 and 40% CO<sub>2</sub>. First the natural atmosphere, in each test chamber, was substituted for the respective CO<sub>2</sub> concentration from cylinders. Following, PH<sub>3</sub> was transferred from a PH<sub>3</sub> release apparatus using an industrial gas syringe at the correct doses. Adequate control of eggs was obtained only at the fumigation time of 96 hours, and under 400 or 600 ppm PH<sub>3</sub> in combination with CO<sub>2</sub>. The 1<sup>st</sup> instar larva was, in general, less tolerant to the combination of PH<sub>3</sub> and CO<sub>2</sub>. Adequate control was obtained in all treatments, except when the low doses of CO<sub>2</sub> and PH<sub>3</sub> were combined. The efficacy of the mixture of PH<sub>3</sub> and CO<sub>2</sub> to control the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> instar larva followed the pattern observed for the 1<sup>st</sup> instar larva. Sufficient control of the pupa stage was accomplished only under 96 hours fumigation time and when PH<sub>3</sub> was mixed with CO<sub>2</sub>. Adults were easy to control in all fumigation time tested, specially when PH<sub>3</sub> and CO<sub>2</sub> were associated, but CO<sub>2</sub> alone provided efficient control at 30 and 40% concentration and under 72 and 96 hours fumigation time. A conclusion drawn is that the mixture of PH<sub>3</sub> and CO<sub>2</sub> can be used to control all life stage of *S. oryzae* and that was observed a synergistic effect of CO<sub>2</sub> when added to PH<sub>3</sub>.

Index terms: Rice weevil, fumigation, controlled atmosphere, stored grain

**[4109] THE EXTRACTION OF PYRALID EGGS FROM FLOUR: THE EFFECTIVENESS AND IMPACT ON EGG EXTERNAL MORPHOLOGY**

V. Stejskal, Z. Kučerová, Dept. of Stored Product Pest Control, Res. Inst. of Crop Production, Drnovská 507, CZ-161 06 Prague 6, Czech Republic, E-mail stejskal@hb.vurv.cz

Food and agricultural commodities are often infested by stored product pests of various instars, but commodity samples frequently contain only eggs of the pest. Usually the eggs are very difficult to find in, or extract from the commodity sample. The egg separation is necessary for determination of the pest species and detection of the infestation level. The goal of the project was (1) to test efficiency of a new extraction method to disclose pest eggs in flour samples, and (2) to evaluate an impact of the extraction process on external morphology of eggs (sizes and surface structure). A modified flotation method based on sodium chloride solution was tested for egg separation. Three types of flour and eggs of two pyralid moths (*Ephesia kuehniella*, *Plodia interpunctella*) were used in our experiment. Flotation tests were done both with fresh and highly matured eggs. Size measurements and SEM micrographs of eggs were done before and after flotation to compare potential morphological differences. The results showed that the flotation method was highly effective for both egg species (*E. kuehniella* – 82-97%, *P. interpunctella* – 78-93% of extraction). The efficiency of extraction depended on the type of flour and the age of eggs; it increased with the decrease of age and the degree of flour milling. Size differences in eggs before and after flotation were insignificant and there were no visible changes on the surface morphology of the eggs after flotation. This method proved to be useful for the detection and evaluation of pest egg infestation in flour samples and pest determination according to egg morphology.

Index terms: *Ephesia kuehniella*, *Plodia interpunctella*, flotation.