



Integrated Pest Management (IPM) module for Tukra mealy bug, *Maconellicoccus hirsutus* (Green) and leaf webber, *Diaphania pulverulentalis* (Hamp.) in mulberry

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ABSTRACT

Sericulture is one of the viable enterprises which provide income through out the year unlike other commercial crops. Indiscriminate use of chemical fertilizers and insecticides for maximizing the leaf yield of mulberry adversely affects the soil health. Hence the study was taken up as farmer's participatory mode in which Integrated Nutrient Management (INM) itself was included as a component of IPM module against tukra mealy bug *Maconellicoccus hirsutus* and leaf webber *Diaphania pulverulentalis* besides spraying of neem oil at 1%, 2% and 3% concentrations in 10 days interval. Data on the infestation (%) of tukra mealy bug *M. hirsutus* and leaf webber *D. pulverulentalis*, population of coccinellids and spiders (Nos./ 20 plants) and soil macro fauna/ ft³ (earthworms, centipedes and millipedes) were recorded. Results indicated the reduction of infestation (%) of tukra mealy bug *M. hirsutus* and leaf webber *D. pulverulentalis* and improvement in the population of coccinellids, spiders and soil macro fauna in mulberry ecosystem.

Keywords: *Maconellicoccus hirsutus*, *Diaphania pulverulentalis*, crop pests, IPM module, mulberry, intercrop, natural enemies

INTRODUCTION

Mulberry (*Morus* spp.) is a sole food plant of *Bombyx mori* L. and cultivated in about 34,600 acres in Tamil Nadu. In recent years, many pests and diseases have been reported to be the major limiting factors affecting production and productivity of mulberry leaves due to intensive cultivation practices and indiscriminate use of nitrogenous fertilizers and pesticides. There is also a change in the insect pest scenario in mulberry due to changes in climate and agro ecosystem. Besides the above practices, the use of high yielding varieties and monoculture has also invited pest problems and minor pests have become major ones. The pink mealy bug, *Maconellicoccus hirsutus* has got 346 host plants and in mulberry it causes leaf yield loss of 4500 kgs/ha/year thus depriving the farmer a brushing of about 450 dfls/ha/year leading decline in cocoon production of 150 kg/ha/year. The leaf webber, *Diaphania pulverulentalis* has been noticed as a serious pest in Karnataka since 1995 which has also spread to Tamil Nadu and Andhra Pradesh on local, M5, MR2, S36 and V1 varieties. The infestation of *D. pulverulentalis* is higher during October to February in Krishnagiri area (Muthulakshmi *et al.*, 2003; Samuthiravelu *et al.*, 2004) and October to December in Salem area (Qadri *et al.*, 2003). Rajadurai *et al.* (2000) reported that the pest caused the leaf yield loss of 12.8% with average incidence of 21.77%. It has been estimated that the cocoon loss in rupees was

45.9 lakhs in undivided Dharmapuri district (Muthusamy *et al.*, 2004). Hence a study was made with an objective of developing an IPM module integrating cropping system approach, bio fertilizer application, neem oil spraying to manage the insect pests *M. hirsutus*, *D. pulverulentalis* and to conserve natural enemies existing in the ecosystem.

MATERIALS AND METHODS

The study was taken up at Kokkanur village in Krishnagiri taluk as farmers participatory research. The experiment was undertaken covering 6 mulberry gardens at an area of one acre each in randomized block design and replicated four times (0.25 acre / replication). The module was developed by integrating different components as follows: 1. sowing of daincha (*Sesbania aculeata*) as green manure cover crop @ 12 kg / acre/crop on 7th day after pruning treated with *Rhizobium* (200 grams), 2. application of *Azospirillum* @ 1.6 kg / acre / crop and Phosphobacteria @ 2kg /acre / crop mixed with 100 kgs of well powdered FYM followed by copious irrigation, 3. spraying of 100 ml of triacontanol (Vipul) in two splits @ 100 ml / acre / crop and 4. spraying of neem oil 1%, 2% and 3% in three doses at 10 days interval (as needed based on the percentage of infestation) and application of neem oil cake @ 60 kgs / acre / crop along with 75% of recommended nitrogenous fertilizer besides full dose of phosphorous and potassic fertilizers.

The control farmers had not applied any biofertilizers, neem oil cake and not sprayed triaccontanol and neem oil but sprayed DDVP @ 2.5 ml / lit. The data on infestation (%) of tukra mealy bug, leaf webber and natural enemies viz. coccinellids and spiders (nos./ 20 plants) besides soil macro fauna (earthworms, centipedes and millipedes/ft³) on weekly intervals for four weeks. The data were collected for four crops continuously and pooled data subjected to statistical analysis.

RESULTS

The results pertaining to reduction of infestation of *M.hirsutus*, *D.pulverulentalis* and the occurrence of natural enemies in IPM module adopted and control gardens are presented in Table 1. The post count of *M.hirsutus* and *D.pulverulentalis* infestation were distinguishable between IPM adopted and control gardens. The percentage of reduction in infestation of *M.hirsutus* was ranging from 25.65 to 36.43 in IPM module adopted gardens and 8.68 to 25.00 in control gardens with the mean value of 32.75 and 18.79 respectively. The percentage of reduction of *D.pulverulentalis* was ranging from 5.52 to 21.14 and -15.53 to 9.44 with the mean values of 14.43 and -0.36 in IPM adopted and in control gardens respectively. The data on occurrence of natural enemies viz., coccinellids mainly *Cheilomenes sexmaculata*, *Coccinella septempunctata* etc. and spiders spp. showed increase in population at IPM adopted gardens significantly than control gardens as presented in Table 1. The mean value of percentage of increase in coccinellid population was 52.99 and 20.9 in IPM module adopted and control gardens respectively. The range of percentage of increase in IPM module adopted gardens

Table 2. Effect of INM-IPM components of mulberry on soil macro-fauna

Name of the farmer Treatment	Earth -worms (Nos/ft. ³)	Centi -pedes (Nos/ft. ³)	Milli -pedes (Nos/ft. ³)
Peter	11.40	3.50	4.30
Madalaimuthu	10.90	3.60	4.60
Madalaimary	9.30	3.50	2.50
Mean	10.53	3.53	3.80
<u>Control</u>			
Jayabal	5.60	2.90	2.40
Murugesan	4.80	2.60	2.10
Sahayaraj	4.30	2.50	1.50
Mean	4.90	2.67	2.00
CD at 5%	2.54		1.94
Significance	*	NS	*

was from 45.45 to 70.78 and from 18.63 to 27.59 in control gardens. In the IPM module adopted gardens, the percentage of increase in spider population was ranging from 40.52 to 51.85 with the mean value of 46.89 and 0.00 to 29.12 with the mean value of 14.09 in control. The results of the soil macro fauna found in one cubic feet of pit are presented in the Table.2. The population of earthworms was significantly higher (9.3 to 11.4) in IPM module adopted gardens than control (4.3 to 5.6) with an average value of 10.53 and 4.9 respectively. The population of centipedes were found non significant in IPM adopted and control gardens. The population of millipedes was ranging from 2.5 to 4.6 with the mean value of 3.8 and 1.5 to 2.4 with the mean value of 2.00 in adopted and control gardens respectively.

Table 1. Impact of INM-IPM components of mulberry on pest and natural enemies in Kokkanur village

Name of the farmer Treatment	Per cent infestation						Nos. /20 plants					
	<i>M.hirsutus</i>			<i>D.pulverulentalis</i>			Coccinellids			Spiders		
	Pre count	Post count	% redu-ction	Pre count	Post count	% redu-ction	Pre count	Post count	% increase	Pre count	Post count	% increase
Peter	4.64	3.45	25.65	1.75	1.38	21.14	2.43	4.15	70.78	2.11	3.14	48.82
Madalaimuthu	5.27	3.35	36.43	1.65	1.4	15.15	2.9	4.22	45.52	2.32	3.26	40.52
Madalaimary	4.87	3.14	35.52	1.45	1.37	5.52	2.86	4.16	45.45	2.16	3.28	51.85
Mean	4.93	3.31	32.75	1.62	1.38	14.43	2.73	4.18	52.99	2.20	3.23	46.89
<u>Control</u>												
Jayabal	2.88	2.63	8.68	1.59	1.58	0.63	1.45	1.85	27.59	1.47	1.56	6.12
Murugesan	5.48	4.41	19.53	1.61	1.86	-15.53	2.14	2.56	19.63	2.21	2.21	0.00
Sahayaraj	4.04	3.03	25.00	2.33	2.11	9.44	3.06	3.63	18.63	2.85	3.68	29.12
Mean	4.13	3.36	18.79	1.84	1.85	-0.36	2.22	2.68	20.90	2.18	2.48	14.09
CD at 5%	0.59	0.35		0.36	0.26		0.53	0.25		0.46	0.35	
Significance	*	*		*	*		*	*		*	*	

DISCUSSION

The best viable strategy to manage mulberry pests is only IPM. Inter cropping with daincha also influenced the population dynamics of *M.hirsutus* and *D.pulverulentalis* besides natural enemies in mulberry ecosystem. Samuthiravelu *et al.* (2005) reported that significantly high population of natural enemies and less infestation of *M.hirsutus* and *D.pulverulentalis* in green manure incorporated fields. In daincha intercropped mulberry, 13 species of predators and three species of parasitoids were recorded due to favorable micro climate (Qadri *et al.*, 2005). Due to intercropping, the organic carbon (OC) content of the soil might have improved the resistance in mulberry which inhibited the population of *M.hirsutus* in the ecosystem. This was further corroborated by the studies of Muthulakshmi *et al.* (2003) where they reported that when the OC was more there was less tukra infestation and interestingly more nitrogen content led to more *D.pulverulentalis* infestation. Hence in this study, the more organic sources of nutrients had been included. Bio-fertilizers such as *Azospirillum* and phosphobacteria also acted as the agents for making nutrients available to the mulberry besides 25% curtail in the application of N & P fertilizers. This also reduces the cost of production of cocoons and pollution of ecosystem. Jayaraj and Palanisamy (2003) reported that the *Azospirillum* biofertilizer induces shootfly resistance in sorghum due to production of poly phenols particularly ortho dihydroxy phenols. This might have also enhanced the population of beneficial micro flora in rhizosphere. In the present study it was found that spraying of neem oil was effectively controlled the infestation of *M.hirsutus* and *D.pulverulentalis* as supported by the findings of Samuthiravelu *et al.* (2003). It was observed that the incidence of *M.hirsutus* and *D.pulverulentalis* was less during first and second week after spraying than third and fourth week. The effect of non-edible oil cakes was also found additive in the management of pests and conservation of natural enemies viz., coccinellids and spiders existing in the ecosystem. Samuthiravelu *et al.* (2004) suggested that neem oil cake @ 150 kg / ha/ crop with reduced level of 75% recommended in fertilizer minimized the incidence of *M.hirsutus* and *D.pulverulentalis* and increased the natural enemies on MR2 mulberry variety. It is a fact that the neem oil cakes also concentrated organic manure which enriches soil nutrient status. Balakrishnan *et al.* (2003) also included neem oil cake as one of the components @ 250 kg / ha before sowing of cotton seed for the management of major insect pests through IPM module. Murugesan and Kavitha (2008) reported that pesticide load in crop ecosystem has

culminated in many undesirable effects such as resistance, resurgence, residues etc., disturbing the agro ecosystem. Ravikumar *et al.* (2005) also reported that such IPM module has improved the population of soil microflora (bacteria, fungi and actinomycetes), soil macro fauna (earthworm, centipedes and millipedes) besides natural enemies in the mulberry ecosystem. Ravikumar *et al.* (2008) have studied the insecticidal activities against the pest, *Coccidho hystrix insolitus* and *Epilachna vigintiocto punctata* using *Withania somnifera*. Hence the present study reveals the possibility of developing an IPM module without any chemical insecticide and releasing of bio-control agents which paves the way for conservation and build-up of natural enemies in the ecosystem for the best biological pest suppression.

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