

Repelency and Mortality Effect of Plant (*Bergera Koenigii*) Extracts against the Red Flour Beetle (*Tribolium Castaneum*)

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ABSTRACT

The effects of different concentrations of extracts of *Bergera Koenigii* against *Tribolium castaneum* (Herbst) at different time interval. Five applications of Control, 1%, 2%, 5% and 10% were used to assess the mortality of *T. castaneum* at three different days. The results revealed that the mortality and repellency of *T. castaneum* increased with highest concentration of plant extracts. *Tribolium castaneum* gave highest mortality (70%) at 10%, while least mortality (40%) was obtained lower concentration (1%). Comparing the relative efficacy of these plant extracts in relation to times, highest percent repellency (80%) at 10%, while least repellency (40%) was obtained lower concentration (1%). Regarding interaction between concentration and time, mortality and repellency increases with respect to increase in concentration. Therefore, this study confirmed that plant extracts are effective in the management of *T. castaneum* and most effectively at higher concentration with longer time period.

Keywords: *Tribolium Castaneum*, Plant Extracts, Mortality, Repellency.

I. INTRODUCTION

Store grain pest:

It has been predicted that one third of the world grain crop is lost each year at the time storage, much of this is due to insect's attack. The grain which is not lost is severally decreased in quality by insect's damage. Many store grain pests in preference to eat out grain embryos, there diminish the protein content of feed grain and reducing the percentage of seeds which grow (S.V. Deshmukh, et.al., 2018). After harvesting, the grain is mostly stored on-farm, where it can be infested by a different variety of beetles. *Tribolium castaneum* is one of the most common and damaging pests of stored products, feeding on various stored-grain and grain products (Weston and Rattlingourd, 2000).

The store grain pest is an insect that destroys stored food or other stored valuable organic matter (i.e., Grains & Plusses). The wheat grains are mostly damaged by *T. castaneum* (Mookherjee et al., 1968). Stored grains, cereals & pulses are important sources of the organic matter, therefore effective conservation of this resource is very

important for life. Maize, Rice, and Wheat are most consumed grains, while, chickpea supplement world food demands (Wondatir et al., 2015).

This beetles adult and larva which feed primarily on the germ of the cereal. It feeds on powdered products produced by other pests after feeding the grains or the broken grain specially rice, miller products like atta, Maida and Suji, in case of heavy infestation, flour turns grayish yellow and subsequently become moldy and emits a pungent smell, acquiring an unpalatable and objectionable taste. This pest is particularly abundant in flour mills. The pest becomes serious in humid season. It also damages beans, peas, baking powdered, ginger, dried fruits, insects' collection, nuts, chocolate, etc. (S.V. Deshmukh, et.al. 2018).

The Rust-red flour beetle is a reddish-brown in colour; Head and dorsal side of the thorax are densely covered with minute punctures. The last few segments of antennae are much larger in size than the preceding ones. They can produce up to 1000 eggs and lay them inside the damaged grain with parts of the larvae able to use the damaged grains and cereal as their food source. The beetle measures 4 mm in length. The adults are live for more than three years (Walter, 1990). Setiferous patch present on the male posterior side of the fore femur, while females have no such setiferous patch. Female lays 2-10 eggs each day throughout most of her adult life. Under optimal conditions of temperature (35 °C) and relative humidity (75%), egg-laying can increase at a rate of 70-100 times a month (Herrman, 1998). They hatch within 5 to 12 days. Beeman et al. (2012) reported that the duration of egg ranged from 3 days at 30°C and 2 days at 34°C.

II. MATERIALS AND METHODS

1) Rearing of experimental insects:

The red flour beetle (*Tribolium castaneum* (Herbst)) was cultured on wheat flour mixed with yeast (10:1 w/w). Insects were released at the rate of 200 adults in 1 L jars containing 200 kg of wheat grains or flour (Daniel et al., 2013). The jars were covered with muslin cloth and held with a rubber band and kept in an incubator maintained at a temperature of $29 \pm 2^\circ\text{C}$ and $70 \pm 5\%$ relative humidity respectively, for two months of oviposition, the parent insects were separated and egg laid materials were maintained and re-cultured to produce newly emerged adults of same generation. The insects appear after four weeks were removed. One-14-day old adults and subsequently these adults were used for the experiments (Ashouri et al., 2010).

2) Soxhlet apparatus used for the Plant extraction:

For the extraction, crude extracts of the following dried plant leaves were used: *Bergera koenigii* (Curry leaves). These leaves were ground in an electric grinder to obtain a powder. The extraction of plant sample was done in about 12h. Soxhlet Extraction Apparatus was used to extract from plant leaves component by dipping 50g of powder in 250 ml ethanol according to the procedure described (Valladares et al., 1997). Plant leaves were done by deposit flasks in the Soxhlet Apparatus. Plant leaves were poured into a filter tube made from filter paper on one end of the cap. A flask which contained 500ml of ethanol was placed under this glass tube for 24h. Then next three days, the solvent was disappeared by the heat lamp. The plant extracts were put at 4°C prior to application.

III. RESULTS

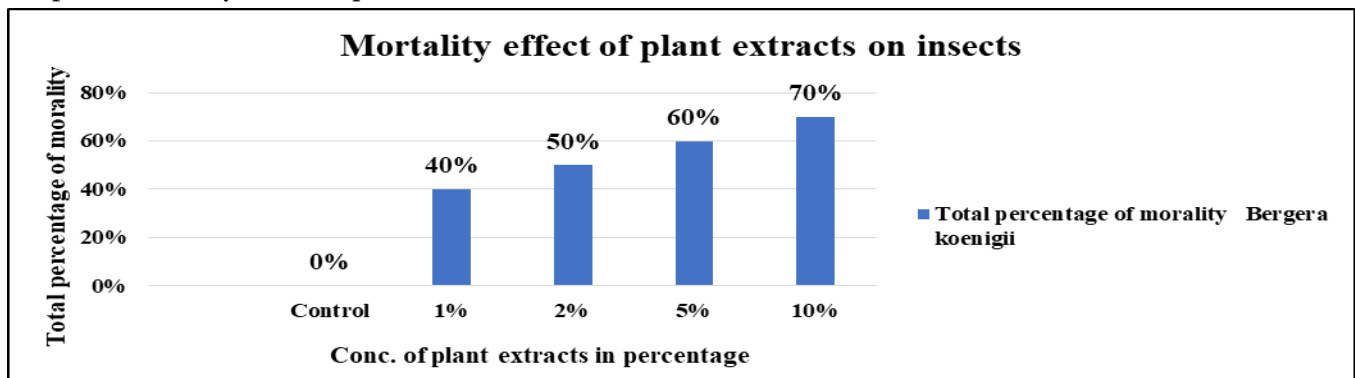
Table 1: Mortality effect of plant (Bergera koenigii) extracts on insects:

| Sr. No. | Conc. of plant extracts in percentage | No. of T. <i>Castaneum</i> exposed | No. of T. <i>Castaneum</i> dead after some days | | | Total percentage of morality |
|---------|---------------------------------------|------------------------------------|---|-------|-------|------------------------------|
| | | | 1 day | 2 day | 3 day | |
| 1) | Control | 10 | - | - | - | 00% |
| 2) | 1% | 10 | 01 | 02 | 04 | 40% |
| 3) | 2% | 10 | 01 | 02 | 05 | 50% |
| 4) | 5% | 10 | 01 | 03 | 06 | 60% |
| 5) | 10% | 10 | 02 | 04 | 07 | 70% |

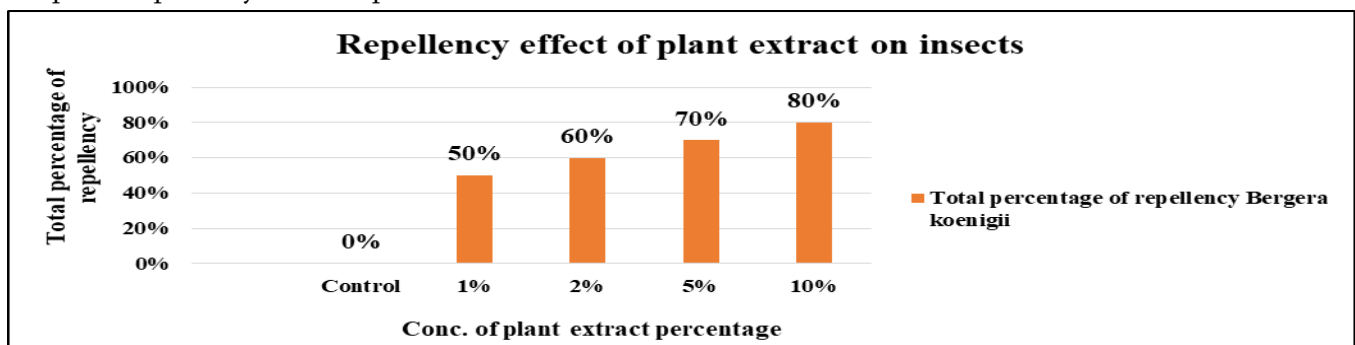
Table 2: Repellency effect of plant (Bergera koenigii) extract on insects:

| Sr. No. | Conc. of plant extract percentage | No. of T. <i>Castaneum</i> exposed | No. of T. <i>Castaneum</i> repelled after some hours | | | Total percentage of repellency |
|---------|-----------------------------------|------------------------------------|--|------|------|--------------------------------|
| | | | 24 h | 48 h | 72 h | |
| 1) | Control | 10 | 01 | 02 | - | 00% |
| 2) | 1% | 10 | 01 | 03 | 05 | 50% |
| 3) | 2% | 10 | 03 | 05 | 06 | 60% |
| 4) | 5% | 10 | 04 | 05 | 07 | 70% |
| 5) | 10% | 10 | 05 | 06 | 08 | 80% |

Graph 1: Mortality effect of plant extracts on insects:



Graph 2: Repellency effect of plant extract on insects:



IV. DISCUSSION

There is improved curiosity during researcher to study the bioactivity of plant extracts against the various stored-grain insect pests (Dubey et al., 2008). Bishkatali plant extracts found both chloroform and ethyl alcohol they show remarkable residual effects on *T. castaneum* by decreasing the production of F1 generation or by increasing the population mortality (Moreira et al., 2007). In this analysis *B. campestris*, *J. mi-mosifolia*, *M. chamomilla* and *V. arvensis* prepare the excellent potential as repellent and toxicant agents to *T. castaneum*. Confirms the findings of various studies which determine the highly lethal or repellent effect of some of these species against stored-grain pests (Alok-Krishna et al., 2005).

In the present study the data indicated that: *Bergera koenigii* mortality effect of plant extracts on insect *Bergera koenigii* plant extract shows significant toxicity against mortality among *Tribolium castenum* the recorded Maximum % mortality was 70% while the minimum mortality 40% (Table 1).

Repellency effect of plant extract *Bergera koenigii* on insects shows significant toxicity for repellency on *Tribolium castenum* the recorded Maximum repellency was 80% while the minimum repellency 50% (Table 2).

V. CONCLUSION

This study clearly indicated differences in toxicity of these plant extracts in relation to exposure period and concentration used. The findings of the study predict the potential of plant extracts towards the stored grain insect pest management. Based on the high mortality and repellency results of the present study, it is concluded that the application of *Bergera koenigii* leaf extracts as plant derived insecticides on *T. castaneum* can control the damage caused by this beetle. *Bergera koenigii* is the most effective plant extract because it had the highest mortality effects of the plant extracts used in this study. This study suggests that *Bergera koenigii* is active plant extracts towards control of stored grain insect pests especially the red flour beetle, *Tribolium castaneum*. However, effort must be intensified to control the damage caused by *T. castaneum* to stored cereals, this could be achieved by the use of plant extracts which are cheap, low risk control techniques and are readily available to the farmers which prompted this study.

VI. REFERENCES

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