



## Biological control methods in *Piper nigrum* Linn. leaves infected with galls caused by *Liothrips karneyi*

Asha Renjith\*, Payal Lodha

Department of Botany, University of Rajasthan, Jaipur - 302 004 (Rajasthan), India



### Article History:

Received on: 15 Aug 2020

Revised on: 14 Sep 2020

Accepted on: 16 Sep 2020

### Keywords:

Gall,  
Plant Extracts,  
Biological Method,  
Liothrips Karnyi,  
Disease Management

### ABSTRACT

*Piper nigrum* Linn. (*Black pepper*) belongs to the family Piperaceae and an economically and medicinally important spice and is a native of Southern India. Leaf marginal gall is transmitted by *Liothrips karnyi* belonging to family Phlaeothripidae of order Thysanoptera (Thrips). Insect induced galls arise due to growth reaction of plants due to the attack of cecidozoa, also known as zoocecidia. The growth and development of the host plant alter due to the infestation of the insect, which involves certain complex phenomena. The different groups of cecidozoa influence the plants in such a way as to produce galls at different stages in their life history. Most of the cecidozoa cause galls only in their developmental stages, but some of them are capable of inducing galls both in larval as well as adult stages. The crop production in India has been adversely affected due to the infestation of pests. And it is necessary to use different approaches of disease management to curb the infestation, and significant researchers have shown progress to protect the crops in an eco-friendly manner. Piperine exhibits diverse pharmacological activities like antihypertensive, antiplatelets, antioxidant, antitumor, antipyretic, analgesic, anti-inflammatory, anti-diarrheal, antibacterial, antifungal, anti-reproductive, insecticidal activities. In the present investigation, the biological method of disease management of marginal leaf gall transmitted by *Liothrips karnyi* has been undertaken. The biological control of leaf diseases has been significant on the increased reflection of environmental problems over pesticide uses.

### \*Corresponding Author

Name: Asha Renjith

Phone: 89630 89791

Email: rasha215@yahoo.com

ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v12i1.4162>

Production and Hosted by

IJRPS | [www.ijrps.com](http://www.ijrps.com)

© 2021 | All rights reserved.

### INTRODUCTION

*Piper nigrum* Linn. (*Black pepper*) grows mostly in the Malabar coast, growing in rich soil in the shade of trees.

It adheres to the trunks through ivy-like rootlets. Coconut, areca nut, jack fruit, mango, subabul are the other supports used in homestead gardens. From its climbing habit, it has received the name of Pepper Vine, and in cultivation, the plants are often trained on artificial supports.

Black pepper is an economically significant plant with medicinal properties, principally being used as a condiment, partly for its flavor, and partly on account of its stimulant influence over the stomach, by which it assists digestion; it is of unique medicinal value for persons suffering from atonic or torpid conditions of the stomach and also for curing ailments like tonsillitis, toothache, sore throat, migraine, throat infection, bronchitis etc., (Bentley *et al.*, 1880). One of the significant problems controlling this crop production is the leaf galls caused by the *Liothrips karneyi*.

**Table 1: Plant galls studied in the present investigation.**

S No	Host Plant	Organ Affected	Gall incitant	Place of Collection
1.	<i>Piper nigrum</i> Linn.	Leaf	<i>Liothrips karnyi</i> (Bagnal)	Thiruvananthapuram, Idukki, Quilon, Calicut, Kottayam

**Table 2: Effect of plant extract and soap solution in management of marginal leaf gall.**

S No	Days after transplanting	By using the extract of neem	By using the extract of <i>Calotropis</i>	By using a soap solution
1	15	75%	62%	72%
2.	30	78%	63%	72%
3.	45	79%	65%	73%
4.	60	80%	70%	73%
5.	75	81%	71%	73%

In the present investigation, biological control methods, using leaf extracts of neem leaves, calotrophis procera and soap solutions have been tested, and the results are presented.

#### MATERIALS AND METHODS

Field experiments were conducted on the onset of monsoon, in Kerala, to test the efficiency of plant extracts and insecticides separately for management of Marginal leaf gall disease of *Piper nigrum* Linn (Table 1). The experiments were conducted in three replicates of each treatment using 10 % Leaf extracts of *Azadirachta indica*, *Calotrophis Procera* and Soap Solutions. Pepper pots were kept under 2x2 m block randomly, with spacing 15 cm between plants and 30cm between rows.

Pepper pots were sprayed with 10% concentration of leaf extracts of neem (*Azadirachta indica*), *Calotropis procera* and soap solution. The spray of plant extract/ soap solution was repeated every 15 days. Control plants were sprayed with distilled water. To obtain 10% plant extract, 1 Kg of air-dried leaves of selected plants were powdered separately and suspended in 5 litres of water. The suspension was heated at 50 degrees C for 1 hour, and the filtered extract was adjusted to 10 litres of volume by adding water that yielded 10% concentration of plant extracts. The soap solution was obtained by mixing 1 tsp full of Nirma detergent powder to 2 litres of water. Control of the intensity of the disease was calculated based on the following formula;

$$\text{Percent disease reduction} = \frac{C - T}{C}$$

Where,

C= Percent disease in control

T= Percent disease in treatment

#### RESULTS AND DISCUSSION

The results of the experiments indicated that highest reduction to control leaf marginal roll galls of *Piper nigrum* Linn. induced by *Liothrips karnyi* (Bagnall) with extract of *Azadirachta indica* and followed by soap solution and *Calotropis* respectively. (Table 2). The effect was duration dependent. However, 100 % control of the leaf galls could not be obtained even up to 75 days of the treatment period. 10% Plant extract of *Azadirachta indica* and soap solution were very effective in controlling Marginal leaf gall transmitted by *Liothrips karnyi*.

Infection of gall thrips generally occurs in the early stages of host plant development when young leaves are more and primarily affect the leaves (Varadarasan and Ananthkrishnan, 1981, 1982). Majority of the economic plants are affected by leaf galls caused by mites of Eriophyses Sp. (Rogerson and Mani, 1965; Channabasavanna and Nangia, 1984), leading to severe damages to their production and causing greater economic losses (Balasubramanian and Purushothaman, 1972; Purohit et al., 1979). For the control of diseases, mainly, the leaf galls, although several controlling mechanisms have been employed, viz., physical methods, chemical methods, disease-resistant plant cultures etc., the biological control methods are considered to be more valuable, cost-effective and free of side effects.

Biological control methods are more preferred, for the reasons that it causes fewer damages to crops, eliminates or reduce the safety hazards of harmful chemicals or insecticides, and protects the environment and water quality. Beneficial insects as predators, beneficial parasites as plant cultures and plant extracts as insecticides are the most pre-

ferred biological control methods (Mukherjee *et al.*, 1994). Among the plant extracts, the leaf extracts of *Azadiracta indica*, *Calotropis procera*, *Mirabilis jalapa*, *Dianthus caryophyllus*, *Clerodendrum aculeatum*, *Amaranthus Viridis* have been widely used. Reduction of foliar infection caused by *Phytophthora capsici* through biological control measures using *Pasteuria fluorescens*. Biological control of *Meloidogyne incognita*, a Root-knot nematode in black pepper, *Piper nigrum* L. using an endospore-forming bacteria, *Pasteuria penetrans*, and a parasitic fungus on eggs, *Paecilomyces lilacinus*, have also been reported (Anith *et al.*, 2003; Paul and Sarma, 2006).

In the present investigation, biological control measures using 10% plant extracts of *Azadiracta indica* and *Calotropis procera* and soap solutions have been investigated in control of leaf galls of black pepper caused by *Liothrips karnyi*. The investigation showed promising results in controlling the leaf galls in a duration-dependent manner. The method is easy to use, cost-effective, and above all, safety to the environment and water resources. 10% leaf extract of *Azadiracta indica* and soap solution were found to be more effective in controlling up to 80% of the disease. A little higher percentage, viz., 15 to 20 % leaf extract is expected to control 100 % diseases.

## CONCLUSIONS

In control of marginal leaf galls of *Piper nigrum* Linn. induced by *Liothrips karnyi* (Bagnall), 10% leaf extract of *Azadiracta indica* and soap solution are considered to be more effective in controlling up to 80% of the disease. A little higher percentage, viz., 15 to 20 % leaf extract is recommended for a 100% disease control. The effect could be dose and duration dependent.

## ACKNOWLEDGEMENT

The Department of Botany supported the investigation by the University of Rajasthan, which is gratefully acknowledged.

## Conflict of interest

The authors declare that they have no conflict of interest for this study.

## Funding support

The authors declare that they have no funding support for this study.

## REFERENCES

- Anith, K. N., Radhakrishnan, N. V., Manomohandas, T. P. 2003. Screening of antagonistic bacteria for biological control of nursery wilt of black pepper (*Piper nigrum*). *Microbiological Research*, 158(2):91-97.
- Balasubramanian, M., Purushothaman, D. 1972. Phenols in healthy & galled leaves of *Pongamia glabra* Vent caused by an eriophyid mite. *Eriophyes cherianii* Masee (*Eriophyidae: Acarina*), 10:394-395.
- Bentley, R., Trimen, H., Churchill 1880. Medicinal Plants (Bentley, R. and Trimen, H., Eds.). *J and A Churchill, London*, pages 183-183.
- Channabasavanna, G. P., Nangia, N. 1984. The biology of gall mites. *Biology of gall insects*, pages 323-337.
- Mukherjee, I. N., Singh, R. K., Singh, J. 1994. Incidence and control of jujube gall mite (*Eriophyes cernuus*) at Varanasi. *Indian Journal of Agricultural Sciences*, 64(5):343-345.
- Paul, D., Sarma, Y. R. 2006. Rhizospheric *Pseudomonas fluorescens* enhances piperine production in *Piper nigrum*, a possible means of biochemical defence against *Phytophthora capsici*. *Archives Of Phytopathology And Plant Protection*, 39(1):33-37.
- Purohit, S. D., Ramawat, K. G., Arya, H. C. 1979. Phenolics, peroxidase and phenolase as related to gall formation in some arid zone plants. *Current Science*, pages 714-716.
- Rogerson, C. T., Mani, M. S. 1965. Ecology of Plant Galls. *Mycologia*, 57(1):145-145.
- Varadarasan, S., Ananthakrishnan, T. N. 1981. Population dynamics and prey-predator/parasite relationships of gall-forming thrips. *Proc. Indian Nat. Acad. B*, 47:321-340.
- Varadarasan, S., Ananthakrishnan, T. N. 1982. Biological studies on some gall thrips. *Proc. Indian Acad. Sci. B*, 48:35-43.