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# Bio-activity and Bio-efficacy of Vegetal Powders against *Callosobruchus maculatus* in Pigeon Pea and Seed Physiological Analysis

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**The objective of this work was to evaluate the insecticide activity of powder-vegetables on *Callosobruchus maculatus* in *Cajanus cajan* beans, and the physiological quality of the treated seeds under laboratory conditions. Powder of *Piper nigrum* seeds, *Eugenia caryophyllata* floral parts, and *Lycopersicum esculentum* leaves caused mortality of 100, 100 and 80.9%, respectively; they reduced oviposition in 100, 100 and 98.21% and adult emergence in 100%. The emergence and the emergence velocity index of plantlets from seeds treated with these powders achieved satisfactory efficiency. However, seeds treated with *Pimpinella anisum*, *Coriandrum sativum, Eucalyptus globulus, Cuminum cyminum* and control did not emerge.**

**Key words**: Insecta, Cowpea weevil, Insecticide plants.

Despite higher crop area under pulses, their yields in India are very low. Many reasons are attributed for low yields, but the conspicuous ones are the least care taken for protecting the pulse crop from pest attack, unscientific thrashing and improper storage. Most important among the pests associated to the attack on stored bean in India is the bruchid beetle *Callosobruchus maculatus* (Coleoptera: ruchidae). It stands out for attacking intact seeds, bringing poor quality and consuming embryo nutrient reserves, and consequently producing seed low germination and weak plantlets. The control of this pest has been accomplished in wide scale with fumigant insecticides, however these product misuse can result in the rise of resistant populations. In other countries, producers already use plants for protection of stored grains against pest attack. They use powders rather than other plant products for the application ease and depending on the type of substratum to be protected (Procópio et al. 2003). Botanical insecticides are of great interest to many, because they are "natural" insecticides, toxicants derived from plants. Historically, the plant materials have been in use longer than any other group, with the possible exception of sulphur. Tobacco, pyrethrum, derris, hellebore, quassia, camphor, and turpentine were some of the more important plant products in use before the organized search for insecticides began. In the India, the use of leaves and seeds of herbs in the pest control of stored bean and corn is common practice among small farmers. Bioactive compounds kill, repel, inhibit oviposition, and reduce larval development,

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fecundity and adults' fertility (OLIVEIRA et al.,1999). In view of the alternatives to reduce conventional insecticides used in the storage of *Vigna radiata* beans, the objective this work was to evaluate the efficiency of seven plant species on the survival, adult oviposition and emergence of *C. maculatus*, and the efficiency on seed physiological quality of beans treated with plant powders.

## MATERIAL AND METHODS

The experiments were conducted at the Laboratory of IBAS, Sikar during2009-2010, To obtain the insects in adequate number and age, a colony-stock was maintained in B.O.D.acclimatized chambers, at 28°±2° C and 65 ± 5% rela tive humidity. The insects were maintained for several generations in 2L glass bottles containing non-treated *Vigna radiata* beans.Powder of *Piper nigrum* seeds, *Eugenia caryophyllata*. floral part, *Pimpinella anisum* seeds, *Coriandrum sativum* seeds, *Cuminum cyminum* seeds, *Eucalyptus globulus* leaves, and *Cinnamomum zeylanicum* leaves in the concentration of 2,5% (w/w) were evaluated against *C. maculatus*. The control consisted of feeding substratum only. A completely randomized design with six replicates was used. Samples of 20 g of seeds were mixed to the powders in plastic recipients, in which ten *C. maculatus* adults with 0-24 hours of age were kept, following the methodology described by Oliveira (1999) for *Zabrotes subfasciatus* (Bohemann, 1833). After five days of confinement, dead insects and eggs (eggs/grain) were counted. The emerged adults (no. holes/grain) were counted on the 60th day. The mortality data (transformed into y = arch sino *x* /100), egg number and adult emergence were analysed by ANOVA and compared with the Tukey's test (P <0.05) (PIMENTEL-GOMES, 1990). The efficiency (%) of the treatments was calculated in relation to the control. To evaluate the efficiency of the treatments on the physiological quality of seeds, the emergence and the emergence velocity index were appraised from the 60th day after setting up the experiment, in which the seeds were sowed in plastic trays (18.5cm x 19.0cm x 11.0cm) placing a seed per hole (2,0 cm deep). The percentage of plantlet emergence was evaluated on the 7th day after sowing, according to BRAZIL (1992), and the emergence velocity index (IVE) was determined by daily recording the number of emerged seeds (plantlets showing totally free cotyledons) until the seventh day, and calculated according to MAGUIRE (1962). A completely randomized design with four replications was used, each sample consisting of 50 seeds. The results were analysed by ANOVA and compared with the Tukey's test (P<0.05) (PIMENTEL-GOMES, 1990).

## RESULTS AND DISCUSSION

The best results for adult mortality were obtained with seeds treated with the powders of *P. nigrum*, *E. caryophyllata* and *C. zeylanicum*. The samples treated with *P. nigrum* and *E. caryophyllata* powders achieved 100% efficiency, and the *C. zeylanicum* powder gave 80.9%. The

**Table 1.** Insecticide action of plant powders against *C. maculatus* in *Vigna unguiculate* bean

| Treatment | mortality (%) | Efficiency | Number of eggs | Efficiency (%) | Adult emergence | Efficiency (%) |
|---|---|---|---|---|---|---|
| *P. nigrum* | 90,00 A | 100,00 | 0,00 C | 100,00 | 0,00 B | 100,00 |
| *E. caryophyllata* | 90,00 A | 100,00 | 0,00 C | 100,00 | 0,00 B | 100,00 |
| *C. zeylanicum* | 72,81 B | 80,90 0, | 12 C | 98,21 | 0,00 B | 100,00 |
| *P. anisum* | 56,93 C | 63,25 | 5,80 A | 13,69 | 8,01 A | 2,43 |
| *C. sativum* | 53,99 C | 59,98 | 5,25 A | 21,87 | 5,23 A | 36,29 |
| *E. globulus* | 49,38 C | 54,86 | 2,55 B | 62,05 4, | 65 A | 43,36 |
| *C. cyminum* | 47,94 C | 53,26 | 5,57 A | 17,11 | 7,73 A | 5,84 |
| Testemunha | 0,00 D | 0,00 6, | 72 A | 0,.0 8, | 21 A | 0,00 |
| Average | 57,63 | | 3,25 | | 4,22 | |
| CV (%) | 10,94 | | 31,27 | | 36,20 | |

treatments derived from *P. anisum*, *C. sativum*, *E. globulus* and *C. cyminum* powders did not differ statistically from each other, however they were shown efficient compared to the control. Powders of *P. nigrum*, *E. caryophyllata* and *C. zeylanicum* were statistically similar for egg number, where the samples treated with powder of *C. zeylanicum* gave a very small number of eggs (98.21% efficiency), and samples treated with *P. nigrum* and *E. caryophyllata* had no oviposition (100% efficiency). Adult emergence was also not observed in samples treated with *P. nigrum*, *E. caryophyllata* and *C. zeylanicum*. *E. globulus* powder showed good efficiency for the number of eggs (62.05%) and adult emergence (43.36%).

The treatments causing greater mortality were more efficient for decreasing ovipositionand consequently adult emergence. Even without knowing the mode of action of these powders, it is believed that their efficiency can be related to the repellent effect of their volatile compounds and to the abrasive effect of their particles on insect cuticle, accelerating water loss by evaporation (Oliveira et al., 1999). Regarding the reduction in egg number, it is also believed in the existence of substances causing sterility in males as well as in females. Oliveira et al. (1999) studying the effect of plant powders against *Z. subfasciatus* in *Phaseolus vulgaris* grains L. found that *P. nigrum* and *C. zeylanicum* caused mortality of 100 and 98% respectively, and reduced oviposition in 100%, and consequently the adult emergence. The emergence of plantlets derived from seeds treated with powders of *P. nigrum*, *E. caryophyllata* and *C. zeylanicum* achieved efficiency of 100, 98.38 and 94.24% respectively. However, seeds treated with the other powders did not emerge. The efficiency of emergence velocity index was greater for *P. nigrum* (100%), followed by *E. caryophyllata* (93.3%) and *C. zeylanicum* (86.76%), not presenting allelopathic effect on the seeds (Table 2).

**Table 2.** Physiologic analysis of the treated seeds with vegetable powders

| | Emergency Seedlings (%) | Efficiency (%) | IVE (%) | Efficiency (%) |
|---|---|---|---|---|
| *P. nigrum* | 96,56 A | 100,00 | 6,12 A | 100 |
| *E. caryophyllata* | 95,00 A | 98,38 | 5,71 B | 93,30 |
| *C. zeylanicum* | 91,00 A | 94,24 | 5,31 C | 86,76 |
| *P. anisum* | 0,00 B | 0,00 | 0,00 D | 0,00 |
| *C. sativum* | 0,00 B | 0,00 | 0,00 D | 0,00 |
| *E. globules* | 0,00 B | 0,00 | 0,00 D | 0,00 |
| *C. cyminum* | 0,00 B | 0,00 | 0,00 D | 0,00 |
| Testemunha | 0,00 B | 0,00 | 0,00 D | 0,00 |
| Average | 35,31 | | 2,14 | |
| CV (%) | 10,00 | | 7,10 | |

*Means not followed by the same letter differ statistically by the Tukey's test ($P<0.05$).

The fact that plantlets derived from seeds treated with *P. anisum*, *C. sativum*, *E. globules* and *C. cyminum* did not emerge is certainly related to the serious infestation of *C. maculatus* in the treatments in which there was no control for insect mortality. MYERS (1995) mentioned that with larva penetration in the seeds, development and feeding on the cotyledons occur before adult emergence, which causes decrease of germinative capacity Smiderle & Cícero (1999) reported that the reduction in germinative capacity is relatedwith the percentage of infestation.

## CONCLUSIONS

The most efficient treatments for controlling insects and physiological quality of seeds were *P. nigrum*, *E. caryophyllata* and *C. zeylanicum*. *E. globulus* powder gave promising results for oviposition and adult emergence.

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