Insecticidal and larvicidal activities of Cinamic acid esters isolated from Ocimum gratissimum L. and Vitallaria paradoxa leaves against Tribolium castaneum Hebst (Coleoptera:Tenebrionidae)

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Insect pest of stored products is one major threat to food safety globally. Various techniques are being employed to address these pest problems. Pest management using botanicals have been widely practiced in recent times. The natural compounds present in these botanicals have been known to be responsible for the protection they offer against insect pests. Some of these compounds may act as single compounds to produce an effect or may be synergistically effective. In the present study using a bioassay guided approach, two cinnamic acid derivatives; Methyl cinnamate and Sitosterol cinnamate were isolated from the leaves of O. gratissimum and V. paradoxa respectively. Adults and a week old larvae of T. castaneum were dipped in the samples and transferred into clean petri dishes containing wheat flour and observed for mortality or larval growth activity. These compounds show high levels of insecticidal, larvicidal and larval growth inhibition activities against T. castaneum. The LC50 of methyl cinnamate was determined to be 26.92 mg/mL against the adult, 8.31mg/mL against the larvae whiles the LC50 of sitosterol cinnamate was determined to be 6.92 mg/mL against the adult and 3.91 mg/mL against the larvae. Generally, the susceptibility of adult T. castaneum to these cinnamic acid esters can be directly associated with the concentration as well as time of exposure to the compounds. Several studies have confirmed the safety of cinnamic acid esters by evaluating acute toxicity, skin irritation and genotoxicity and therefore can be used safely for stored product protection.

Assai (Euterpe oleracea Mart.) fruit: Green method development by Andiroba oil (*Carapa guianencis* L.) for Hemiptera control

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The assai (*Euterpe oleracea* Mart.), in Portuguese açaí, is a Brazilian fruit grown mainly in the Amazon forest (Northern region) and Cerrado (Northeastern region) which has a quite high staple & economic importance to the country. It is part of the region's culture and the fruit is consumed in salty dishes (mixed with cassava or tapioca flour and also with fried fish) by the natives. Although the main consumption is in those regions, its frozen pulp is the best-known worldwide available product (exported to the United States & European Union, mainly) and has increased in recent years. Apart from Amazon forest natives high lipid and protein food source, assai fruit is rich in antioxidants (anthocyanins & flavonoids), with high levels of vitamin C and fibers - that makes it highly consumed by the youngsters and sports people (as diet supplement - frozen pulp / ice-cream). Despite that, insects (Hemiptera *Triatoma brasiliensis*) infestation with subsequent disease development caused by *Trypanosoma cruzi* (parasite present in the mosquitoes faeces) may take place at the assai fruit stage. Considering the lack of information on assai fruit contamination and mosquito (parasite vector) control, the current study aimed to develop a green method through Andiroba oil (*Carapa*

guianencis L.) to control/repel that Hemiptera from the fruits (thus replacing chemical insecticides exposure). Andiroba oil and assai fruits utilized were from Belem city, Para state, Northern region of Brazil. They were divided into 2 main groups: treated (Treated Group - TG) and not treated (Control - C). The TG was sub-divided into TGI, TGII, TGIII, TGIV and TGV for the application of oil at different concentrations (10, 25, 30, 50 e 100%, respectively) and time of exposure (n=3). After oil treatment under controlled environment, the assai fruits insects were left standing 24 h, with their behavior variation observed (each 2 h) and the most effective concentration registered by decreasing order of efficacy was selected. As expected, on the assai surfaces`, the insect movements (distance) and speed reduced with the percentage of dead ones reaching to 100% as the oil concentration raised. The Andiroba oil green method could be a safe treatment to be utilized for assai insect infestation (instead of chemical insecticides) as the whole fruit is utilized n the de-pulping process.

Colour changes in pulses fumigated with different metal phosphide formulations

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Abstract

Many phosphine-emitting products are used globally to control insect pests in dried vegetables, grains and pulses. However, variation in phosphide formulations is associated with colour change in many pulses. This study evaluated the effect of fumigation using Mg_3P_2 containing ammonium carbamate; AlP containing no ammonium carbamate and pure ammonium carbamate on colour of diferrent pulses. Different pulses showed different reactions towards fumigation with phosphine. A distinctly darker discolouration was observed in broad beans and lentils when fumigated with ammonium carbamate containing Mg_3P_2 and pure ammonium carbamate, whereas there were no apparent colour changes in white kidney beans, soybeans and green peas. The use of ammonium carbamate-free AlP resulted in no changes in any of the pulses. Therefore, formulation type of the phosphine product plays a major role in the visible colour change of the pulses.

Keywords: phosphine, ammonium carbamate, pulse varieties, colour change

Introduction

In many fields of stored product protection one of the most important substances in use worldwide to control stored product pests is the fumigant phosphine. The most established method of distribution is the use of solid-based aluminium phosphide and magnesium phosphide products in the form of tablets, pellets, bags or plates. After distribution, existing stored product moisture or ambient moisture contribute to the release of the actual active substance itself: phosphine gas. The advantages of this gas are its excellent penetrative ability and its extraordinarily high rate of efficiency against all stock-damaging insects. In this respect, all developmental stages of storage insect pests can be easily controlled; these properties even deal reliably with those developmental stages living hidden within the stored products.

Phosphine also has favourable properties regarding innocuity and the formation of no residues in treated food and animal feed products. The gas has no negative impact on the treated products and volatilizes quickly after use. Therefore, no residues are to be expected in fumigated goods. Besides, quality parameters such as germability or taste are not negatively influenced by the gas. However, according to oral reports, colour changes have arisen in different types of pulses after fumigation with metal phosphide products. This present study emonstrates the extent phosphine is may be responsible or the circumstances under cwhich certain changes in product colour may be triggered by substances emitted from the product formulation enhancers.

Materials and Methods

Five types of pulses were selected for the studies: green peas (*Pisum sativum*), broad beans (*Vicia faba*), lentils (*Lens culinaris*), white kidney beans (*Phaseolus vulgaris*) and soybeans (*Glycine max*)