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***SHORT COMMUNICATION***

# Effects of Cinnamon (*Cinnamomum zeylanicum*) powder extract against the pest of Radish (*Raphanus raphanistrum* Subsp. Sativus)

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**ABSTRACT**

*Cinnamon (Cinnamomum zeylanicum Blume) is an important spice and medicinal plant in Sri Lanka. It comprises essential oils with antibacterial, antifungal, antioxidant, and insecticidal properties. Radish (Raphanus sativus L.,) is an important and popular vegetable crop in Sri Lanka. The crop is attacked by many pests and farmers are using chemical insecticides to control pests. However use of chemical insecticides has bad impact on health and environment. Considering this important issue, a study was conducted at the Institute for Agro-technology and Rural Sciences of the University of Colombo in Weligaththa, Hambanthota to examine the insecticidal effect of different types of cinnamon preparations (bio-control) and their optimum dosage in radish cultivation. The treatments consist of 1% cinnamon powder water filtrate (CPWF), 1% cinnamon powder suspension (CPS), 0.6% abamectin and control using randomized complete block design. The results indicated that there was no significant different between chemical insecticide (abamectin) and the cinnamon powder applications for pest control. One percent cinnamon powder water filtrate significantly reduced the number of damaged leaves in radish plant with lowest number of pests. Therefore, cinnamon powder can be used to control pest damages of Radish (Raphanus raphanistrum) without significant effect on growth performance in radish cultivation. The best form of application was cinnamon power water filtrate and the optimum concentration was 1.0% for controlling pests in radish cultivation.*

***Keywords*:** Cinnamon powder, insect repellents, pests, pesticide, radish

Cinnamon (*Cinnamomum zeylanicum* Blume) is a spice considered to be endemic to Sri Lanka (Liyanage *et al*., 2021; Ribeiro-Santos *et al*., 2017), which contains essential oils with antibacterial, antifungal, antioxidant and insecticidal properties ((Bandusekara *et al*., 2020; Ranasinghe *et al*., 2002). Cinnamaldehyde is the main constituent of cinnamon bark, but it also contains b-caryophyllene, linalool, and other terpenes. Further, Brari and Thakur (2015) reported that cinnamaldehyde and linalool exhibit contact and fumigant toxicity against the adults of *Callosobruchus maculatus* (F.) and *Sitophilus oryzae* (L.). Radish (*Raphanus sativus*) is a commonly consumed vegetable in the Brassicaceae family. Generally, people eat radish raw as salad and also as vegetables while the leaves used as vegetable. Radish possesses high medicinal and nutritional value. Which contains dietary fibers, sugar, protein, and even fat and fluoride. Additionally, it contains a number of water-soluble vitamins (B1, B2, B3, B5, B6, B9, and C) as well as minerals. Furthermore, radish has been discovered to have a variety of bioactive chemicals that may have human health advantages. Glucosinolates and isothiocyanates are the two most important bioactive chemicals found in radish. In Unani, Greeko-Arab, and Indian folk medicine, radish is used as a household remedy for a variety of ailments including jaundice, gallstones, liver illnesses, rectal prolapse, indigestion, and other gastrointestinal aches. Recently, several research studies reported that anti-inflammatory, anti-cancerous and antidiabetic activities of radish (Banihani, 2017; Zhao-liang *et al*., 2008).

One of the constrains in radish cultivation is the pest attack, which resulted in considerable loss of yield. The major pests associated with radish in Sri Lanka are vegetable leaf miner (*Liriomyza huidobrensis*), aphids, cut worms (*Agrotis* spp.) and flea beetles (*Phyllotreta cruciferae*) (DOA, 2021, Jayathilaka *et al*., 2016). To control these pests, farmers are used different chemical pesticides. Indiscriminate application of synthetic pesticides

in crop production leads to detrimental consequences in the ecosystem such as ground and surface water contamination, soil contamination, loss of non-target species and pesticide use can also result in resistance evolution in pest populations (Mahmood *et al*., 2016). Hence, attention has been paid towards organic farming by using appropriate cropping techniques, biological control, and bio-pesticides (Dar *et al*., 2021).

In comparison to synthetic pesticides, plant-based insecticides are safer for the environment, are generally less expensive, are easier to handle, and are employed by small industries and farms. Moreover, these pesticides are often active against variety of species, are often biodegradable, nontoxic and appropriate for use in integrated pest management. Essential oils are a possible alternative to botanical extracts used as pesticides because of their widespread availability and relatively low cost. These are secondary metabolites synthesized by plants, and play vital roles in plant defence (both against biotic and abiotic stresses) and signalling processes. Further, they including the attraction of pollinators and beneficial insects (Campolo *et al*., 2018).

Therefore, an experiment was conducted to evaluate the effectiveness of pesticides developed from cinnamon powder on the status of pest attack in radish cultivations in dry zone field conditions of Sri Lanka with the objectives of to identify best form of cinnamon pesticides and their effective doses as compared to synthetic one.

The experiment was carried out at the Institute for Agro-technology and Rural Sciences of the University of Colombo in Weligaththa, Hambanthota ($DL_5$ agro-ecological zone of Sri Lanka) during January – March of 2021. The investigation was consisted with two experiments; first experiment was to identify the best form of cinnamon pesticide spray on radish plants while the second experiment was to identify the optimum dosage of the cinnamon preparation as a pesticide.

Initially, radish seeds were placed in nursery trays and let to grow under shade house till seedling grew up to 4-5 leaf stage. Then, three weeks old radish (var. local) seedlings were transplanted in 1 m × 3 m size raised beds with 25 cm × 10 cm spacing (120 plans per plot) during the end of January 2021. Sprinkler irrigation was practiced during the crop season (1 ½ month period).

Initially, 1% cinnamon powder water filtrate (CPWF) was prepared by dissolving 10 g of commercially available cinnamon powder in 1 litre of distilled water. Then the mixture was filtered through muslin cloth (Raju *et al*., 2020). Likewise, 1% cinnamon powder suspension (CPS) was prepared without filtering.

The field planted radish plants were treated by spraying of 1% cinnamon powder water filtrate,1% cinnamon powder suspension, Abamectin 0.6% and control plants were maintained without application of any substances. Abamectin (commercially available chemical pesticide) was used to compare the effectiveness of prepared bio-pesticides. Different pesticides were sprayed evenly during the evening time of the day in every five days starting from ten days after transplanting to harvest. Plant growth data (Number of leaves per plant and leaf length) and pest incidence (Number of pests attacked plants and number of damaged leaves) were recorded. Data recording was started two weeks after the planting of radish and was performed every 4 days. Randomized Complete Block Design (RCBD) with four replicates was used for the experiment.

The best form of cinnamon pesticide selected from the first experiment was used for this experiment. The procedure followed for this experiment was precisely similar as described above. Three weeks old seedlings were transplanted in 1 m × 3 m size raised beds with 25 cm × 10 cm spacing during mid of February 2021. Field planted radish plants were treated with 1%, 1.5% and 2% cinnamon powder water filtrates. Treatments were allocated according to RCBD design with three replicates. Plant growth data (Number of leaves per plant and length of leaves) and pest incidence (number of pests attacked plants, number of damaged leaves and number of pests identified in experimental unit) were recorded from two weeks after spraying with four days intervals. Data were analyzed by ANOVA using MINITAB version 17 statistical software.

Application of different pesticides were not significantly ($p<0.05$) affected on plant growth of radish in respect of leaf number per plant and leaf

length as compared to the untreated control (Table 1). However, Different types of pesticides significantly ($p<0.05$) affected on pest incidence of radish plants (Table 1). During the study period, the major pests identified in experiment plots were leaf miner (*Liriomyza huidobrensis*) and leaf eating caterpillars (*Spodoptera litura* and *Crosidolomia pavonana*). Significantly highest number of pest attack plant and average number of damaged leaves were recorded in control plants compared to other treatments. Furthermore, between two forms of cinnamon powder preparations, 1% cinnamon powder water filtrate showed lowest pest attack on radish as compared to cinnamon powder suspension (Table 1). Therefore, cinnamon powder water filtrate was used as the best form of application for the second experiment. The result clearly indicated that bio-pesticide could replace the use of synthetic pesticide in radish cultivation.

**Table 1: Effect of different pesticides on growth and pest attack of radish plant**

| Treatment | No. of leaves plant$^{-1}$ | Average leaf length (cm) | No. of pest attacked leaves plot$^{-1}$ | No. of pest attacked plant plot$^{-1}$ |
|---|---|---|---|---|
| 1% CPWF | 13.9$^{a}$ | 28.5$^{a}$ | 61.0$^{b}$ | 21.3$^{b}$ |
| 1% CPS | 14.1$^{a}$ | 28.6$^{a}$ | 63.8$^{b}$ | 21.5$^{b}$ |
| 0.6% Abamectin | 13.9$^{a}$ | 28.5$^{a}$ | 57.8$^{b}$ | 21.0$^{b}$ |
| Control | 14.2$^{a}$ | 28.6$^{a}$ | 164.3$^{a}$ | 26.0$^{a}$ |

**Note:** 1% cinnamon powder water filtrate (CPWF), 1% cinnamon powder suspension (CPS), Means with the same superscript in a column are not significantly different from each other, however, means with different superscript are significantly different at $p<0.05$.

Different concentrations of cinnamon powder water filtrate were not significantly affected of plant growth of radish in respect of leaf number per plant and leaf length. Similarly, there was no significant effect of different concentrations of extract on number of pest attacked plant /plot of radish. However, different concentrations of cinnamon extract significantly ($p<0.05$) affected the number of pest attacked leaves /plot of radish. The lowest number of pest attacked leaves/plot (61.0) was recorded in 1% cinnamon powder water filtrate (CPWF) as against highest (80.7) in 1.5% CPWF (Table 2).

**Table 2: Effect of different concentrations of cinnamon powder water filtrate on growth and pest attacked to the radish plant**

| Treatment | No. of leaves / plant | Average leaf length (cm) | No. of pest attacked leaves/plot | No. of pest attacked plant/plot |
|---|---|---|---|---|
| 1% CPWF | 12.7$^{a}$ | 27.1$^{a}$ | 61.0$^{c}$ | 21.7$^{a}$ |
| 1.5%CPWF | 14.0$^{a}$ | 28.5$^{a}$ | 80.7$^{a}$ | 23.0$^{a}$ |
| 2% CPWF | 13.6$^{a}$ | 28.3$^{a}$ | 71.0$^{b}$ | 22.7$^{a}$ |

**Note:** 1% cinnamon powder water filtrate (CPWF), 1% cinnamon powder suspension (CPS), Means with the same superscript in a column are not significantly different from each other, however means with different superscript are significantly different at $p<0.05$.

Several studies discussed insecticidal properties of cinnamon plant parts. For example, Samarasekera *et al.* (2006) investigated insecticidal activity of cinnamon bark and leaf oil against housefly (*Musca domestica*), where bark oil showed the better knock down effect and mortality against *M. domestica*. Further, Kowalska *et al.* (2020) investigated that tomato varieties Agro and Hamlet showed a positive reaction to cinnamon water filtrate spray and increased number of branches while controlling pest attacks. The result of the present study also agreed with this statement where cinnamon water filtrates were identified as the best form of application as compared to water suspensions.

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