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RESEARCH ARTICLE

**EVALUATION OF SOME POWDERED SPICES AS TOXICANT AGAINST RED FLOUR BEETLE,
TRIBOLIUM CASTANEUM HERBST**

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ABSTRACT

Regarding the side effects of synthetic pesticides on food commodities, an experiment was designed to determine the biological activity of nine spices namely Turmeric, Chilli, Coriander, Garlic, Fennel seeds, Black pepper, Ginger, Fenugreek and Cumin against *Tribolium castaneum*. All the spices showed significant effect on adult mortality and germination viability among which highest adult mortality (9.67) as well as germination viability (95.67%) was recorded with black pepper (0.5g) treated seeds (50g). Whereas lowest adult mortality (1.00) was counted in untreated control and minimum germination viability (86.00%) was reported with ginger treated wheat grains. While all rest of spices varied significantly in their reaction to test insect. Furthermore, the sequence of toxic effect of spices as followed black pepper > cumin>chilli> coriander> garlic> fennel seeds> ginger>fenugreek>untreated control.

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INTRODUCTION

Red flour beetle, *Tribolium castaneum* (Herbst.) is a serious insect pest of stored wheat with cosmopolitan distribution (Hulasare *et al.*, 2003). Every year about 10 to 20% wheat grains are damaged through insect pests (Khan *et al.*, 2010). Chemicals are quite harmful to the environment, human beings and animals whereas, many of the botanical products provide novel modes of action against insects that can reduce the risk of cross-resistance as well as offering new leads for design of target-specific molecules (Pugazhvendan, *et al.* 2012). Management of stored pests using natural origin plant materials is the subject of interest due to their little environmental hazards and low mammalian toxicity (Nadra, 2006). Among the botanical products spices are characterized by their flavor and odour due to presence of aromatic oils. These volatile constituents can influence insect behavior. The use of spices against stored product pests is less costly, easily available, safer and do not cause hazards in the commodity (Mahdi and Rahman, 2008). The solid residue of turmeric oleoresin has a strong repellent and antifeedant effect against red flour beetle. (Navarro and Finkelman, 2014). Leaves extracts of *Azadirachta indica*, *Curcuma longa*, *Catharanthus roseus* shown insecticidal properties against *T. castaneum* (Umadevi and Sujatha, 2013). Black pepper (*Piper guineense*) caused 100% mortality of red flour beetle (Ajayi and Olonisakin

2011), rice weevil and lesser grain borer (Ashouri and shayesteh, 2010). Turmeric and cinnamon has been proved to work as repellent and shown toxic effect against lesser grain borer, granary weevil and red flour beetle (Shayesteh, *et al.*, 2010). Research on spices as grain protectant in india is scancy. Therefore the present research work was undertaken to evaluate efficacy of different spices powder as grain protectant.

MATERIALS AND METHODS

The experiment was conducted at the laboratory of the Department of Entomology, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, India, during Kharif season 2014.

Rearing of test insect

Adult insects of *T. castaneum* collected from the National Seed Corporation, Meerut (U.P.) The Fifteen pairs were released into plastic jars containing 200 gm wheat flour covered with muslin cloth, tied with a rubber band and kept in an incubator maintained at a temperature of 29±2°C and 65±5% R.H. After 2 weeks of oviposition, dead as well as alive adults were removed and egg laid materials were maintained and re-cultured to produce newly emerged adults of same generation used for further experiments.

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Preparation of spices and mortality test

Turmeric (*Curcuma longa*), Chilli (*Capsicum annum*), Coriander (*Coriandrum sativum*), Garlic (*Allium cepa*), Fennel seeds (*Foeniculum vulgare*), Black pepper (*Piper nigrum*), Ginger (*Zingiber officinale*), Fenugreek (*Trigonella foenumgraecum*) and cumin (*Foeniculum vulgare*) were used in this experiment. These powdered spices were selected because no assumption on human toxicity and their general use in foods. The spices were purchased from local market of Meerut. All spices were grinded separately in grinder and make them fine powder. The powders were carefully placed inside airtight containers and kept until the beginning of the experiments. The wheat variety UP2425 was used for experimental purpose in which 0.5 g power of each spices were thoroughly mixed with 50 g wheat seeds and kept in 250 g plastic jar. For untreated control, 50 g seed was also kept in same size container. Ten adults of uniform age were released in each jar and covered with muslin cloth and tightened with the help of rubber band. Numbers of dead insects from each treatment were counted after 2nd, 3rd, 5th, 7th and 15th day of insect release. Hundred seeds from each treatment were kept for germination on filter paper and percent germination was counted.

Statistical analysis

Experiment was replicated three times and Completely Randomized Design (Factorial) was followed. All counts were submitted to a two-way ANOVA ($P<0.05$). OPSTAT software was used for statistical analysis.

RESULTS AND DISCUSSION

Effect of powdered spices on adult mortality

The effect of different powdered spices of Turmeric, Chilli, Coriander, Garlic, Fennel seeds, Black pepper, Ginger, Fenugreek and cumin were tested against *T. Castaneum*. The data pertaining to the mortality was presented in Table and Figure 1. In general all the powdered spices have significant effect on adult mortality. The mortality of test insect increased gradually with increase in exposure time. Average mortality of red flour beetle at 2nd, 3rd, 5th, 7th and 15th days indicated that Black pepper (9.67) possessed the highest toxic effect followed by Cumin (4.00) whereas least adult mortality was recorded in untreated control (1.00). The order of toxicity of the nine powdered spices on red flour beetle, *T. castaneum* were: Black pepper > Cumin > chilli > coriander > garlic > fennel seeds > ginger > fenugreek. Our findings are closely related to previous finding on repellence effect of black pepper, chili pepper, cinnamon and turmeric against three stored-product insects, *T. castaneum*, *R. dominica* and *S. granaries*. Ajayi and Olonisakin, (2011), Shayesteh, et al. (2010), Ashouri and Shayesteh, (2010) and Gautam, et al. (2000).

The germination per cent was ranged from 86.00 to 95.67 per cent among which maximum germination per cent was recorded in black pepper (95.67 %) which was significantly higher than rest of treatments (Table 1).

Table 1. Effect of powdered spices on adult mortality and seed germination

| Treatments | Adult mortality (Mean) after | | | | | Seed germination (%) |
|-------------------|------------------------------|--------|--------|--------|---------|----------------------|
| | 2 days | 3 days | 5 days | 7 days | 15 days | |
| Turmeric | 2.00b | 2.33b | 2.33b | 2.67bc | 2.67b | 90.67b |
| Chilli | 1.67ab | 2.33b | 2.67b | 2.67bc | 2.67b | 90.67b |
| Coriander | 1.67ab | 2.67b | 2.67b | 2.67bc | 2.67b | 90.00ab |
| Garlic | 2.00b | 2.00ab | 2.33b | 2.33b | 2.67b | 90.33b |
| Fennel seeds | 1.67ab | 2.33b | 2.67b | 2.67bc | 2.67b | 90.67b |
| Black pepper | 3.33c | 5.00c | 7.33c | 8.33d | 9.67d | 95.67c |
| Ginger | 1.67ab | 1.67ab | 1.67a | 2.00ab | 2.67b | 86.00a |
| Fenugreek | 2.00b | 2.33b | 2.33b | 2.67bc | 2.67b | 91.33b |
| Cumin | 2.67bc | 2.67b | 3.00b | 3.33c | 4.00c | 91.00b |
| Untreated control | 1.00a | 1.00a | 1.00a | 1.33a | 1.33a | 87.67ab |
| CD at 5% D.F. | 0.939 | 1.253 | 1.039 | 0.939 | 1.085 | 4.107 |

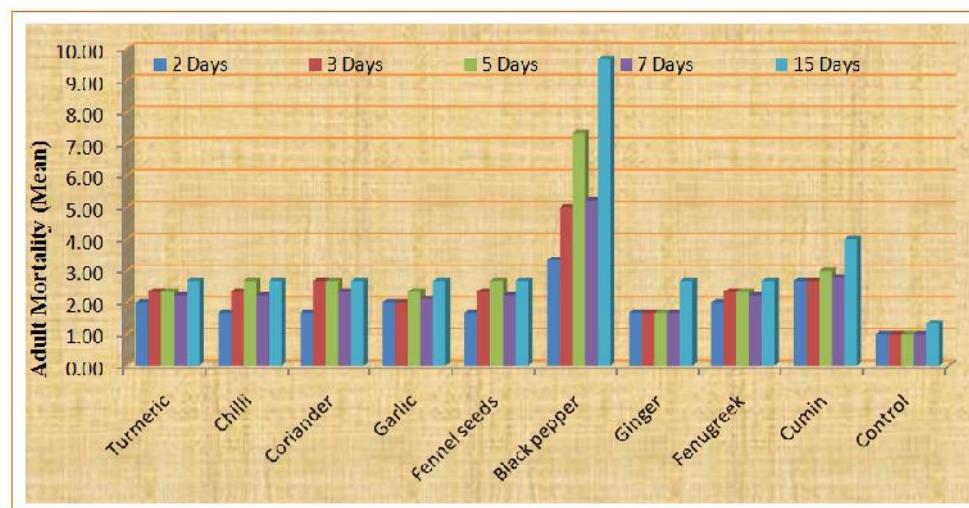


Figure 1. Effect of powdered spices on adult mortality of *T. castaneum*

This was followed by fenugreek (91.33 %), cumin (91.00 %), turmeric (90.67 %), chilli (90.67 %), fennel seeds (90.67 %) and garlic (90.33 %) coriander (90.00 %) and untreated control (87.67 %). While significantly lower germination was recorded in ginger (86.00). Devi and Devi (2013) reported that spices protect to wheat up to 9 months without affecting seed germination.

Conclusion

Our experiments proved to be effective in terms of the toxic effect of the powdered spices. There is a need to find out the natural origin potential molecule is to be safe, eco-friendly and stable to check insect damage at post-harvest condition. It may be possible because plant possesses several alkaloids, terpenoids, glucocinolates, phenols and other secondary metabolites. Overall, our experiment suggests that Black pepper and Cumin are best for management of stored grain pests.

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