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Field study on Miticidal activity of some Plant extracts on Leaf Galls of *Pongamia pinnata* (L.) Pierre in Forest nursery of Indore, India

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Abstract

Gall formation is the consequence of interaction between the offensive stimulation of the insect and the defensive response of the plant. Eriophyes cheriani massee is a gall formation insect found on the leaves of Pongamia pinnata. In current study, Different concentrations of leaf aqueous and ethanol extract of Calotropis procera, Ipomoea carnea and Thevetia peruviana were tested against galls inducing insect Eriophyes cheriani massee on host plant Pongamia pinnata. Prepared leaf extracts were tested in field condition and the most effective concentration has been worked out.

Keywords: *Eriophyes cheriani massee, pongamia pinnata* and leaf extracts.

Introduction

The pests are the various organisms which infect plants and cause various diseases. These infections adversely affect the growth and development of plants. It is highly desirable to keep plants free from pests. There are a number of pesticides available in market, all are synthetic toxic chemicals. Over dependence on chemical fertilizers for increasing food production has made our soil sick[1]. There is hardly any leftover natural resistance in most of our farmlands to pest and disease. Use of such chemically treated food crops also caused a multitude of diseases in humans, adding new dimension to the problem. The development of botanical insecticides is a novel and safer alternative strategy. These botanical insecticides are safer as well as environmentally friendlier than synthetic insecticides.

The use of botanical insecticides/Bio-pesticides may serve as suitable alternative as they are relatively less harmful and economical (abundantly available in nature). Bio-pesticides are derived from natural materials such as plants, animals and bacteria widely used for controlling insects and disease causing pathogens. Though several plants from different families have been reported for their pesticidal activity, only a few botanicals have moved from the laboratory to field use. The extract of *Azadirachta indica* seeds (Neem Oil) were used as herbal pestcide and insect repellent. Many plant extract were reported to contain bioactive molecules in plant part including leaf, flower, seed, and fruit and have potential to act as pesticide. These bioactive molecules may kill or inhibit the growth of insect/pests. The present studied, were conducted in field condition to observe the miticidal activity of aqueous and ethanol solvent leaf extract of *Calotropis procera, Ipomoea carnea* and *Thevetia peruviana* against leaf galls of *Pongamia pinnata.*

Material and method

Host plant: *Pongammia pinnata* is a medium sized evergreen glabourus shrub or tree 15-25 m high, more in diameter and broad crown of branches. Bark is grey –brown, smooth or faintly vertically fissured. Branchlets are hairless with pale stipule scars, leaves are alternate, imparipinnate with long slender leafstalk, hairless, pinkish red when young, glossy dark green above and dull green with prominent veins beneath when mature[2].

It is used as medicinal plant particularly in ayurvedic medicine system of India, for bronchitis, whooping cough, rheumatic joints and diabetes. Leaves used as medicated bath for reliving rheumatic pain and for cleaning ulcer in gonorrhea. The bark is used internally for treatment of bleeding piles and diabetes and as antimicrobial. The pongam seed oil has bitter taste and considered as non edible oil. It is used as fuel for cooking and lamps, lubricant, tanning leather making soap and as illuminating oil. The seed oil contains karanjin, an active ingredient with important biological attributes. After extraction of oil from seeds, the remaining press-cake is used as poultry feed[3].

In current study, insect galls were observed on leaf surface of *Pongamia pinnata*. The insect species *Eriophyes cheriani massee* causes galls on both leaf surface of *Pongammia pinnata*[4]. These insect galls were made by outgrowth of plant tissue (figure-1 and 2). It generally does not kill the host plant but can severally reduce growth and yield. Further leaves become dry and are discarded. In current study we observed effect of some neem oil based botanical extracts on infected karanj plants.

Figure-1
Insect Galls on *Pongamia pinnata* leaf

Figure-2
Insect Galls on *Pongamia pinnata* leaf in Forest nursury

Collection of Test plant materials: Samples of test plants viz. *Calotropis procera, Ipomoea carnea* and *Thevetia peruviana,* were collected from different places of Indore district. The samples containing leaves of the selected plant materials were air-dried for 6-7 days. After complete drying the plant parts were pulverized into powder. The plant material was extracted by following method.

Soxhlet extraction: The ordinary method of extraction was not efficient to yield good amount of active principle of the plant material. To extract more active principle from all the plant materials, Soxhlet extraction was used. Known amount of plant material of each species was filled into the Soxhlet apparatus. A cotton plug was used at the place of thimble to stop the entry of the crude material into the siphoning tube. The required solvent (Aqueous/Ethanol) was filled up five times more than total amount of the sample material into the flask of the apparatus. The apparatus was then connected with the water supply to the condenser. The temperature of the heating mantle was maintained. The process was carried out for 5 to 6 hours for each sample[5]. The extract was transferred to Petri plates and solvent was allowed to evaporate.

The evaporated material was weighed and mixed with neem oil based emulsion. Neem oil based emulsion was a mix. Emulsion of neem seed oil (8ml), liquid soap (4ml) and water (2L). 2.5 gm of plant part extract of each test plant species in 10% different solvent mixed with 250ml neem oil based emulsion. Different types of formulation were fill up in different spray pump and sprayed on host plant species.

Treatment (process of dose administration): The dose were prepared in glass jars and filled in spring bottles. The formulation was sprayed on selected plants in a month of (July-august). This is the period, usually atmospheric temperature is normal but during the present study the Moisture was also present in air. During our trials test plants were exposed to ample sunlight regularly. The weather was rainy. These are optimum condition for growth of insect and pest.

In field trial, treatments of formulation on host plants were given in regular interval of 7 and 15 days from first day of treatment. The trials were started with leaf crude aqueous/ethanol extract of *Thevetia, Ipomoea* and *Calotropis* plants on host *Pongamia pinnata.*

Results and Discussion

The Data presented in table 1 showed that number of infected leaves in control was increased and at treatments number of infected leaves was reduced. Table 1 revealed that ethanol extract of *Calotropis procera* leaves with neem oil based emulsion found more effective than aqueous as ethanol has been inhibited by 6.9% infected leaf compare to 1.6% increase by aqueous extract. The ethanol extract of *Ipomoea carnea* leaves with neem oil based emulsion found more effective than aqueous as ethanol has been inhibited by 4.6% infected leaf compare to 2.9% increase by aqueous extract. The ethanol extract of *Calotropis procera* leaves with neem oil based emulsion found more effective than aqueous as ethanol has been inhibited by 8.6% infected leaf compare to 4.3% decrease by aqueous extract.

The results showed, effect of leaf extracts of test plants with Neem oil based emulsion, to control leaf galls in host plant. Effects of treatments on leaf galls in plant evaluated from the reduction in numbers of infected leaves after application of treatments. The analysis of variance in the effects of treatments generally indicated that plant extracts (with neem oil emulsion) were effective on infected leaves, than untreated during trials. Soxhelt aqueous/ethanol leaf extract of *Calotropis procera, Ipomoea carnea* and *Thevetia peruviana* with Neem oil based solution found effective on infected plant. Only neem oil based

emulsion found also effective. Neem oil has some biochemical constituent. These constituent found effective against insect *Eriophyes cheriani massee*. Neem seed extract reported effective against Leaf folder, aphids, Jassids, fruit borer and stem borer insect[6]. Biologically active principles isolated from different parts of the plant include: Azadirachtin, meliacin, nimbidin, nimbolides, salanin, nimbin meliacin forms bitter principles of neem oil. The seed also contain tignic acid responsible for the distinctive odour of the oil[7]. The four best limonoids compounds are Azadirachtin, Salanin, Meliantriol and Nimbin. Limonoids contain insecticidal and pesticidal activity[8].

The present study indicates *Thevetia peruviana* leaf extract in ethanol were effective against galls infection in leaf. While *Thevetia peruviana* aqueous leaf extract were not much effective. All parts of these plants are toxic, and contain a variety of cardiac glycosides including nerifolin, thevetin A, thevetin B and oleandrin[9]. *Thevetia peruviana* seed oil used as antifungal, antibacterial and antitermite reagent[10]. The acetone leaf and bark extract of *Thevetetia peruviana* were found effective against freshwater fish *Catla catla*[11].

Ipomoea carnea leaf extract also found effective, Bio-pesticidal activity of *Ipomoea carnea*, *Jatropha curcas* and *Calotropis gigentea* against leaf folder insect (*Cnaphalocrosis medinalis*) also reported[12]. A protein inhibitor and poisonous compound Swainsnine was reported in *I. carnea*. This compound together with bitter alkaloid has antifeedant activity against rice leaf folder[12]. The leaf proteins of *I. carnea* have antimicrobial properties[13].

C. procera leaf extract found most effective which resulted that the plant species have some miticidal properties. Chloroform extract of *C. procera* leaf found maximum anti feeding activity followed by hexane; ethanol, acetone, ethyl acetate and methanol extract[14]. *C. procera* leaf extract also found effective against *Tribolium castaneum* Herbst in Stored Wheat *Triticum Aestivum* L.[15]. Pharmacologically substances such as calotropon, calotropin, uscharine, calotoxin, calctin, uscharidin and calotropagenin etc are some important chemicals obtained from the leaves and latex of *C. procera* plant[16]. The results in table-1 (figure-3) represented that the *Calotropis procera* leaf ethanol extract have some repellent property against mite *Eriophyes cheriani massee.* The toxicity of *Calotropis* and *Annona* leaf extracts against *M. domestica* larvae and phytochemical analysis of the extract showed the presence of alkaloids in maximum amount in ethanol extract of *C. procera* leaves[17].

Table-1
Treatment on *Pongamia pinnata* with Soxhelt leaf Ethanol/Methanol Extract of selected plant species

S. No.	Treatment Type	No. of Leaves						Effect of treatment on infected leaves After 15 day in %
		Total No. of leaves			No. of Infected leaves (%)			
		A	B	C	A	B	C	
1.	Control	140	139	130	48 (34.2)	59 (42.4)	70 (53.8)	19.6 Increase
2.	1. Base sol.	144	140	122	70 (48.6)	63 (45)	55 (45)	3.6 Decrease
3.	2. Base sol. with *Thevetia* leaf extract in water	123	132	130	51 (41.4)	44 (33.3)	56 (43)	1.68 Increase
4.	3. Base sol. with *Ipomoea* leaf extract in water	138	126	132	66 (47.8)	71 56.3)	67 (50.7)	2.9 Increase
5.	4. Base sol. with *Calotropis* leaf extract in water	140	134	156	67 (47.8)	49 (36.5)	68 (43.5)	4.3 Decrease
6.	5. Base sol. with *Thevetia* leaf extract in 95% Ethanol	99	83	124	46 (46.4)	38 (45.7)	49 (39.5)	6.9 Decrease
7.	6. Base sol. with *Ipomoea* leaf extract in 95% Ethanol	118	84	133	31 (26.2)	31 (25)	28 (21.6)	4.6 Decrease
8.	7. Base sol. with *Calotropis* leaf extract in 95% Ethanol	95	101	80	45 (47.3)	49 (48.5)	31 (38.7)	8.6 Decrease

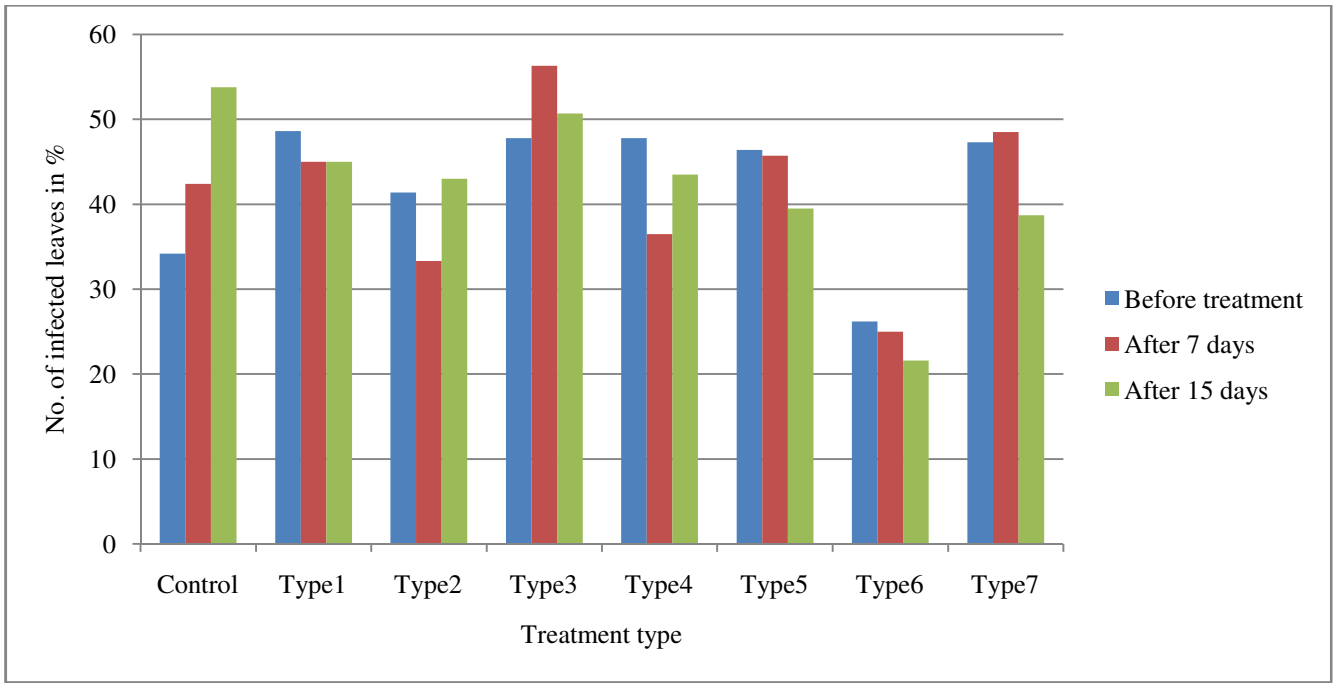

Figure-3
Treatment on Pongamia pinnata with Soxhelt leaf Aqueous/Ethanol Extract

Conclusion

Now we concluded that the Leaf Extract of test plants found effective against mite *Eriophyes cheriani massee*. The experimental results proved that the biopesticides derived from plants play a major role in combating the insect pest, and thereby prevent the damage caused by the mites. These biopesticide, applied at the right dosage and time it would certainly be an alternative to chemical pesticides at the field level. If these biopesticides produced commercially and farmers are trained for their use there is no doubt that these eco-safe products can replace the hazardous chemicals of the field in coming days.

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