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Evaluation of insecticidal activity of aqueous extracts of *Chenopodium* spp. in relation to *Rhyzopertha dominica* (Fabr.) (Coleoptera: Bostrichidae)

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Abstract

This work was carried out to evaluate the insecticidal activity of extracts from leaves and fruits of *C. ambrosioides* L., *Chenopodium quinoa* Willd and *Chenopodium album* L. against *Rhyzopertha dominica* (F.) adults under laboratory conditions. Powders were obtained from plants cultivated in the experimental area of the ESALQ/USP. Powders were immersed in distilled water (at 10 % w/v) to obtain the extracts. Insecticidal effect was evaluated by using plastic boxes (6.0 cm diameter and 2.0 cm high) containing wheat (15 g of whole grains plus 5 g of ground grains) previously sprayed with extracts of *Chenopodium* spp. and infested with twenty adults of *R. dominica*. The control treatment was done by wheat sprayed with distilled water only. The evaluations of the adult mortality were done daily during 5 days. The emergence of adults was evaluated in the period of 25 to 60 days after the initial infestation. The results were submitted to variance analysis and averages compared by Tukey's test (5 %). The results indicated that extracts of leaves and fruits from *Chenopodium* spp. did not present effect on the survival and emergence of *R. dominica* adults.

Key words: Insecta, Chenopodiaceae, botanical insecticide, pest control, lesser grain

borer.

Introduction

In Brazil the losses caused by insect pests is about 10 to 20 % of the total grain production evidencing the relevancy of the damages (Gallo et al., 2002). One of the main pests associated to stored grains is the lesser grain borer *Rhyzopertha dominica* (F.) (Col., Bostrichidae) due to its high biotic potential and to its broad host range since it can attack wheat, barley, rice and oat (Lorini et al., 2002) what increase the need for efficient control.

R. dominica has a large destructive potential in wheat grains because it is able to damage 5 to 6 times its self weight within a week. The pest feeds inside and outside grains and is an important pest of cereals and its products. Adults and larvae feed on the grains reducing them just to their self hollow barks. The grains remain holed and with flour-like residues due to the pest alimentary habit.

Stored grains pest control has been realized in large scale by chemical products. Current researches and the increasing knowledge about the harm derived from the indiscriminate use of these products (as environmental and human contamination, existence of residues in foods and the consumer concern with food quality) have

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encouraged studies related to novel tactics of pest control like the use of botanical insecticides.

These natural insecticides, so called insecticidal plants, present several advantages in relation to synthetic compounds as their rapid biodegradation reducing the risks of environment and food contamination besides the easy way of obtaining and preparation.

Studies with these botanical insecticides have two basic objectives: a) direct application in pest control by using powders, aqueous extracts and oils in small areas or in organic crops; b) as source for novel molecules aiming for the development of novel products more selective and less toxic than synthetic insecticides currently used (Vendramim and Castiglioni, 2000).

The utilization of botanical insecticides in stored grains pest control demonstrates to be very promising, mainly due to the possibility of controlling environmental conditions inside the stores units, maximizing the insecticidal effect. In these places the natural product can be used as powders, extracts and oils.

Several plants may have insecticidal or repellent activities against insects and among them, the Mexican-tea *Chenopodium ambrosioides* L. is an important vegetal species with both repellent (Su, 1991; Novo et al., 1997; Mazzonetto, 2002) and insecticidal (Delobel & Malonga, 1987; Peterson et al., 1989; Tapondjou et al., 2002; Mazzonetto and Vendramim, 2003; Silva et al., 2003; Tavares and Vendramim, 2005a) potential for controlling stored grain pests of different families as Anobiidae, Bostrichidae, Bruchidae, Curculionidae and Tenebrionidae. However, some researches with others species of the genus *Chenopodium* as *Chenopodium album* L. and *Chenopodium quinoa* Willd. can also be found in literature.

Since researches have demonstrated the possibility of using botanical pesticides in stored grains pest control this work was carried out to evaluate the insecticidal potential of aqueous extracts of leaves and fruits from *C. ambrosioides*, *C. quinoa* and *C. album* (Chenopodiaceae) in relation to *R. dominica* adults under laboratory conditions.

Materials and methods

Trials were carried out at the Insecticide Plants Laboratory of the Departamento de Entomologia, Fitopatologia e Zoologia Agrícola of the Escola Superior de Agricultura “Luiz de Queiroz” – Universidade de São Paulo, under 25 ± 2 °C, 60 ± 10 % r.u. and photophase of 12 h.

Insects used in the bioassays were obtained from a stock culture maintained on wheat grains inside 300 ml glass bottles covered with fine cloth under laboratory conditions.

Powders of leaves and fruits of *C. album*, *C. quinoa* and *C. ambrosioides* were obtained from plants grown in the experimental area of the Departamento de Entomologia, Fitopatologia e Zoologia Agrícola. The vegetal material was dried in a stove under 40 °C and subsequently ground to obtain a fine powder. Powders of leaves and fruits of each vegetal species were stored in glass recipients.

Aqueous extracts were done by immersing powders into distilled water (10 g of powder per 100 ml of water) and filtrating the mixture with a fine cloth 24 hours later. Extracts were used within 2 hours post filtration.

Evaluation of the insecticidal activity of aqueous extracts from leaves and fruits of the three *Chenopodium* species on *R. dominica* adults was done by previously spraying wheat grains (15 g of whole grains plus 5 g of ground grains) with extracts (10 % w/v) aided by a “mini-atomizer” (Arprexâ pistol, model 5, 0.8 mm point, connected to an air compressor, model 0411, type 2VC). Control treatment was done by spraying wheat grains with distilled water. Sprayed grains were stored in plastic boxes (6.0 cm diameter and 2.0 cm high) and then infested with 20 adults of *R. dominica* not separated by sex and with 5 to 30 days after emergence. Adult mortality was verified daily during 5 days by counting the number of died insects in each box. Adult emergence was evaluated in the period of 25 to 60 days after the initial infestation by daily counting and taking from boxes the emerged adults. Six replications were used per treatment.

Results were submitted to variance analysis and averages compared by Tukey’s test (5 %).

Results

Aqueous extracts of leaves and fruits of the three species of *Chenopodium* evaluated did not present insecticidal effect in relation to *R.*

dominica adults since values found for extracts (varying between 0.5 and 2.9 %) did not differ from that observed for the control (distilled water) with 2.3 % (Figure 1).

In relation to adult emergence, values obtained for extracts 2 months after the initial infestation (93.4 to 101.8 insects per recipient) did not differ from control (93.4 insects) (Figure 2).

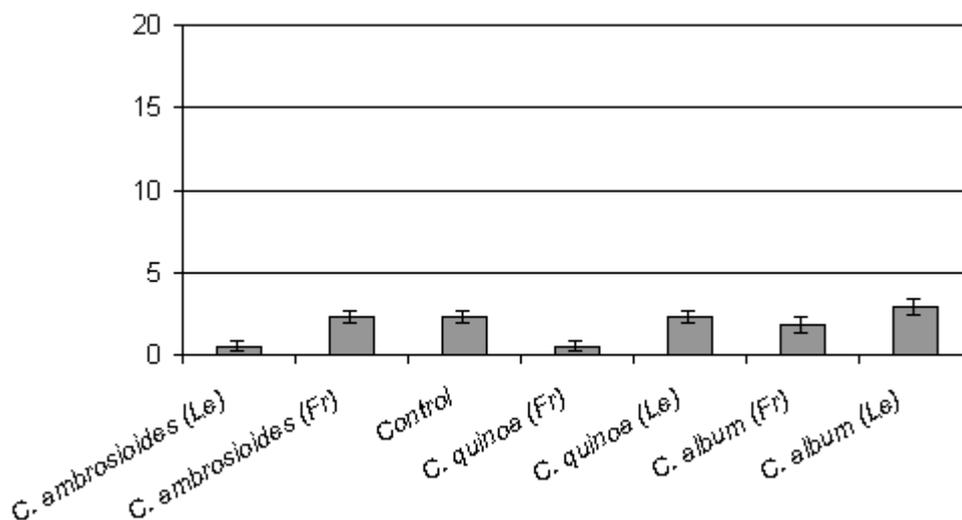


Figure 1. *Rhyzopertha dominica* adult mortality (%) in wheat grains sprayed with aqueous extracts of leaves (Le) and fruits (Fr) of *Chenopodium* spp. 5 days after infestation.

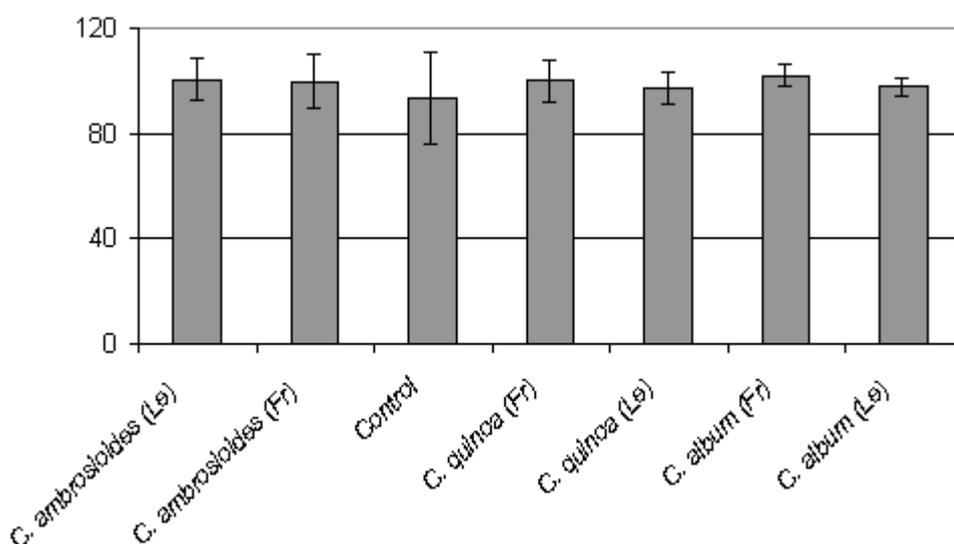


Figure 2. *Rhyzopertha dominica* adult emergence from wheat grains sprayed with aqueous extracts of leaves (Le) and fruits (Fr) of *Chenopodium* spp.

Discussion

Tavares and Vendramim (2005b), evaluating the insecticidal effect of aqueous extracts of branches, leaves and fruits of *C. ambrosioides* in relation to *Sitophilus zeamais* adults, also verified small mortality and high emergence of maize weevil adults from wheat grains sprayed with *C. ambrosioides* extracts.

Peterson et al. (1989), working with organic extracts, isolated four fractions from hexanic and etanolic extracts of fruits of *C. ambrosioides* with insecticidal effect against *S. zeamais* and *Tribolium castaneum* adults.

Results obtained in the present research and in the work of Peterson et al. (1989) suggest that compounds with insecticidal activity present in *C. ambrosioides* cannot be extracted by a high polarity solvent and must be taken with middle to low polarity solvents (as chloroformium and hexane).

We can conclude that aqueous extracts obtained from leaves and fruits of *C. ambrosioides*, *C. quinoa* and *C. album* did not affect the adult survival and the development of *R. dominica*.

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