Adoption of integrated pest management practices in sericulture – A case study in Tamil Nadu

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ABSTRACT

Sericulture is an agro-based enterprise, highly suited to small and marginal farm holdings with less capital investment. Cocoon production involves two distinct activities namely, mulberry leaf production, which is the sole feed for silkworm and silkworm rearing. Both mulberry and silkworm are infested with a number of pests, which affect the cocoon quality and productivity resulting in economic loss to the farmers. Chemical control measure of pests is widely adopted by the farmers and its hazardous effects on human health and beneficial organisms are the least considered. Therefore, Integrated Pest Management (IPM) techniques mainly involving suitable biological measures have been evolved and popularized for the control of mulberry and silkworm pests. However, despite the favourable results, the adoption level has remained low. In this context, a study was conducted in Thirunelveli and Virudunagar districts of Tamil Nadu with the information collected from 60 randomly selected farmers to understand the gap between available scientific knowledge in IPM practices and its adoption by sericulture farmers. The results revealed that there was the highest technological gap (87.60 %) in the adoption of biological control measures against the mulberry pests whereas the gap with cultural/ mechanical practices was 33.30 % and minimum 9.80% in the adoption of chemical measures. In case of management of uzifly menace on silkworms, there was no technological gap with respect to mechanical method of using nylon net to prevent the entry of uzifly inside the rearing house, whereas the technological gap of 77.00 % and 71.50% was observed for biological and chemical control methods, respectively. Thus, the IPM practices with the special emphasis on biocontrol method needs to be popularized among the farmers by intensified extension efforts for wider adoption at the farmer's level.

Key words: Adoption, biological control, chemical control, IPM, mulberry, silkworm

INTRODUCTION

About 200 insect and non insect pest species attack mulberry due to indiscriminate use of chemicals and fertilizers. Among these, Pink mealy bug (*Maconellicoccus hirsutus* Green), papaya mealy bug (*Paracoccus marginatus* Williams and Granara De Willink), leafwebber (*Diaphania pulverulentalis* Hampson) and thrips (*Pseudodendrothrips mori* Niwa) are the major pests. The average incidence and loss in mulberry leaf yield caused by these pests is estimated to be 34.24% and 4500 kg/ha/yr (Manjunath, 2004).

Silkworm (*Bombyx mori* Linnaeus) is a domesticated insect and reared in colonial form. The incidence of pests and diseases in silkworm rearing is very common and sometimes lead to complete crop loss. The mulberry silkworm is affected by a number of insect pests like uzifly (*Exorista bombycis* Louis), earwig, dermestid beetle and ants. Among the pests, uzifly is the most serious pest in Karnataka, Andhra Pradesh, Tamil Nadu and West Bengal. Saratchandra (1997) recorded 10 to 40 % silkworm crop loss due to uzi infestation.

Though chemicals control measure is invariably used by the farmers, the method has some drawbacks *viz.* pollution due to toxic residues, development of resistance in the pests, destruction of natural enemy complex as well as hazardous effects on silkworms and human beings. Therefore, Integrated Pest Management (IPM) techniques comprising physical, chemical and biological measures have been evolved and popularized for the control of mulberry and silkworm pests. The objective of IPM is to maximize pest control in terms of overall economical, social and environmental values.

Since farmers are the final decision-makers for the adoption of any technology, it is essential to identify their reaction and adoption level of various package of practices recommended for pest management in sericulture. However, not much attention has been paid to assessing the farmer's perception

and knowledge about the pests and their control measures. Therefore, a study was conducted to understand the gap between available scientific knowledge in IPM practices and its adoption by sericulture farmers.

MATERIALS AND METHODS

Thirunelveli and Virudunagar districts of Tamil Nadu were purposively selected for the study. As the sericulturists in the study area are highly scattered, the farmers practising sericulture were selected by random sampling method using the list of farmers available with Research Extension Centre (REC) of Central Silk Board located at Srivilliputtur in the study area. The data were collected from sixty randomly selected sericulturists using a pre-tested structured interview schedule. The data were collected during January 2010.

The collected information were compiled, tabulated and subjected to tabular and percentage analyses. Technological Gap Index (TGI) was computed to analyze the extent of adoption of various IPM practices related to sericulture. The term 'technological gap' refers to the gap between the recommended IPM practices of sericulture and actual adoption of IPM practices. The following formula was used to compute the technological gap (%) for IPM practices for different pests of mulberry and silkworm.

$$\text{Technological Gap Index (TGI)} = \frac{(R - A)}{R} \times 100$$

Where R = Recommended score

A = Adopted (obtained) scores

On account of a wide range of technological gap in the adoption of IPM practices by the respondents, the farmers were categorized as 'High' for those having TGI of 75 and above, 'Medium' and 'Low' having TGI between 40 and 75 and below 40 respectively.

RESULTS AND DISCUSSION

Distribution of respondents

It is evident that a majority of the respondents (56.67%) belonged to the medium technological gap category. Only 13.33 % of the respondents were found under low technology gap category, whereas 30% of the respondents were found in low level of technology gap.

Technological gaps in IPM practices against pest

It can be inferred from Table 1 that among the three sets of practices recommended, the technology gap was very minimum with respect to practising chemical method for the control of all the four pests of mulberry namely, pink mealy bug, papaya mealy bug, leaf roller and thrips. For the control of pink mealy bug, the cultural method of clipping and destruction of affected portions is recommended, which was not adopted by 29% of the sample respondents. A wide technology gap of 87.7% was noticed in the biocontrol method of releasing ladybird beetle (*Cryptolaemus montrouzieri* Mulsant) @ 250 adults/acre. Similarly, technology gap of 31.6 % and 96.5%, respectively were noticed with respect to the use of cultural/mechanical practices and bio-control methods for the control of leaf roller.

In case of papaya mealy bug, the technology gap with respect to cultural/mechanical practices and biocontrol methods was 36.5 % and 76.3 %, respectively. Medium level of technology gap of 51.40% in case of mechanical method of spraying water in full force to dislodge and wash out the pest was noticed for the control of thrips in mulberry garden.

The adoption gap analysis clearly indicates that among IPM practices recommended for the mulberry pests, the chemical practices and a few cultural/mechanical practices with less complexity were more feasible in adoption as compared to biological practices. It might be due to several constraints viz., lack of knowledge, lack of technical help, unconvincing merit of technology and non-availability of technical inputs complexity of practice. More or less similar findings were reported by Nikhode *et al.* (1997); Verma *et al.* (2003) and Bhagwan Singh *et al.* (2007).

Technological gaps in IPM practices against uzifly

Uzifly is the most dreaded pest of silkworm and causes huge loss to silkworm rearing in India. For managing uzifly a combination of practices namely, mechanical methods of using nylon nets in the entrance and windows of rearing house to prevent the entry of uzifly and using uzitrap, a chemo trap that attracts and kills adult flies, chemical method of spraying uzicide for killing the eggs and adult flies and biological method of releasing the natural enemy *Nesolynx thymus*, which is an ecto-pupal parasitoid that kills the uzi pupae, are recommended as IPM practices (Dandin *et al*., 2003). It is observed that the adoption gaps were found less in the mechanical (18.0 %) and chemical methods (10.7%) for the control of uzifly attack in silkworm rearing but a wide gap of 90.2% was observed in case of biocontrol method.

Constraints in use of IPM practices for the mulberry and silkworm pests

Though the IPM practices were found effective in pests, they were not adopted by many farmers due to various technical, socio-economic, institutional and managerial reasons. Therefore, the farmer's opinion was documented on the

Table 1. Technological gap at farmer's level in adopting IPM practices against major pests of mulberry

Sl. No	Particulars of practices	Technological Gap (%)
I	**Pink mealy bug (*M. hirsutus*)**	
A	**Cultural/mechanical practices** Clipping and destruction of affected portions	29.0
B	**Chemical control method** Spraying 0.1% DDVP two times at 10 days interval	8.5
C	**Bio-control method** Release of predatory ladybird beetle (*C. montrouzieri*) @ 250 adults/acre	87.7
II	**Leafwebber (*D. pulverulentalis*)**	
A	**Cultural/mechanical practices** ❑ Manual collection and destruction of larvae ❑ Collection and burning of dry leaves and weeds harbouring pupae ❑ Setting up of light traps @ 2 traps per acre to kill adults	31.6
B	**Chemical control method** Spraying of 0.076% DDVP on infested apical portions	7.8
C	**Bio-control method** Release of egg parasitoid *Trichogramma chilonis* Ishii @5 tricho-card (20000 eggs/card)/acre 20days after harvesting at an interval of 3 days) or pupal parasitoid *Tetrastichus howardii* (Olliff) @ one lakh /crop/acre in three splits	96.5
III	**Papaya mealy bug (*P. marginatus*)**	
A	**Cultural/mechanical practices** • Clipping and destruction of affected portions • Crop sanitation • Spraying strong jet of water to dislodge and wash out the pest	36.5
B	**Chemical control method** Two sprays viz. 0.05% Dimethoate followed by 0.1% DDVP in 0.5% soap solution in 10 days interval	6.9
C	**Bio-control method** Release of parasitoids (*Acerophagus papayae* Noyes & Schauff) @ 100 per acre	76.3
IV	**Thrips (*P. mori*)**	
A	**Cultural/mechanical practices** Spraying strong jet of water to dislodge and wash out the pest	51.4
B	**Chemical control method** Two sprays viz. 0.05% Dimethoate followed by 0.1% DDVP in 0.5% soap solution in 10 days interval	15.1

constraints in adoption of IPM practices for the mulberry and silkworm pests. It can be inferred from seventy percentage of respondents expressed the problem of lack of technical knowledge regarding the use of the practices recommended under IPM, followed by 60.00% who highlighted the constraints such as non availability of biocontrol agents on time. Venkata Shiva Reddy (2006) has documented the same constraints in his study. Expensive to use IPM practices, non-availability of recommended IPM package and non-effectiveness of recommended IPM practices in controlling the pests were some of the other constraints expressed by the respondents.

It is therefore suggested that extension agencies should intensify their efforts to organize extension educational programmes like trainings, demonstrations, field days, etc., to motivate the farmers to accept and adopt the IPM practices. In the extension programmes, a special emphasis should be given to promote eco-friendly bio-control methods against insect pests of mulberry and silkworm. Further, the availability of technical inputs should be made easy at the doorsteps of the farmers.

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