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Studying the Efficacy of Traditional and Non-Traditional Control Methods against Some Stored Grain Insects

PRESENDED BY

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SUMMARY

The main problem that faces storage process is the attack of stored product insect species which cause great losses both qualitative and quantitative. *S. oryzae* and *C. maculatus* are considered two of the most important stored product insects.

The common method for controlling inside the store largely depends to a large extent on chemical insecticides. It is known that the chemical control results in severe risks to human and the environment. To avoid the negative side effects of chemical insecticides, research workers try to replace the chemical control by available, cheep, easy degradation materials such as plant products which have some advantages, since they are relatively safe, retard the resistance of insects because it contain numerous active components that have many properties like repellent, fumigant and affect the biology of insects. Therefore the subjects of current study include two tools:

1. **Chemical methods:**
    a. **Use of plant products (extracts and powders) (materials of natural origin).**
    b. **Nanoparticles of copper.**
    c. **Pyrethroid insecticide, Cypermethrin.**
2. **Natural tool: different level of temperature.**

Bioassay methods, (mixing with medium) were used to determine the percent of mortality, weight loss and the effect on biology of *S. oryzae* and *C. maculatus*. The results obtained are summarized in the following points:

a. The all tested plant materials had detternt effects against the two tested insects, these materials both extracts or powders had moderately toxicity, reduced the emergence of insects.

b. Reduced the weight loss of cowpea seeds or rice grains.

Plant extracts effect:

C. maculatus

Toxicity

The toxicity increased with increasing of exposure periods, since LC_{50} decreased from 61279.0 and 67573.0 to 34185.0 and 30660.9 µg/cm^3 after two to eight days post treatment for camphor and clove, respectively. Camphor had the first rank after 2 days while clove was the premier after 8 days of exposure. Additionally, results showed that clove has long life residue compared to camphor. While, ficus exhibited no effect against *C. maculatus* for two days after treatment.

Effect on progeny and weight loss:

Results showed that clove achieved more reduction (%) for emergence (F_1) and weight loss than the two other extracts.

S. oryzae

The results had the same trend of *C. maculatus*. Based on LC_{50} clove extract was the premier followed by camphor and ficus.

Plant powders effect:

C. maculatus

Toxicity

Similarly, the plant powders had the same direction of plant extracts, since the toxicity increased with the increasing of exposure period. For example LC_{50} dropped from 2.27, 3.93 and 13.4 after 2 days to 1.33, 1.24 and 1.58 (% w/w) after 3 days of exposure for camphor, ficus and clove, respectively. Unlike the extracts the results showed that clove extract of the first place, it self-placed the later deposition following, the camphor and ficus. Further-more, plant powders achieved greater toxicity compared to extracts of the same plants against the two tested insects.

Sitophilius oryzae

The presented findings revealed that the same trend of extracts with *C. maculatus* showed for the powders with *S. oryzae* where the toxicity increased with the increasing of exposure time.

The obtained data indicated to the superiority of powders compared to extracts with the two tested insects at the all times of exposure. In addition, *S. oryzae* adults were more tolerant than *C. maculatus* to plant extracts, and on the contrary with plant powder where *C. maculatus* was more tolerant than *S. oryzae*.

Effect on progeny and weight loss.

For plant extracts.

The levels of reduction and weight loss % parallel with the rate of toxicity of both insects, where *S. oryzae* caused the highest weight loss and produced the least reduction % (F_1) compared to *C. maculatus* which was more susceptible than *S. oryzae*.

For plant powders.

The results with powders in respect to rate of reduction and weight loss opposite to that of extracts where *S. oryzae* was more susceptible than *C. maculatus* but *S. oryzae* produced low level of F_1 reduction and high % weight loss. This result is surprising and surprising. This may due to the difference in the food behavior of the larvae stage in both insects, as it is known that the adults of legume insects die after short time (14 days), where that *S. oryzae* live long time, as these results in a reduction in the number offspring of the cowpea beetle compared to that of *S. oryzae*.

Effect of chemical insecticide (Cypermethrin):

C. maculatus

Toxicity

Based on LC_{50} of the two tested insects, results obtained showed that *C. maculatus* was more susceptible than *S. oryzae* with LC_{50} values ranged between 12.96 – 2.84 µg/ml and from 18.14 – 8.6 µg/ml with a along time of experiment (1 – 3 days), for the two mentioned insects, respectively.

Effect on % reduction (F_1) and weight loss:

Cypermethrin completely prevented any emergence or weight loss (0 %) of *C. maculatus* compared to *S. oryzae* which produced 97 % reduction of F_1 and 2.5% weight loss.

Effect of copper nanoparticles:

Toxicity

Nanoparticles of copper largely showed equal effectuation on both insects under investigation except the action after three days, where *S. oryzae* was more susceptible than *C. maculatus* with LC_{50} values of 2.2 and 5.5 % (w/w), respectively.

Effect on progeny and weight loss:

Nanoparticles of copper had the greatest effect on *C. maculatus* compared to *S. oryzae* which showed lower response than *C. maculatus*. Nanoparticles of copper caused 99.9 % reduction and zero % weight loss with *C. maculatus* while they effectuated 72.11 % reduction and 3.33 % weight loss for *S. oryzae*.

Ultimately, the all tested materials had deterrent influences on the all studied parameters (toxicity, progeny and weight loss) against the two experimental insects.

Results showed significant differences between the actions of tested materials on both insects with the studied parameters.

Cypermethrin was the premier among the investigated materials concerning the all criteria under study following by copper-nanoparticles, plant powders and plant extracts. The different response of the two

insects against the evaluated materials might be due to some of factors like type of plant, plant formulation, chemical composition of each plant, plant part used, experimental conditions, type of insect species, nutrition behavior of each insect, harmful insect phase and the insect surface area exposed to the tested material.

Effect of natural tool (Temperature):

Insects in stored grain can be controllowed by manipulating the physical environment or applying physical treatments to the grain and insects. The variables in physical environment are controlled temperature, relative humidy or grain moisture content and relative composition of atmosphere gases in the intergranular air. The currenty study included the controlled temperature.

The greatest effect of temperature showed with the egg stage. 30°C temperature was the most suitable to development of the all stages followed by 25 and 20°C**.** The high temperature of 35, 40 and 45°C caused the highest negative effect on the all tested phases of *C. maculatus* or *S. oryzae*.

The effect of temperature increased with increasing time of exposure and temperature with both insects according the means of emerged insects. The highest effect was found with the highest temperature (40 and 45°C) and the longest time (20 min.).

According the means of emerged adults of the different immature stages at the different temperatures and times of exposure *S. oryzae* was more susceptible than *C. maculatus*.