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Evaluation of insecticidal activity of *Artocarpus heterophyllus Thespesia populnea* bark extracts against *Sitophilus oryzae*

S Viveka[1], D Merin Emerald[2]

[1] Assistant Professor, Department of Zoology, Kunthavai Naacchiyar Government College for Women (Affiliated to Bharathidasan University), Thanjavur, Tamil Nadu, India

[2] Assistant Professor, Department of Zoology, Rajah Serfoji Government College (A), (Affiliated to Bharathidasan University), Thanjavur, Tamil Nadu, India

Abstract
Insecticides are a group of compounds with heterogenous toxicity, whose intended purpose is to kills insects. Synthetic insecticides are known for their very harmful environmental and health impacts. This therefore generates a need for a safer solution. Botanicals are a special group of insecticides with a natural origin, obtained primarily from plant parts. There is a continued interest to screen plants for their insecticidal activities in light of the great destruction done to crops that affect the livelihood of the populace worldwide The aim of the study was to investigate the insecticidal activity of medicinal plants against rice insect pest, *Sitophilus oryzae.* Two different indigenous plants *Artocarpus heterophyllus* and *Thespesia populnea* bark extracts were screened for insecticidal activity against *Sitophilus oryzae*, which is a severe pest on rice. Among the plants screened, *Thespesia populnea* bark extract showed higher activity against the selected pest as compared with *Artocarpus heterophyllus* bark extract. Preliminary phytochemical analysis revealed that the presence of alkaloid and quinines in the ethanol extract indicate higher percentage of activities. Hence, it may suggest its use for controlling the rice insect pest, *Sitophilus oryzae*.

Keywords: Insecticidal activity *Sitophilus oryzae*, *Artocarpus heterophyllus* and *Thespesia populnea*

1. Introduction
Insects, though useful in many ways to mankind, have had negative effects in the field of agriculture. They have attacked plant parts such as stored grains, seeds, flowers, leaves, stems, fruits etc and have had a significant effect on the agroeconomy of many countries [1, 2]. One way to control insects deleterious effects on crops is to utilize chemical pest control, which employs potent chemical pesticides to curb, reduce or eliminate pests and thus sustain crop production throughout the world. However, most synthetic insecticides used to date are deleterious to human health and the environment. Applications of chemical pesticides minimize the threat from pest manifestation by rapid knock-down effect, albeit with little consideration to the quality (nutritional contents) of the crop and agro-residues. Many workers reported that the indiscriminate use of chemical pesticide over a long period has not only been proved to be harm full to soil microflora, animals and human life, but also contributed to a number of side effects, viz. development of resistance by the insects/weeds/pests resurgence and outbreak of new pests, toxicity to non-target organism, presence of non-permissible level of pesticide residues on seeds, vegetables, fruits, border alteration in dynamics of pest species population, cumulatively causing poor soil fertility and hazardous effects on environment endangering the sustainability of ecosystem [3, 4]. Due to higher dose and repeated frequency of application, every year one million people suffer from pesticide poisoning [5].
Thus, an alternative strategy is necessary. That alternative strategy is the use of plant extracts and phytochemicals as natural antifeedant, insect deterrents and repellent [6]. Plant extracts are safe alternatives that are of low cost, convenient to use and environmentally friendly. Plant products have been successfully exploited as insecticides, insect repellents and insect antifeedants [7]. In addition, natural products insectides have been isolated from plants and serve the basis for structure mimicry synthesis. In the present study to investigate the insecticidal activity of *Artocarpus heterophyllus* (Tamil name: Palaa maram) and *Thespesia populnea* (Tamil name: Poovarasu maram) bark extracts against *Sitophilus oryzae*.

2. Methodology
2.1 Plant materials
The chosen herbal plants as *Artocarpus heterophyllus* and *Thespesia populnea* barks were collected in August 2020 from Thanjavur s, Tamil Nadu.

2.2 Preparation of extracts
The collected *Artocarpus heterophyllus* and *Thespesia populnea* barks were washed several times with distilled water to remove the traces of impurities from the barks. The barks were dried at room temperature and coarsely powdered. The powder was extracted with aqueous and ethanol for 24 hours. A semi solid extract was obtained after complete elimination of water and alcohol under reduced pressure. The extract was stored in desiccator until used. The extract contained both polar and non-polar phytocomponents of the plant material used.

2.3 Rearing of *Sitophilus oryzae*
The larvae were collected from Super marker, Thanjavur,

Thanjavur district, Tamil Nadu. Larvae were reared in laboratory condition. These laboratory-reared larvae were used for bioassays and the cultures were maintained throughout the study period.

2.4 Evaluation insecticidal activity

The *Artocarpus heterophyllus* and *Thespesia populnea* bark extracts were applied (spiked) to 25g grain, by mixing to give 10, 25, 50, 75 and 100 milligram per kilogram. Controls for each set of treatments consisted of grain treated with water only. 10 unsexed *Sitophilus oryzae* was introduced into the glass jars containing the treated or untreated grains. The glass jars were covered with cotton cloths held with rubber bands. The number of dead insects in each jar was counted after 24 h and also after 7 d and the percentage insect mortality was calculated by Abbott [8] formula. Mc = (Mo Mc/100 Me) 100, Where, Mo = Observed mortality rate of treated adults (%), Me = mortality rate of control (%), and Mc = corrected mortality rate (%).

2.5 Statistical analysis

The percentage mortality observed was corrected using Abbott's formula. Statistical analysis of the experimental data was performed using the MS EXCEL 2011 to find out the LC_{50} values.

3. Results and Disccussion

Botanicals are a rich source of organic chemicals on earth. Already 10,000 secondary metabolites have been chemically identified. In nature many plants have unpalatable substances like high content of phenols, alkaloids, flavanoids, terpenes, quinone, coumarin etc., which play a defensive role against particularly agriculture insect pests. Identifying sources with useful biological activity is only the starting point in the long process of development of a botanical pest management product. Success of botanical in the field depends on number of factors such as, ongoing availability of the natural resources, adequate biomass to justify extraction, the feasibility of extraction near the harvest site and the stability of the extract in storage after preparation [9]. The important primary pests are the rice weevil, *Sitophilus oryzae* (L.), granary weevil, Rice is the single most important and staple food of eighteen million people of Sri Lankan as in many other Asian counties. Every year 30-50% of the total paddy production is stored by farmers for their consumption, future sale, wages and seed purposes [10]. Rice weevil, Sitophilus oryzae L. is a major pest of cereals like rice, sorghum, wheat, barley and maize both in field before harvest and storage. *Sitophilus oryzae* L. (Coleoptera: Curculionidae) commonly called rice weevil has become primary pest of stored grains of warm climatic areas. One pair of *Sitophilus oryzae* can reproduce about one million of its species with in a period of three months under favorable conditions [11]. It is the most destructive and widespread cereal pest in the world and got economic importance [12]. It causes 18.30% losses to stored grains [13]. Insecticidal activity of ethanol extract of *Artocarpus heterophyllus* and *Thespesia populnea* bark were studied at different concentrations (10, 25, 50, 75 and 100mg/kg.) against *Sitophilus oryzae* and represent table 1 and 2. Insecticidal activity of solvent extracts was calculated based on larval mortality after treatment. High larval mortality normally indicates potential insecticidal activity of plant extracts. In the present study irrespective of concentration and solvents used for extraction the insecticidal activity varied significantly. Data pertaining to the insecticidal activity clearly revealed that maximum insecticidal activity was recorded in *Thespesia populnea* bark extract. In the present study irrespective of concentrations used for the insecticidal activity varied significantly. Data pertaining to the insecticidal activity clearly revealed that maximum insecticidal activity was recorded in *Thespesia populnea* bark as compared to *Artocarpus heterophyllus* extract.

Table 1: Grain protection potential of *Artocarpus heterophyllus* and *Thespesia populnea* bark extracts on mortality response of stored-product insect *Sitophilus oryzae* on treated rice at 24 h exposure.

Concentrations (mg/kg)	% of Mortality rate	
	***Artocarpus heterophyllus* bark extract treated**	***Thespesia populnea* bark treated**
10	15.32±1.07	19.26±1.34
25	34.49±2.41	43.42±3.03*
50	51.07±3.57	67.35±4.71*
75	68.96±4.82	76.84±5.37*
100	81.46±5.70	92.51±6.48*
IC_{50} (mg/kg)	51.63	39.13

Values are expressed as Mean± SD for triplicates
*Significantly different (p<0.05) from *Artocarpus heterophyllus.* (Data was calculated by student *t*-Test Independent sample, *P* value two tail using MS-excel ver.)

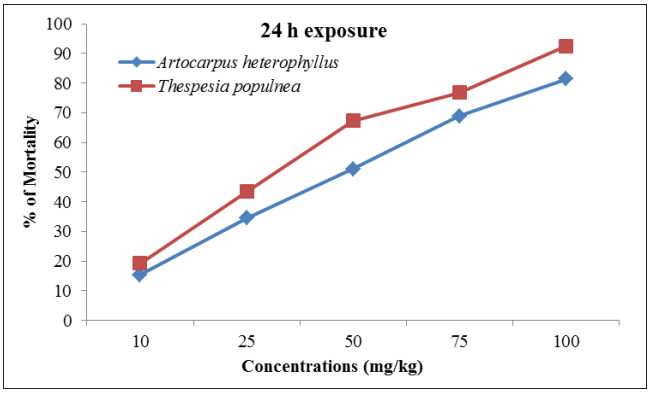

Fig 1: Grain protection potential of *Artocarpus heterophyllus* and *Thespesia populnea* bark extracts on mortality response of stored-product insect *Sitophilus oryzae* on treated rice at 24 h exposure.

Table 2: Grain protection potential of *Artocarpus heterophyllus* and *Thespesia populnea* bark extracts on mortality response of stored-product insect *Sitophilus oryzae* on treated rice at 7th day exposure.

Concentrations (mg/kg)	% of Mortality rate	
	***Artocarpus heterophyllus* bark extract treated**	***Thespesia populnea* bark treated**
10	17.86±1.25	23.61±1.65*
25	42.76±2.99	49.23±3.44*
50	61.48±4.30	70.95±4.96*
75	74.01±5.18	89.53±6.27*
100	86.45±6.05	98.49±6.89*
IC_{50} (mg/kg)	42.92	31.82

Values are expressed as Mean± SD for triplicates
*Significantly different (p<0.05) from *Artocarpus heterophyllus* Data was calculated by student *t*-Test Independent sample, *P* value two tail using MS-excel ver.

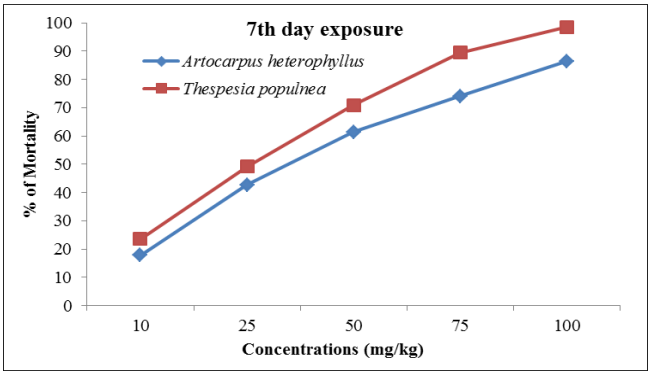

Fig 2: Grain protection potential of *Artocarpus heterophyllus* and *Thespesia populnea* bark extracts on mortality response of stored-product insect *Sitophilus oryzae* on treated rice at 7th day exposure.

Screening plant extracts for deleterious effects on insects is one of the approaches used in the search for novel botanical insecticides [14, 15]. Secondary plant compounds act as insecticides by poisoning per se or by production of toxic molecules after ingestion. In the present study *Thespesia populnea* bark extract exhibited significant insecticidal activity at 100% concentration. It is possible that the insecticidal property present in the selected plant compound may arrest the various metabolic activities. In the present study preliminary phytochemical analysis revealed that alkaloid and quinines present in the *Thespesia populnea* bark extract indicate that higher percentage of insecticidal activity observed in bark extract of *Thespesia populnea* bark. Similar works have already reported insecticidal activity of many plants and their compounds against different groups of insects [16, 17].

4. Conclusion

The plant extracts of *Thespesia populnea* and *Artocarpus heterophyllus* bark showed the potential to be developed into compounds for the management of insect as *Sitophilus oryzae.* Among the two plants, maximum insecticidal activity was recorded in *Thespesia populnea* bark as compared to *Artocarpus heterophyllus* extract These plants are widely available, cheap, and easy to extract in crude forms; consequently, farmers should adopt their uses for the management of insect in order to curtail human and environmental hazards associated with the use of synthetic insecticides and to reduce cost of purchase.

5. References

1. Dethier VG, Barton Browne L, Smith CN. Econ Ent J. 1960; 53:134-136.
2. Schoonhoven IM. Entomol Exp and Appl. 1982; 31:57-69.
3. Katyal T, Satake M. Environmental pollution. In: Rajkumar, Ed., Introduction to Environmental Pollution, Anamol Publications, New Delhi, 1996, 1-6.
4. Kannaiyan S. Insect pest management strategies: current trends and future prospectus In: Ignacimuthu S. Jeyaraj S. Eds., Strategies in Integrated Pest Management, Phoenix Publishing House, New Delhi, 2002; 1-13.
5. Bami HL. Pesticide use in India-Ten questions. Chemical Week. 1997; 4:7-10.
6. Gallo L, Allee L, Gibson D. Insecticidal effectiveness of *Mammea americana* (Guttiferae) extracts on larvae of *Dlabrotica virgifera virgifera* (Coleoptera: Chrysomelidae) and *Trichoplusia ni* (Lepidoptera: Noctuidae). Economic Botany. 1996; 50(2):236-242.
7. Mordue AJ, Azadirachtin. A review of its mode of action in insects. In: Kleeberg H (Ed.). Practice Oriented Results on Use and Production of Neem-Ingredients and Pheromones, Germany, 1998, 1-4.
8. Abbott WS. A method of computing the effectiveness of an insecticide. J econ. Entomol. 1925; 18(2):265-67.
9. Isman MB, Gunning PJ, Spollen KM. Tropical timber species as sources of botanical insecticides. In: Hedin, P.A., Hollingworth, R.M., Masler, E.P., Miyamoto, J. and Thomson, D.G., Eds., Phytochemicals for Pest Control, ACS Symposium Series. 1997; 658:27-37.
10. Gunatathna TVNM, Karunaratna MMSC. Laboratory evaluation of some Sri Lankan plants as post-harvest grain protectants for the control of rice weevil *Sitophilus oryzea*. Vidyodaya Journal of Science. 2009; 14(11):69-83.
11. Thomas KJ, Selvanayagam M, Raja N, Ignacimuthu S. Plant products in controlling rice weevil *Sitophilus oryzae*, 2002.
12. Champ BR, Dyte CE. Global survey of pesticide susceptibility of stored grain pests. FAO Plant Protection Science, No. 5, FAO, Rome, 1976.
13. Adams JM. Weight loss caused by development of *S. oryzae*. J. Stor. Prod. Res. 1976; 12:269-272.
14. Isman MB, Wan AJ, Passreiter CM. Insecticidal activity of essential oils to the tobacco cutworm, *Spodoptera litura*. Fitoterapia, 2001; 72:65-68.
15. Lajide L, Escoubas P, Mizutani J. Antifeedant activity of metabolites of Aristolochia albida against the tobacco cutworm, *Spodoptera litura*. Journal of Agricultural and Food Chemistry. 1993; 41:669-673.
16. Rajam MV. Insecticidal activity of inhibitors of polyamine synthesis on *Spodoptera litura* F. larvae. Indian Journal of Experimental Biology. 1991; 29:881-882.
17. Bohnenstengel FJ, Wray V, Write L, Srivastava RP, Prokach P. Insecticidal Meliascarpins (*Cseco limonoids*) from Melia azedarach. Phytochemistry. 1999; 50:977-982.