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A Study on Insecticidal Activities of *Cinnamomum tamala* (Lauraceae) Essential Oil against *Sitophilus oryzae* L.

Agam Gupta[1], Garima Dinde*[1] and Harendra Nath Sharma[2]

[1]*Department of Biotechnology, Raja Balwant Singh College, Agra, Affiliated to Dr. Bhim Rao Ambedkar University, Agra, Uttar Pradesh, India*
[2]*Department of Zoology, Agra College Agra, Affiliated to Dr. Bhimrao Ambedkar University, Agra, Uttar Pradesh, India*
* Corresponding author. E-mail- pratibhadinde4@gmail.com
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ABSTRACT

The present work is conducted to assess insecticidal activities of plant extract. The result of prevent work were concluded that, Lauraceae leaf extracts possess effect insecticidal activities. The obtained results thus give the experimental basis to understand the use of Lauraceae specsis in traditional medicine as an insecticidal agent. Further, studies are required to identify the active principles of the extract and its mode of action. These findings strongly suggest that the essential oil extracts of Lauraceae can be further investigated as effective insecticidal agents against *Sitophilus oryzae* adults. The bay leaf is the most popular herb in developing countries. Extracts of bay leaf have possible insecticidal activity, which should be further investigated for their safety aspects. More studied are required to identify and produce more Eco-environmentally biodegradable materials and nanoparticles that have no harmful effect on the atmosphere. Based on our results, it can be concluded that the studied plants namely bay laurel (*Laurus nobilis*), *Cinnamomum tamala* (Laucrceae) possess insecticidal activity against weevils (*Sitophilus oryzae*) without any difference among the species. However, further research is needed to identify and determine the individual phenolic contents and phytochemicals present in the extracts.

Introduction

With the beginning of agricultural practices, Storage of food grains started as a safeguard against viruses. Since then, insects also started damaging stored grains both qualitatively and quantitatively. To protect stored grains from insect infestation, several synthesis pesticides gave been used, beat these synthetic Pesticides have increased the risk of ozone depletion, Neurotoxicity. Carcinogenicity teratogenicity and Mutagenic effects among non-target species and Cross-resistance and multi resistance in insects (Lee, 1995; UNEP, 2000; Beckel *et al*; 2002, Cardiet *et al*., 2012). This has led to increase public awareness on human safety and possible environmental damage diverting attention towards plant products especially volatile Chemicals In Stored-grain insect pest management. Essential oils are highly volatile and non-persistent. Some of these exhibit adulticital, larvicidal and antifeedant activity, Capacity to delay development, Adult Emergence and fertility, and have deterrent Effects on opposition (Callero-Gallardo *et al*, 2011; Isman *et al*; 2011; Liu *et al*; 2011; Stefanazzi *et al*; 2011.) There are 17,500 aromatic species among higher plants belonging to families Alliaceae, Lauracees Myrtaceae, Piperaceae, Poaceae, Rutaceae and Zingiber-acee (Bakkali *et al*; 2000.) of 3,000 Essential oil known, 10% have commercial importance in cosmetic, food and pharmaceutical industries (Bakkali *et al*; 2000). Biological activities of essential oils depend on their chemical composition, which, in turn varies with plant phonological stage, harvesting season, plant age, soil nature and Environmental conditions (Masotei *et al*; 2003; Angioni *et al*; 2006). *Cinnamomum tamala* belonging to family Lauraceae is a tree native to Indio Bangladesh, Nepae, Bhutan and China. It has aromatic Leaves called tejpatta which are used for Culinary and & Medicinal purposes. Historically, it is one of the oldest known and used species. It is mainly used for flavouring food and in pharmaceutical preparation belongs of its hypoglycaemic, stimulant and carminative properties (Hussain *et al*. 1980.) Leaves and bark have aromatic, astringent, Stimulant and Carminative qualities and used in rheumatism, colic, diarrhoea, nausea and vomiting.

Fig.1 *Cinnamomum tamala*

Ancient Literature has revealed that in the first century A.D, dried Leaves and bark of this plant were presented for fever, anaemia and body odour. Its seeds were crushed and mixed with honey or Sugar and administered to children for cough (Edwards, 1993.) Essential oil of *C. tamala* Leaves has excellent inhibitory effects on bacteria (Minakshi *et al*; 1999). Due to its aroma, the leaves are kept in clothes and also chewed to disguise bad month odour. The oil of *C.tamala* is used in fever, fungus disease of Skin, fractures, eye disease, foul odour of body, disease of oral cavity, herps and in disorders of breast milk. The oil is extensively used as fragrance component in Soaps, detergents, cosmetic, perfumes, tooth pastes and industrial fragrances (Jantan and Goh, 1990.) Hydrodistillation of *C. tamala* leaves yields 1.2% colourless essential oil. In rural area, *Cinnamomum tamala* leaves have been used to protect stone grains from insect infestation since time immemorial. *Cinnamomum tamala* essential oil is yellow to darkish-brown in colour, with a scent that is fresh and spicy, with a distinctive medicinal edge.

Materials and Methods

Soxhlet extractor- A Soxhlet extractor is a piece of laboratory apparatus invented in 1879 by Franz Von Soxhlet. It was originally designed for the extraction of a lipid from a solid material. Typically, Soxhlet extraction is used to when the desired compound has a limited solubility in a solvent, and the impurity is insoluble in that solvent. It allows for unmonitored and unmanaged operation while efficiently recycling a small amount of solvent to dissolve a larger amount of material. A Soxhlet extractor has three main sections: a percolator (boiler and reflux) which circulates the solvent, a thimble (usually made of thick filter paper) which retains the solid to be extracted, and a siphon mechanism, which periodically empties the thimble. The source material containing the compound to be extracted is placed inside the thimble. The thimble is loaded into the main chamber of the Soxhlet extractor. The extraction solvent to be used is placed in a distillation flask. The flask is placed on the heating element. The Soxhlet extractor is placed atop the flask. A reflux condenser is placed atop the extractor.

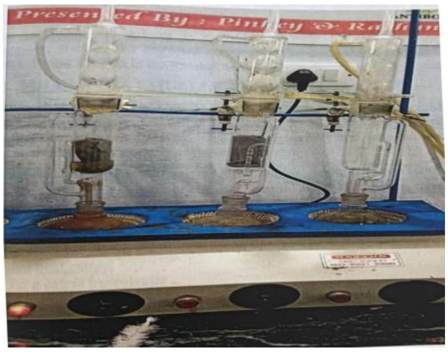

Fig. 2 Soxhlet Extractor

The solvent is heated to reflux. The solvent vapour travels up a distillation arm and foods into the chamber housing the thimble of solid. The condenser ensures that any solvent vapour cools, and drips back down into the chamber housing the solid material. The chamber containing the solid material slowly fills with warm solvent. Some of the desired compound dissolves in the warm solvent, When the Soxhlet chamber is almost full, and the chamber is emptied by the siphon. The solvent is returned to the distillation flask. The thimble ensures that the rapid motion of the solvent does not transport any solid material to the still pot; this cycle may be allowed to repeat many times, over hours or days. During each cycle, a portion of the non-Volatile compound dissolves in the solvent, after many cycles the desired compound is concentrated in the flask. The advantage of this system is that instead of many portions of warm solvent being passed through the sample, just one batch of solvent is recycled. After extraction the solvent is removed, typically by means of a rotary evaporator, yielding the extracted compound. The non-soluble portion of the extracted solid remains in the thimble, and is usually discarded.

Insects

Rice weevils (*Sitophilus oryzae* L.) were used to determine the institute nature of *cinnamum tamala* leaves essential oil. The insect were reared on whole rice at the home at normal room temp. The adult female rice weevils Lays an average of 4 eggs per day and may live for four to five months. The full life cycle may take only 26 to 32 days during hot summer months (May to July). The rice weevils, *Sitophilus oryzae*, has a life cycle that can vary depending on temperature and humidity. The egg stage lasts about 3 days. The stage around 18 days larval. The pupal stage about 6 days, with the adult emerging after 3-4 days.

Fig. 3 *Sitophilus oryzae* (Rice Weevils)

The bay leaves extracts was obtained by soxhlet extraction and concentrated using a rotary evaporator before subjecting. The essential oil extracts of *Cinnamomum tamala* respectively, exhibited similar inhibitory effect against the *Sitophilus oryzae* L. (weevils).

Plant materials and extract preparation with experimentation process

Fresh plant leaf materials of *Cinnamomum tamala* were collected from the Grocery store. Leaf materials were cleaned with distilled water and dried at room temperature under shade. It was ground to obtain coarse powder using an electric grinder. Shade dried leaves (6g) were coarsely powdered and subjected to successive solvent extraction by continuous soxhlet extraction. The stepwise procedure is as follows-

1. Took the foam sponge in square shape, and spray the essential oil on the foam sponge.
2. Took sprayed foam sponge and placed at the bottom of the petridish.
3. Took 46 *Sitophilus oryza* L. (weevils)and released on the centre of the sponge foam and petridish were coverd and kept in the dark, for 24hrs.
4. Offer 24hrs, 21 *Sitophilus oryza* L. adults (weevils) replicates.
5. Calculated percent repellency (PR) using formula: PR=(C-T)/(C+T) x100

C=number of insects in the untreated leaves and T=number of insect in treated halves.

6. Preference index (PI) values between -1.0 and -0.1 indicate repellent essential oil, -0.1 to + 0.1 neutral essential oil and + 0.1 to + 1.0 attracted essential oil.

Results and Discussion

Repellent activity- Repellency test was performed in glass petridish (diameter 8.5, height 1.2cm). Test solution of different dilution (2.50ml, 3gm vol:vol) of *Cinnamomum tamala* essential oil were performed in mineral water. 20 Rice vessels were released in Rice. 20 Rice vessels were released in white chickpea. Then put it for 24hr. After 24hrs, we checked its ratio, in rice 20/17, in pulses 20/26 and in white chick peas 20/3. The insects collected all this survived *Sitophilus oryzae* adult (rice weevils). Total were 46 *Sitophilus oryzae* L. (rice weevils) we took square shape sponge, and it treated with *Cinnamomum tamala* essential oil. Now, essential oil sprayed on the sponge foam and placed at the of petridish. 46 *Sitophilus oryzae* adults were released on the centre of the sponge foam and petridish were covered and kept in dark for 24hrs. After 24hrs, checked 21 *Sitophilus oryzae* adults, replicates from the sponge foam.

Fig. 4 Essential Oil of *Cinnamomum tamala*

Mortility activity- Formulations of different dilution of *Cinnamomum tamala* essential oil (3ml, 6g vol: vol) of *Cinnamomum tamala* essential oil were prepared in mineral water. *Sitophilus oryzae* adults collected from the laboratory in petridish (diameter 8.5cm, height 1.2cm) glass. Sponge foam were threated with *Cinnamomum tamala* essential oil. Essential oil sprayed on the sponge foam and placed at the bottom of petridish. Petridish were covered and kept in dark for 24hrs. After 24hrs, We checked in the chick white pea, so Mortality show 100% (20/3).

Fig. 5 *Sitophilus oryzae* (Rice Weevils) on Sponge

Among plant-based insecticides plants volatiles have recived much attention in the scientific community in insect pest management programme. *Acorus calamus*, *syzygium aromaticum* ,*Hyptis spicigera*, *Ocimum canum* and *vepris hetrophyla* essential oils exhibited repellent activity, insecticidal effect and inhibition of progeny in *S. Oryzae* (Vishwam *et al*., 2015). Essential oil components also have been evalulated for their role in insect pest management programme. In present study, repellent and mortality, inhibitory activities of *Cinnamomum tamala* essential oil in *Sitophilus oryzae* was studied. This essential oil show significant repellent activity against *Sitophilus oryzae* adults *Cinnamomum tamala* essential oil induced high mortality in *Sitophilus oryzae* adults when treated by sprayed method (Veal, 1996). *Cinnamomum tamala* essential oil reduced progeny production in *Sitophilus oryzae* which ultimately may be reduced damage caused by the insect. *Cinnamomum tamala* essential oil decreased consumption of floar disk of *Sitophilus oryzae*. Similar, results have been shown by *Schinus Molle*, *Alpimia conchigera* , *Zingiber zerumbet* and *Curcuma zedoaria* essential oils in *T. castaneum* and *S.oryzae* (Singh *et al*., 1989). Insecticidal activity and mechanism of eugenol against American cockroaches showed hyperactivity followed by hypertension of the legs and abdomen, then fast knockdown or quick immobilization followed by death (Sharma and Meshram, 2006).

Ants and German cockroaches showed fast immobilization followed by Mortality. It cause blockage of octopamine receptors binding sites at lower concentractions. Little is known about the mode of action of essential oils and their constistuents in insects. Essential oils are lipophilic in nature and can be inhaled (Ngassoum *et al*., 2007). The rapid action against insect pests is indicative of a neurotoxic mode of action and interference with the neuromodulator octopamine. Several essential oil components act on the octopaminergic system of insects. Octopamine is a neurotransmitter ,neurohormone, and circulating neurohormone, neuromodulator, and its disruption resuts in total breakdown of the nervous system (Chaubey, 2016). Octopaminergic system of insects represents a target for insect control. Most insecticides bind to receptor proteins in the insects and interrupt normal neurotransmission leading to paralysis and death.

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