IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Research Finding On Bio-Control Of Leaf Spot Disease In Mulberry (Morus Spp.) Using Different Bio Chemical Methods

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Abstract

Sericulture in India is as old as Indian culture itself. India has emerged as a prominent sericulture practising country in the world landscape. The silkworms' healthy and vigorous growth is dependent on the quality of the mulberry leaf. Diseases are a key limiting issue in Mulberry farming, with Cercosporamoricola Cooke, the incitant of leaf spot, being one among them, inflicting significant harm to leaf yield while also affecting silkworm health. When four plant extracts and three plant oils were tested against the pathogen, Eucalyptus globules at 10% (72.59%) and Madhucaindica oil (3%) shown the greatest inhibition. Among the many fungal biocontrol agents tested against the disease, Trichodermaviride (80.55 percent) inhibited mycelial growth much more than the control.

Keywords:- Mulberry, Leaf spot disease, Bio-Control methods, silkworm health.

I. INTRODUCTION

Mulberry plant is distributed all over the world. It is cultivated both in temperate and tropical regions of the world. Mulberry forms the sole food and the only source of nutrition for silkworm (Bombyx mori L.). For the development of silk industry, production of high-quality silkworm cocoons is must. To achieve the goal of production of good quality silkworm cocoon crop, certain factors play an important role. The most important factor is the mulberry leaf, contributing about (38.2%) followed by climate (37%), rearing techniques (9.3%), silkworm race (7.3%), and other factors (6.6%) (Kamili and Masoodi,2000). Hence, the quality of the mulberry leaf is one of the basic prerequisite for sericulture and plays a pivotal role in successful silkworm cocoon crop. The growth and development of larvae and subsequent cocoon production are very much influenced by its nutritive value (Krishnaswamy, 1978). Although the leaf quality is a specific character of mulberry variety, it is adversely influenced by the improper soil and climatic conditions, improper agronomic inputs and the outbreak of diseases and pests (Reddy etc al., 2001 & 2004; Lakshmi et al., 2001). “While the major producers are in Asia (90% of mulberry production and almost 100% of non-mulberry silk), sericulture industries have been lately established in Brazil, Bulgaria, Egypt and Madagascar as well. Sericulture is labor-intensive. About 1 million workers are employed in the silk sector in China”. ‘China and India’ are the major producers of silk among the silk producing countries of the world. China produces nearly 71% of the total raw silk production in the world, followed by India (17%). Other countries like Japan, Brazil, Korea Republic, Uzbekistan, Thailand and Vietnam are also practicing sericulture. The demand for silk is also increasing all over the world and it is only the China and India which are meeting the demand of world raw silk. “India is the second largest producer of silk in the world with an annual silk production of 23,679 MT (Provisional) in 2012-13. India has the unique distinction of being the only country producing all the five kinds of silk namely,

Mulberry, Eri, Muga, Tropical Tasar and Temperate Tasar. Among them, mulberry silk is the most popular variety, which contributes around 79% of the country's silk production. Sericulture is an important labour-intensive and agro-based cottage industry providing gainful occupation to around 7.63 million persons in rural and semi-urban areas in India. Of these, a sizeable number of workers belong to the economically weaker sections of society. There is substantial involvement of women in this Industry". "In India, sericulture is mostly a village- based industry providing employment opportunities to a large section of the population. Although sericulture is considered as a subsidiary occupation, technological innovation has made it possible to take it up on an intensive scale capable of generating adequate income. It is also capable of providing continuous income to farmers. Silk and silk goods are very good foreign exchange earners. The present global scenario clearly indicates the enormous opportunities for the Indian silk Industry".

II. DISEASES & PESTS OF MULBERRY FOOD PLANTS

1. Leaf Spot

Pathogen: Cercospora moricola

Occurrence: It is more prevalent during rainy season followed by winter. The disease starts progressing 35-40 days after pruning (DAP)/leaf harvesting and becomes severe on the 70thDAP.

Crop loss: 10-12 %

Symptoms: Brownish necrotic, irregular spots appear on the leaf surface. Spots enlarge, extend and join together leaving characteristic 'shot hole'. Leaves become yellow and wither off as disease becomes severe.

Fig.1.Leaf spotFactors responsible for spreading of the disease:

- The disease is air borne spreading by conidia primarily through rain droplets.
- Temperature of 24-26 ºC and 70-80 % relative humidity are most congenial for thedisease development.

Control measures to be adopted:

- Spraying of 0.2 % Bavistin (Carbendazim 50% WP) solution on the leaves.
- Safe Period: 5 days.

2. Powdery Mildew

Pathogen: Phyllactinia corylea

Occurrence: Disease is prevalent during winter and rainy seasons and progresses 40th DAP/leaf harvest becoming severe on 70th DAP.

Crop loss: 5-10%

Symptoms: White powdery patches appear on the lower surface of the leaves. The corresponding portions on the upper surface develop chlorotic lesions. When severe, the white powdery patches turn to brownish-black; the leaves become yellow, coarse and loose their nutritive value.

Fig.2. Powdery mildewFactors responsible for spreading of the disease:

- The disease is air borne spreading by conidia primarily through wind current.
- Temperature of 24 - 28º C and high relative humidity (75-80 %) are responsible forinfection and disease development.

Control measures to be adopted:

- Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system[(90 +150) × 60 cm]
- Spraying of 0.2 % Karathane (Dinocap 30% EC) / Bavistin on the lower surface of theleaves. Safe period 5 days.
- Or spray Sulfex (80WP) 0.2%, safe period 15 days.

3. Leaf Rust

Pathogen: Cerotelium fici

Occurrence: The disease is more prevalent during winter and rainy seasons. It starts progressing 45-50 DAP becoming severe on 70th DAP. The mature leaves are more proneto the disease

Crop loss: 10-15%

Symptoms: Initially, circular pinhead sized brown eruptive lesions appear on the leaves and later leaves become yellow and wither off.

Fig.3. Leaf rust factors responsible for spreading of the disease:

- The disease is air borne dispersing by uredospores through water droplets and windcurrent.
- Temperature of 22-26°C and high relative humidity above 70 % are favourable for thedisease development.

Control measures to be adopted:

- Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system[(90+150) × 60 cm]
- Avoid delayed leaf harvest
- Spraying 0.2% Kavach (Chlorothalonil 75 % WP) on the leaves
- Safe period: 5 days

4. Sooty mould

Pathogen: A group of fungi

Occurrence: The disease is more prevalent during winter (August-December) season.Crop loss: 10-15%

Symptoms: Thick black coating develops on the upper surface of the leaves.

Factors responsible for spreading of the disease:

- The disease occurs due to the presence of white flies in the mulberry field.
- The fungi develop on the honey like substance produced by the whiteflies.
- Temperature of 20-24° C and high relative humidity above 70 % are favourable forthe disease development.

Control measures to be adopted:

- Spray 0.2% Indofil-M45 to check growth of saprophytic fungi
- Foliar spray of 0.02% monocrotophos on 15th and 30th day after pruning to controlwhite fly infestation.
- Safe period: 15 days.
- prevent the disease.

III. Experiment and Result

Cercospora leaf spot disease was observed on the mulberry plantations in different parts of Andhra Pradesh. The plantations are with V1 variety with spacing of 60 cm x 60 cm in between rows and plants. Studies related to the leaf spot infestation were carried out during July - December, 2016. Leaf Samples with Cercospora infections were collected from the mulberry plants and utilized for further work. Further experimental work was carried out in the experimental field of the Sericulture farmers. Experiments were conducted under field conditions on the popular mulberry variety namely, V1 by following spacing of 60 cm x 60 cm in between rows and plants. Recommended agronomical practices were adopted for the better crop growth in all the plots.

Isolation and identification of Cercospora moricola Cooke from the infected mulberry leaves:

Nature of sample collection: The collection of the leaf samples infected with Cercospora moricola Cooke was done in sterilized polythene bags separately for culturing and isolation from the Mulberry Demonstration Farm at Anantapur, A.P.

Isolation:

The collection of diseased leaves having distinct leaf spot symptoms was done to identify causal pathogen. Lactophenol-cotton blue staining was done for microscopic slides of free- hand sections of infected leaves and was observed under microscope (400 X).

A one minute surface sterilization was done with 0.1% Mercuric Chloride solution to the Cercospora moricola Cooke. infected areas of the mulberry leaf which was cut into bits (0.5cm) and was washed in sterile distilled water for three times before being plated in Potato Dextrose Agar Media. Incubation of the plates were done at 28 ± 2 o C. On the 4th day, the aseptic transfer of the bits to PDA slants was done after the bits being examined for the fungal growth around it. “The isolate was further purified by mono-hyphal

tip method,identified and maintained on PDA medium".

Identification:

"Atomizing the aqueous conidial suspension (4.5x10 6 conidia/ml) @ 8-10 ml/plant on to the 3-month-old potted Mulberry plants of V1 variety was performed to test Pathogenecity. The control plants were kept covered with polythene bags for 48 h to maintain sufficient moisture for spore germination and development of disease. After 15 days, the similar symptoms of leaf spot as seen as seen on the original diseased plants were observed, thus fulfilling the Koch's postulates. With the help of the illustrated manual and published papers (Ellis and Ellis, 1985; Biswas et al, 1996; Hartman, 1991; Singh and Bhalla, 2000) the fungus was identified as Cercospora moricola Cooke, belongs to the order Moniliales of the class, Deuteromycetes. The isolated fungus, Cercospora moricola Cooke was maintained as stock culture in the slants of PDA medium. Stock cultures of Trichoderma viride and Trichoderma harzianum were procured from the Biological Pest Control Laboratory, Department of Agriculture, Anantapur, (A.P) were also maintained in the PDA slants".

Maintenance of pure cultures: The slants of potato dextrose agar medium was used for the stock cultures of the respective fungi, Cercospora moricola Cooke, Trichoderma viride and Trichoderma harzianum which were maintained at 4^{o}c for further usage. Once in every three months they were sub cultured in fresh slants. Two slants were maintained for the respective fungi of which one is used for the regular culturing for utilizing it in the experimentation while the other is kept as stock culture.

Table:1. Cercospora moricola Cooke mycelial growth inhibition (percent) and colony diameter (in vitro) efficacy of plant products

Plant species	Concentration		
	2.5%	5%	10%
Azadirachta indica	15.25 ± 2.22	29.06 ±2.58**	35.25 ±2.03**
Allium sativum L.,	22.00 ±2.16	24.75 ± 1.96**	41.08 ±2.47**
Adathoda vasica	15.75 ± 2.63	26.75 ±2.80**	46.00 ±2.18**
Aloe barbedensis	20.75 ± 1.71	32.15 ±4.03**	45.75 ±2.75**
Eucalyptus globules	11.25 ± 2.22	22.35 ±2.58**	72.59 ±2.17**
Oscimum sanctum	14.25 ± 2.22	37.55 ± 2.92**	49.08 ±2.34**
Parthenium hysterophorus L.	19.75 ± 1.26	25.55 ±2.20**	49.00 ±2.91**
Phyllanthus emblica	25.75 ± 6.24	27.25 ±2.85**	46.75 ±2.57**
Neem seed kernel extract	34.16 ± 3.24	38.5 ±2.87**	48.38 ±5.91**
Control	0.00	0.00	0.00

Values are representing of four replicates; ± values are SD, significant ** $P \leq 0.001$ when compared to the values of 2.5%

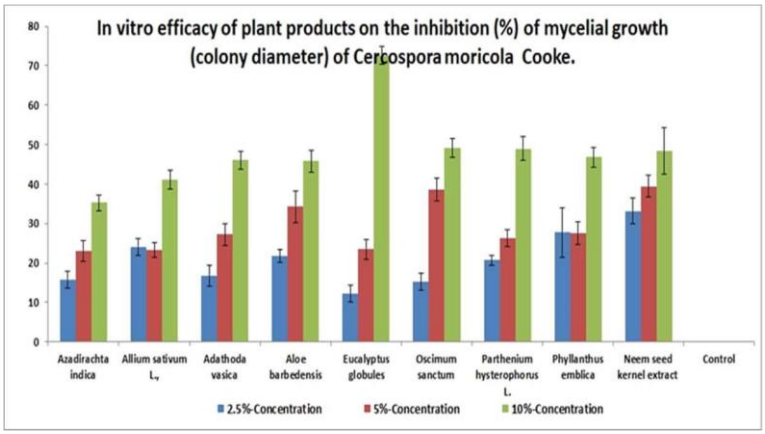
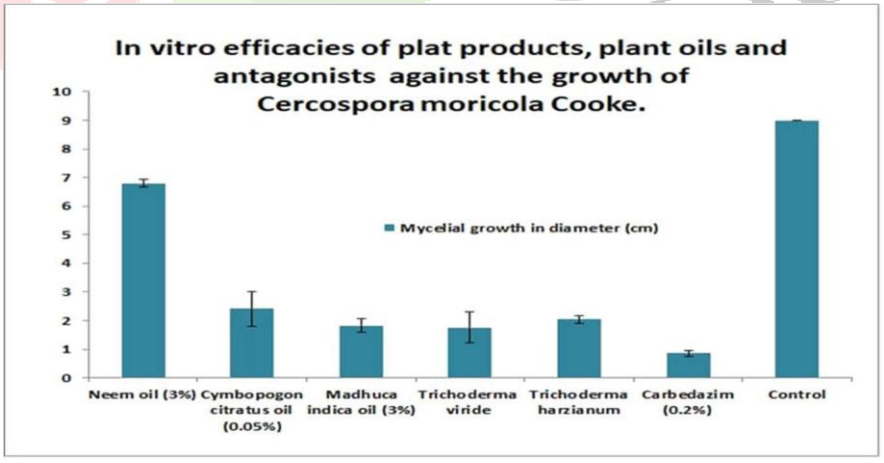


Table: 2. Cercospora moricola Cooke antagonists, plant oils, and their in vitro effectiveness against the organism.

Treatment	Mycelial growth in diameter (cm)	Inhibition %
Neem oil -3%	6.8 ± 0.14	24.44 ± 1.97**
Cymbopogon citratus oil - 0.05%	2.41 ± 0.61	73.22 ± 1.13**
Madhuca indica oil – 3 %	1.82 ± 0.24	75.73 ± 1.57**
Trichoderma viride	1.75 ± 0.54	80.55 ± 2.43**
Trichoderma harzianum	2.04 ± 0.13	60.91 ± 3.24**
Carbedazim - 0.2%	0.85 ± 0.11	90.55 ± 2.13
Control	9.00	0.00

Values are representing of four replicates; ± values are SD, significant ** $P \leq 0.001$



IV. Conclusion

Studies are to be aimed at the seasonal incidence of Cercospora Spp. on other crop plants and weeds that are nearer to the mulberry gardens for better assessment of their role as a source of inoculum, in supporting incidence of leaf spot disease on mulberry leaves.

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