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SPICES AS PLANT PROTECTANT

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ABSTRACT

The effect of doses of black pepper, black cumin, garlic and methi powder against pulse beetle and recorded the highest adult mortality (83%), lowest number of eggs (42%), numbers of adult emergence (11.11%) and amount of weight loss (29.00 %) when gram seeds were treated with black pepper powder at 1.00 g/kg. The efficacy of four plant extracts viz., Clove, Sehjan, Ajwain and Ginger against *Fusarium solani* at 10%, 25% and 50% concentrations. Among all four plant extracts tested, Clove was found to be most effective against *Fusarium solani* on Third, Fifth and Seventh day at 50% concentration and conquered the colony growth by 100% compared to control. Different bacterial species and the amount of clove oil used and observed that *Ralstonia solanacearum* was the most sensitive when 50 µl of clove oil was used in our agar diffusion assay. Tomato and Geranium plants grown in *R. solanacearum*-infested soils pre-treated with 0.5% clove oil were significantly taller and produced significantly more root and above-ground plant tissues than their untreated control. Geranium plants grown in *R. solanacearum*-infested soils treated with 0.5% clove oil produced similar number of flowering stalks to those in bacterium-free soil with or without clove oil treatment.

Key words- Pulse beetle, *Fusarium Solani*, *Ralstonia solanacearum* and Mortality

Spices

Spices constitute an important group of Horticultural commodities, which, since antiquity, have been considered indispensable in the culinary arts for flavouring foods. Some are used in pharmaceutical, perfumery, cosmetics and several other industries, and others possess colourant, preservative, antioxidant, antiseptic and antibiotic properties. Besides, they also play quite a significant role in the national economy of India and also in those of various other spice-producing, exporting and importing countries of the world.

Definition of Spices

The Geneva-based International Organization for Standardization (ISO) defines spices as: **Vegetable products or mixtures thereof, free from extraneous matter, used for flavouring, seasoning and imparting aroma in foods.** According to the International Organization for Standardization (ISO) report, there are about 109 spices grown in different parts of the world. India grows more than 60 spices.

Spices are natural plant products used to improve the flavour, aroma, taste and colour of food products; they are also used in beverages, liquors, and pharmaceutical, cosmetic and perfumery products. From time immemorial, India has been known as the 'Land of Spices'. No other country in the world has such a diverse variety of spice crops as India. Indian spices are renowned for their excellent aroma, flavour and pungency, not easily matched by any other country. Even in minute quantities, spices are a real delight to the senses,

making food more palatable, tasty and easily digestible. While, their usage is common in one form or the other in every household, their demand in the food processing industry is increasing at a rapid pace across the world. Thus, the demand for spices in recent years has been continuously growing.

Classification of Spices

Table 1: Classification of spices based on Botanical families:

Family	Crops
Apiaceae	Coriander, cumin, dill, celery, fennel, fenugreek, parsley, asafetida
Lamiaceae	Mint, basil, rosemary, sage, thyme, savory
Liliaceae	Leek, chive
Solanaceae	Capsicum, chilli
Zingiberaceae	Ginger, turmeric, cardamom
Myrtaceae	Clove, allspice
Alliaceae	Onion, garlic
Lauraceae	Cinnamon, cassia
Brassicaceae	Mustard, horse radish
Myristicaceae	Nutmeg, mace
Piperaceae	Pepper

Table 2: Classification of spices based on Mixed combination:

Major Spices	Cardamom, black pepper, ginger and turmeric
Seed spices (Minor spices)	Coriander, fennel, cumin, fenugreek, dill, aniseed, celery and bishop weed.
Tree spices	Clove, nutmeg, cinnamon, cassia, tamarind, curry leaf etc.
Herb spices	Rosemary, thyme, horse radish, parsley etc.
Others (Miscellaneous)	Saffron, asafoetida, vanilla, garlic etc.

Scenario of spices

CURRENT STATUS

- India- Land of spices
- India- Largest producer, consumer and exporter of spices
- China - second largest producer
- >90% for domestic consumption
- 109 spices- all over world
- India- 52 spices
- Share of spices in total agricultural export- 6%
- India's share of world spice trade- 45-50% by volume and 25-30% by value
- The total exports of spices have touched a record Rs 153384.46 lakhs for 525750 tonnes in 2018.
- Value-added spices (Curry powder/paste, mint products and spice oils and oleoresins) has contributed around 43 per cent of the total foreign earnings during this period.
- Export of pepper was the major contributor, which had gone up to 18850 tonnes valued at Rs 7788.5 lakhs.

Plant Protectants

- Plant Protectants are an important group of naturally occurring, often slow-acting crop protectants that are usually safer to humans and the environment than conventional pesticides and with minimal residual effects (Pavela, 2009).
- The concept of management of pests and diseases employing eco-friendly materials gained momentum as mankind became more and more environment conscious. Use of botanicals instead of chemicals is one of the recent approaches for plant protection, as chemicals may cause health hazard and may directly increase environmental pollution.

Characters of pest managing plants

- ✓ Effective at the rate of maximum of 3-5 % plant material based on their dry weight
- ✓ Easy to grow, require less space and time for cultivation
- ✓ Perennial, recover quickly after material is harvested
- ✓ Not become weed or host to insect pests and plant pathogens
- ✓ Complimentary economic uses
- ✓ No hazard to non-target organisms
- ✓ Easy to harvest, preparation should be simple, less time consuming
- ✓ Application should not be phyto-toxic or decrease the quality of the crop

Jhon et al., 2012

Production of antimicrobial compounds in plant tissues

- Plants produce thousands of compounds like glycosides, sulphur containing compounds, phenols etc.
- Stored in different plant parts (heartwood & epiderm) in different organs. (cytoplasm, lysigenous glands, ducts)
- Mechanical or pathogenic injuries to tissues bring these compounds in contact with separately stored enzymes.
- Enzymatic actions on these compounds leads to production of antimicrobial compounds.

Role of plant protectants in IPM

- It have demonstrated the potential of pest management and used worldwide.
- Use of plant protectants and bio-agents has assumed significance as an important component of IPM due to their economic viability and eco-friendly nature instead of chemical synthetic pesticides.
- It application as a component of IPM programs can play important role in overcoming disadvantage of chemical insecticides that have some important characteristics such as biodegradable and self-perpetuating, less harmful on beneficial pests, mostly host specific and less shelf life.

Role of plant protectants in some important spices

Spices Powder

Islam *et al.* (2013) studied the effect of doses of black pepper, black cumin, garlic and methi powder against pulse beetle and recorded the highest adult mortality (83%), lowest number of eggs (42%), numbers of adult emergence (11.11%) and amount of weight loss (29.00 %) when gram seeds were treated with black pepper powder at 1.00 g/kg.

Devi and Devi (2011) studied the Insecticidal activity of spice powders mortality and weevil exposed wheat at 1% and 5% levels is shown significant differences in toxicity of the test materials were observed with pepper and mace causing 100% mortality at both the concentrations tested by 1 week. Powders of nutmeg and clove at 5% level killed 100% insects by 14 days. toxicity of extracts of selected spices at 1,000 ppm concentration to Rice weevil (*Sitophilus oryzae*) adults exposed and pepper oil recording 100% mortality by 5 days.

Ashouri and Shayesteh (2010) studied the Black pepper seed powder significantly caused complete mortality at highest concentration level tested (0.5%). Application of black pepper of Lesser grain borer (*Rhyzopertha Dominica*) showed complete mortality but red pepper fruit powder did not cause complete mortality on insects after 14 days.

Spices Extract

Dwivedi and Dwivedi (2012) studied the efficacy of four plant extracts viz., Clove, Sehjan, Ajwain and Ginger against *Fusarium solani* at 10%, 25% and 50% concentrations. Among all four plant extracts tested, Clove was found to be most effective against *Fusarium solani* on Third, Fifth and Seventh day at 50% concentration and conquered the colony growth by 100% compared to control.

Nehal and Mokhtar (2007) studied that spice extracts showed superior reducing effect on damping-off disease incidence at pre-emergence growth stage to that of powder treatments and Rizolex-T as well, while an opposite effect was observed at post-emergence growth stage. Carnation and cinnamon spices showed the highest protecting effect against disease incidence when applied as powder 5 g/kg or extracts (5%) but Spice plants as powder or extracts gave a similar effect to the fungicide Rhizolex-T in reducing damping-off incidence either at pre- or post-emergence stages of faba bean growth.

Asawalam and Igwe (2012) studied that higher numbers of adult Khapra beetle (*Trogoderma granarium*) mortality were recorded on groundnut seeds treated with Methanol (37%) and different solvent extracts than control treatment. There was no significant difference between the adult mortality on groundnut seeds treated with acetone, hexane and methanol extracts of Turmeric (*Curcuma longa*) and also showed that adult emergence was significantly reduced in the different solvent extracts of turmeric rhizomes than the control.

Amuji *et al.* (2012) observed that populations of Flea beetle (*Podagrica unifirma*) on the plots treated with ginger extracts were appreciably reduced compared with the untreated (0% ginger) control.

Essential oil

Kishore *et al.* (2007) studied the essential oil or components applied 10 minute before pathogen inoculation significantly reduced the lesion frequency as compared with the untreated control. Clove and cinnamon oils at 1% were significantly more effective than 0.5% clove oil or either rate of geraniol or eugenol.

Huang and Lakshman (2010) studied on different bacterial species and the amount of clove oil used and observed that *Ralstonia solanacearum* was the most sensitive when 50 µl of clove oil was used in our agar diffusion assay. Tomato and Geranium plants grown in *R. solanacearum*-infested soils pre-treated with 0.5% clove oil were significantly taller and produced significantly more root and above-ground plant tissues than their untreated control. Geranium plants grown in *R. solanacearum*-infested soils treated with 0.5% clove

oil produced similar number of flowering stalks to those in bacterium-free soil with or without clove oil treatment.

Conclusion

- From the foregoing discussion it could be concluded that –
 - Spice powder**
 - Black pepper @ 1.0 g/kg showed the highest toxicity against pulse and powders of nutmeg and clove at 5% level killed 100% Rice weevil by 14 days.
 - Spices extract**
 - Among spices extracts, clove and spice extract were found to be most effective against *Fusarium solani* and *Rhizoctonia solani*. Application of Methanol (37 %) and different solvent extract also showed mortality of higher number of adult khapra beetle.
 - Essential oil**
 - *Ralstonia solanacearum* soils infested pre-treated with 0.5% clove oil significantly showed taller growth, more root and above ground plant tissue of tomato and geranium than their untreated control.

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