Adoption of biocontrol agents at the field level for management of mealybugs: challenges and proposed solutions

Tanusri Basu

ABSTRACT

To implement biocontrol program effectively in the field, the farmers from three villages of Chikballapur District, Karnataka were trained on mass multiplication of mealybug predator *Cryptolamous montrozieri* (Mulsant). Training and field level demonstrations of efficacy of the methodologies improves the awareness and faith among farmers. However, actual adoption still remains low. A survey conducted by the authors shows that there are two statistically significant reasons for low adoption rate: (a) perception that chemical pesticides act much faster, and (b) biocontrol agents are not readily available in the villages. In this paper, the authors propose different approaches for countering the above two challenges. Firstly, Economic Threshold Level (ETL) of mealybug (*Planococcus citri* Risso) on Guava (*Psidium guajava L.)* infestation was determined. This paper considers 5% damage as the ETL and the statistical analysis shows that ETL is reached when the infestation density is 21 mealybugs per leaf. Farmers should be encouraged to start using IPM/biocontrol methodology as soon as the infestation reaches the ETL. This will eliminate farmer's need of chemical pesticides for immediate result at a later stage. Secondly, a commercially viable production and distribution channel is proposed for addressing the non-availability of biocontrol agents. Authors find that rural women, specially, Self-Help-Groups, are interested in production of biocontrol agents for an additional source of income. For distribution, authors propose to use the conventional channel of village shops for seeds, fertilizers and pesticides. With an attractive commission scheme, commercial insectaries can sell biocontrol agents.Finally, our survey of 61 farmers' a statistically significant correlation between the education levels of farmers with their awareness about crop damages. This reconfirms our belief that spread of education among rural farmers will help to establish environment friendly pest management methodologies at farm level. This will help farmers to minimize the use of toxic insecticides like Dimethoate, Methomyl etc., which are now being used by many farmers.

Key words: Mealybugs, crop pest, farmer practice, challenges and proposed

INTRODUCTION

Mealybugs (*Planococcus citri*, *Maconellicoccus hirsutus*, etc.) are one of the wide spread and serious pests in tropical and subtropical regions. Infestation of mealybugs on leaves, shoots, and fruits are common in most of the orchards, but can be checked by natural enemies (Krishnamoorthy and Mani, 1994). The Australian ladybird beetle, *Cryptolamous montrouzieri* (Mani and Krishnamoorthy, 1997) is a predator and is used in control of mealybugs. This method is considered as safe to humans, a good alternative to conventional pesticides, amenable to small scale local production and addresses increased public awareness of environmental concerns. To implement this biocontrol program effectively in the field, the farmers from three villages of Chikballapur District, Karnataka were trained on mass multiplication of the ladybird beetle. Extensive training sessions were conducted and farmers were shown effectiveness of the method at the field level. This was expected to improve the awareness and faith in biocontrol method among farmers. In spite of these, it was found that the adoption was adoption low. The primary objective behind this paper is to investigate the reasons of low adoption by farmers and to propose solutions for increased adoption of biocontrol method.

METHODOLOGY

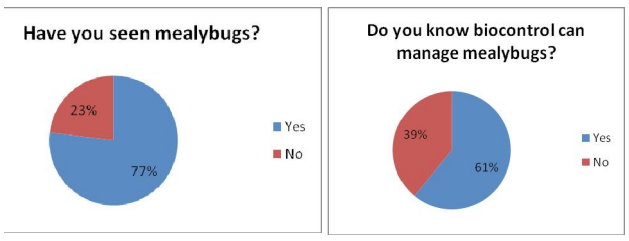
A survey was conducted to find out why farmers are reluctant to adopt biocontrol methodology, even after seeing the effectiveness of the methodology. A printed questionnaire was used for conducting the survey, as it is a cost effective method for studies involving large sample sizes and provides structured data in easy-to-analyze format. Moreover, questionnaires reduce bias - the researcher's own opinions will not influence the respondent to answer questions in a certain manner.

By design, the questionnaire was kept short and simple. There were three groups of questions.

(1) The first group with yes/no answers was designed to test farmers' awareness about biocontrol methods, (2) The second group of questions was designed to check correlation between farmers' educational qualification, economic status, crop diversity and his knowledge/ awareness about extent of loss. For each question, four response levels are given, so that 'middle response' implying neutral answer is eliminated and (3) The third group of questions explores possible reasons for low adoption of biocontrol method. Questionnaires printed in local language were distributed to farmers and answers were collected after 15 - 30 minutes. Data collected from this survey were analyzed using statistical tools. Results of statistical analysis are given in the following section.

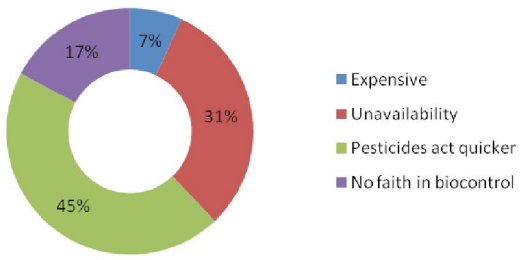
RESULTS

Analysis of Group-1 questions show that majority of farmers know about the mealybug infestation and were aware of biocontrol methods as effective control method. The following pie-charts show the survey finding.



Analysis of Group-2 questions indicated a statistically significant correlation between the education levels of farmers with their awareness about crop damages (Correlation coefficient +0.297, significant at p = 0.05, df = 59).

Analysis of Group-3 questions show two significant reasons for low adoption rate: (a) perception that chemical pesticides act much faster, and (b) biocontrol agents are not readily available in the villages.



Analysis and Proposed Solutions

To improve adoption of biocontrol methods, we need to address farmers' two primary concerns as shown in the previous section: (a) biocontrol methods act much slower than pesticides and (b) biocontrol agents are not easily available in the villages.

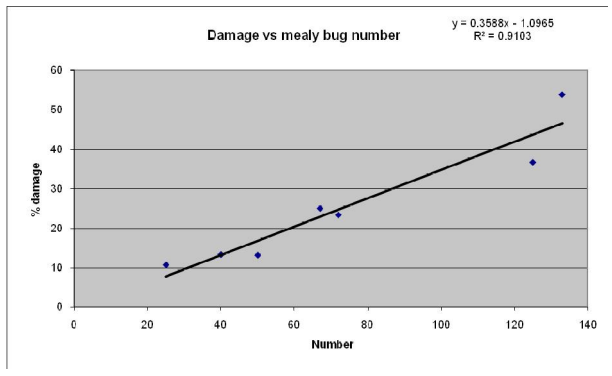
The reason behind the first concern that biocontrol agents acts slower comes from 'crisis management' approach taken by farmers for pest control. They act only when the infestation reaches a high level and therefore, they depend on large quantity of chemical pesticide to get a quick solution. Farmers must be motivated to move to a more plan driven approach, where infestation level is monitored regularly, and decisions are taken at the appropriate time. We propose that mealybug infestation is monitored on a regular basis and as soon as it reaches Economic Threshold Level (ETL), farmers must start using IPM/ biocontrol methods. This will eliminate farmer's need of chemical pesticides for immediate result at a later stage.

In the following paragraph, we derive a simple measure of ETL for mealybug infestation in guava (*Psidium guajava L.)* plants. Similar measure of ETL can be derived for other plants as well. The adoption of biocontrol method warrants working out decision support tools like this.

The following data have been collected from a guava orchard in Chikballapur district. Three infested plants were selected and in each plant, randomly three branches were chosen. Total number of leaves were counted in each selected branch and mealybug infested leaves are separated from them. The total number of mealybugs are counted for all leaves coming from a branch. The following table gives the actual data.

Plant No	Sl. No	Total no leaves	Damaged of leaves	Per centage damage	Count of mealy -bugs	Mean no of Mealybugs per leaf
1	1	28	3	10.71%	75	25
	2	26	8	30.77%	71	24
	3	30	11	36.67%	374	125
2	1	38	5	13.16%	150	50
	2	26	14	53.85%	400	133
	3	30	4	13.33%	120	40
3	1	21	7	33.33%	150	50
	2	24	6	25.00%	200	67
	3	30	7	23.33%	215	72
	4	43	11	25.58%	385	128

The above data is fitted in a linear regression model y = b * x + c, where x = average number of mealybugs per leaf, y = percentage damage and b, c are constants. Least Squares Error (LSE) fitting of the regression line is shown in the following graph.



The LSE fitting gives values b = 0.3588 and b = -1.0965. Using the above equation, we can estimate the percentage damage at different levels of infestation. In this paper, we considered 5% damage as Economic Threshold Level; at this level estimated number of mealybugs are 21 per leaf on an average. Farmers should be encouraged to start using IPM/biocontrol methodology as soon as the infestation reaches this ETL.

To address the second concern of non-availability of biocontrol agents in villages, we propose a commercially viable production and distribution channel. The initial investment in mass breeding technology is relatively small, and this has been demonstrated by us at villages of Chikballapur district. The running cost is also very low as it requires only supply of pumpkins for rearing of mealybugs. We have found that rural women, specially, Self-Help-Groups, are interested in production of biocontrol agents for an additional source of income. For distribution, authors propose to use the conventional channel of village shops for seeds, fertilizers and pesticides. With an attractive commission scheme, commercial insectaries can sell biocontrol agents.

In this paper, we have proposed a decision support tool essential for adoption of biocontrol methods at the farm level. We have also suggested a commercially feasible production and distribution mechanism for biocontrol agents. Finally, our survey result showing a strong correlation between the education levels of farmers with their awareness about crop damages, reconfirms there is no alternative to spread of education among rural farmers for establishing environment friendly pest management methodologies. This will help farmers to minimize the use of toxic insecticides like Dimethoate, Methomyl etc., which are now being used by many farmers.

Acknowledgement

I thank the Department of Science and Technology, New Delhi, for supporting a research work titled “Transfer of mass breeding technology of biocontrol agents to rural areas for management of mealybugs in agricultural crops”. I thank all the farmers who participated in the survey and provided valuable information.

REFERENCES

Krishnamoorthy, A. and Mani, M. 1994. Manage mealybug in citrus orchards, *Indian Horticulture*, **39** (1): 12 -13.

Mani, M. and Krishnamoorthy, A. 1997. Australian ladybird beetle, *Cryptolaemus montrouzieri*, *Madras Agriculture Journal*, **84**: 237 – 249.

Tanusri Basu

Department of Zoology, Bangalore University, Bangalore-560056, India, Email: basu_tanusri@yahoo.com