

Use of caffeine for the management of rice weevil *Sitophilus oryzae* (L.)

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ABSTRACT

Caffeine, a naturally occurring alkaloid was tested in the laboratory for its efficacy against rice weevil *Sitophilus oryzae* (L.), a devastating primary pest of stored grains. The chemical was found to be effective at 1.5 and 2.0% and resulted in >80% cumulative mortality with in a period of 5 days after its application. Total mortality was observed in two-week period. The nutritional indices RGR, RCR and ECI were high at 1.5 & 2.0% caffeine concentrations. The FDI index was negative for all the doses of caffeine confirmed the stimulant nature of the chemical to rice weevil. The filter paper method did not show any significant repellency of the chemical. However it can be recommended for alternation with other chemicals and as synergist in stored product pest management.

Key words: Rice weevil, Caffeine, Mortality, Whole kernel bioassay, Nutritional indices, Repellency studies.

INTRODUCTION

Rice weevil, *Sitophilus oryzae*.L. is a serious pest of large grain storage areas having world-wide distribution (Cotton, 1963). The insect damage to stored grains and their products amounts to 5-10% in temperate zone and 20-30% in tropical zone (Nakakita, 1998) in addition to the quality deterioration. Many countries, such as Australia, Canada and France, impose zero tolerance for imported grains.

This problematic pest is generally managed using synthetic insecticides. However, increased concern by consumers over insecticide residues in processed cereal products and the occurrence of insecticide resistant insect strains (Subramanyam and Hagstrum, 1995) new and alternative approaches are gaining momentum.

Many phytochemicals from plant sources are used in many parts of the world from ancient days and these ethno botanicals are easily available to farmers, less expensive and compatible with international trade and regulations. Hence they continue to be a valuable tool in integrated and biological pest management programs. Many plant secondary metabolites play an important role in plant-insect interactions and therefore such compounds may have insecticidal, hormonal or antifeedant activity against insects (Camps, 1988).

Caffeine (1, 3, 7-trimethylxanthine), is one such phytochemical in the plants like coffee, tea, and cacao found to have pestistatic and pesticidal action (Nathanson, 1984), It also causes sterility in some insects and possess antibacterial and antifungal properties. It also acts as repellent or toxicant for slugs and snails (Hollingsworth

et al., 2002) and an effective bird repellent (Avery and Cummings, 2003; Avery *et al.*, 2005).

Based on these considerations, the current study was undertaken to assess the potential and effectiveness of caffeine and to explore the possibilities of utilizing this as an alternate chemical for rice weevil, a treaded primary pest of stored cereals.

MATERIALS AND METHODS

Rice weevil, *Sitophilus oryzae* (Coleoptera: Curculionidae) culture obtained from Agriculture and Agri-Food Canada, Winnipeg, maintained in the laboratory at Bio systems engineering department of McGill University, Canada was used for conducting experiments. Insects were reared on Hard Red Spring wheat variety at 13-14% moisture content at 25° C and 55±5% R.H. The chemical caffeine (1, 3, 7-trimethylxanthine) purchased from Sigma Chemicals was used for the experiments.

Whole kernel bio assay :

Caffeine was mixed with whole wheat kernel at varying concentrations of 0.1, 0.5, 1.0, 1.5, 2.0, 5.0 and 10.0g/100g of grain and the untreated one was maintained as control to eliminate mortality due to other factors. Each treatment was replicated five times. Twenty gram of grain was weighed and treated with the chemicals thoroughly for about two minutes. The treated grain was placed in a paper cup and covered using a muslin cloth for free air circulation. Ten unsexed adults from mixed age population were released into each cup.

Observations were made after 1, 3, 5,7,14 days of treatment and at each observation dead insects were

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