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Yield Loss in Mulberry Due to Sucking Pest Whitefly, *Dialeuropora decempuncta* Quaintance and Baker (Homoptera: Aleyrodidae)

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The whitefly, *Dialeuropora decempuncta* Quaintance and Baker (Homoptera : Aleyrodidae) causing considerable damage to mulberry, *Morus alba*. Crop loss caused by the whitefly was estimated in mulberry. Quantitative yield loss was estimated on the basis of harvest data from both sprayed and unsprayed plots. Data on pest incidence has been recorded at weekly intervals in both sprayed and unsprayed plots from 30 th day of plant age till harvesting i.e., 60 days after pruning in August October season. An attempt has been made to establish a relationship between whitefly population and percentage of crop loss due to it. Percentage of crop loss due to whitefly has got a linear relationship with the whitefly population. An initial population of 24 adults/top leaf would be able to cause 24% loss (1,630 Kg leaf/ha) in a period of 30 days. Economic analysis postulates that application of pesticide can save a net amount of 1,630 Kg leaf/ha which is sufficient to produce 67.65 Kg of additional multivoltine cocoons. This determines the cost/benefit ratio which will enable to workout the economics of management practices.

Key words : Crop loss, Whitefly, Pest incidence, Linear relationship

Introduction

Estimates of crop losses are required to determine the relative importance of particular pests, and thus decide upon the level of resources that should be devoted to research and pest management inputs (Amin and Mc Donald, 1984) and provide a basis for understanding the often complex interaction between pest and its host plant (Southwood and Norton, 1973; Bardner and Fletcher, 1974).

Predicting the level of pest attack is unlikely to be useful unless that is ultimately related to lost revenue. Mulberry, *Morus alba* is a hardy crop extensively grown in the three traditional districts of West Bengal. It is also grown in the states of Karnataka, Andhra Pradesh,Tamil Nadu, Kerala etc. It is grown annualy in an area of 21565 hectares (1998 -1999) with an average leaf yield production of about 41.28 MT/ha in West Bengal and hence occupies an important place in the sericulture industry of the state. The crop is attacked by more than 10 insect pests. Of the various pests infesting mulberry, the whitefly, *Dialeuropora decempuncta* (Quaintance & Baker) (Homoptera: Aleyrodidae) is very destructive and occurs during monsoon and postmonsoon period regularly in West Bengal. It is an important pest of mulberry *M. alba* L. This homopteran insect damages mulberry leaf by extracting large quantity of leaf juices from the lower surface of the tender leaves. The first symptoms appear on young leaves in the form of mild scattered yellow specks or spots. In severe cases dryness of leaves, leaf curl and sooty mould disease were observed resulting in huge leaf yield loss.

To grow a crop as free from insect infestation as possible and then to compare its yield with that of the check crop in which the insect activity has been normal. This principle has been used with some modifications for estimating the losses caused by whitefly in cotton (Hussain and Trehan, 1940) and in black gram (*Vigna munga*) (Rao *et al.*, 1990).

In the present study an effort is made to protect the experimental crop by the pest control schedule known for a particular pest, and the yield is compared with that under normal insect infestation. Many workers have tried to determine the yield per unit area in different fields which have had different degrees of infestation with a particular pest and then workout a correlation equation between the

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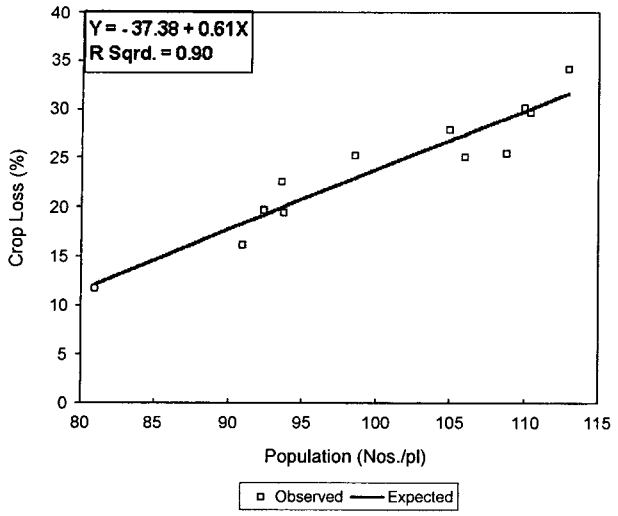

Fig. 1. Relation between whitefly population and crop loss.

yield of the crop and degree of infestation. Mound (1965) has shown the correlation equation between the yield of cotton (*Gossypium barbadense*) and whitefly *Bemisia tabaci.*

Information on yield loss of *M. alba* due to whitefly infestation in sericulture zones of West Bengal is scarce. The objective of this study was to assess the yield loss in *M. alba* and thereby to study a relationship of yield components with whitefly population under natural infestation.

Materials and Methods

To assess the avoidable mulberry yield loss by this pest, the present experiment was laid out during late monsoon i.e., August October, 1999 at C.S.R.& T.I., Berhampore in randomized block design in 12 replications with promising variety of S_1 under two sets of condition viz, protected and unprotected. In the protected plots (@16x16 size, 40 plants with 60x60 cm spacing), the crop was sprayed with 0.01% monocrotophos (Monocil-EC 40%) for two times at fortnightly interval from 30 days after pruning. Unprotected plots were left exposed to natural infestation of the pest. Avoidable loss i.e., the yield difference between pairs of representative plots of the crop, one of which has been protected and the other unprotected was estimated by using the following formula (Le Clerg, 1971).

Percentage loss due to pests=[(Y1-Y2)/Y1x100] where Y1 is the yield in completely protected plots and Y2 is the yield in unprotected plots. The recommended package of practices were followed for better crop growth in all the plots.

Data was recorded on 10 randomly selected plants from each replication of both the treated and untreated plots and it has been started from 30th day of plant age till harvesting i.e., 60 days after pruning in August October season. The whitefly population was recorded at weekly intervals in the middle of September by counting the adults on top two leaves, early nymphs on mid two leaves and late nymphs on bottom two leaves per plant. The mulberry leaf yield from 24 plots was calculated on per hectare basis by multiplying with the conversion factors. Analysis of Covariance was performed to test the variance in between the whitefly population and percentage of crop loss (Snedecor and Cochran, 1967). The data was statistically analysed and presented in Table 1. The economics were worked out.

Table 1. Adjusted mean population of whitefly before and after application of Monocrotophos (0.01%)

Segment	Level	Treat-Ment	First Spray				Second Spray			
			Pre-Trt Popu-lation	Post Treatment Population			Pre-Trt Popu-lation	Post Treatment Population		
				24 hrs	7 days	14 days		24 hrs	7 days	14days
Horizontal	Top (Adult)	Unsprayed	28.08	28.73	30.60	28.84	33.36	34.73	37.50	42.63
		Sprayed	24.80	0.23	10.86	18.30	16.88	0.00	6.46	16.67
		CD at 5%		2.18	4.40	3.67		3.93	1.60	3.59
	Middle (Early nymph)	Unsprayed	1.17	1.05	1.24	1.00	0.99	0.96	0.91	1.13
		Sprayed	1.73	0.17	0.00	0.34	0.45	0.20	0.34	0.94
		CD at 5%		0.23	0.44	0.28		0.25	0.21	0.19
	Bottom (Late nymph)	Unsprayed	2.73	4.23	4.72	6.45	6.62	5.53	5.59	6.96
		Sprayed	2.13	1.41	1.70	2.96	4.92	0.81	2.85	4.20
		CD at 5%		1.41	2.28	1.23		1.12	1.22	0.87
Vertical		Unsprayed	63.95	67.75	72.85	72.32	81.93	82.62	88.19	101.64
		Sprayed	57.13	3.97	25.37	43.47	44.48	1.18	19.11	43.43
		CD at 5%		6.07	13.01	8.57		7.22	5.02	7.62

Results and Discussion

The whitefly appeared on the crop during monsoon time. The incidence started raising from July and reached peak during September. This homopteran pest damage mulberry leaf by extracting large quantities of leaf juices and causes chlorosis, leaf curl and sooty mould disease resulting in a huge quantity of leaf yield loss. Similar symptoms appeared in the early and severe cases in moth bean (*V. acontifolia*) caused by the other whitefly *B. tabaci* (Vir, 1984). The population declines from October and disappears at the end of November (Bandyopadhyay *et al.*, 1997).

The incidence of whitefly, *D. decempuncta,* was recorded (Pre-treatment population) in the middle of September. Monocrotophos (0.01%) was applied to control the incidence of whitefly population. It was observed that, both horizontal and vertical population of white fly remains significantly lower (Table 1) in the treated plots indicating the efficacy of the insecticide. Adult, late and early age nymphal population depleted to almost nil within 24 hours of application of monocrotophos (0.01%) but it tends to increases thereafter reaching the peak after about 14 days. Therefore, a second application of monocrotophos (0.01%) (14 days after application of 1st spray) found to be beneficial in keeping the pest incidence below threshold level and to harvest the maximum quantity of mulberry leaf with better quality. A comparison of the recorded leaf yield data from both treated and untreated plots revealed that on an average 24% reduction in leaf yield occurred due to whitefly infestation in the experimental plots. An attempt has been made to establish a relationship between level of whitefly population and percentage of crop loss due to it. It is observed that percentage of crop loss (due to white fly infestation) is linearly regressed with the extent of the pest population. A functional form (Y=37.38+0.61X) has also been established for predicting about the incidence of whitefly and extent of crop loss there upon. From the equation, it can safely be predicted that nearly 100 whitefly individuals (which has been started initially with 24 adults per top leaf) can be responsible for 24% loss in mulberry leaf yield.

Further, benefit-cost ratio analysis (due to this partial modification in crop protection schedule) postulates that, application of monocrotophos (0.01%) can save a net amount of 1,630 Kg of mulberry leaf per hectare which may sufficiently be utilized in producing an additional amount of 67.65 Kg of cocoon, if reared with multivoltine races. Ultimately, a net gain of Rs.4179=00 can be had from this proposition.

Since the gain in leaf yield due to protection measures is upto the tune of 1,630 Kg/ha (in all the ruling variety S_1) and the expenditure involved in 2 sprayings of 0.01% monocrotophos is quite low (Rs 688=00/ha). The monetary loss due to whitefly infestation was Rs. 4016/- per hectare at the prevailing market rate. Raghupathy and Doraiswamy (1990) has shown that whitefly population was depleted from 8.9/plant to 1.8/plant and 1.2/plant in soyabean after spraying of neem oil and monocrotophos respectively. The gain in leaf yield was significant in neem oil sprayed plot, which gave a yield of 566.5 Kg/ha compared with 438.5 Kg/ha in the unsprayed soyabean plot. Sandhu *et al.* (1987) observed, the yields are 33.8% greater than that with the standard treatment of carbaryl, in cotton plants. Satpute *et al* (1988) reported a net loss of 4.6% in seed cotton yield by the whitefly *B. tabaci.* The study thus reavealed that the whitefly is capable of causing substantial losses in the laterite soil. It is also capable of causing substantial loss even in tropical zone of Rajasthan.

In the present study it was observed that population of adult, early age and late age nymphal population was depleted to almost nil after application of the pesticide. The recorded leaf harvest data has shown a reduction of 24% leaf yield in unsprayed plots. It has been observed that percentage of crop loss has got a linear relationship with the whitefly population. Mound (1965) has shown the percent reduction in cotton yield Y1=66 log 10 (X+1) in *Gossypium barbadense* (cotton) by whitefly (*B. tabaci*) in Sudan. He has also shown in cotton that % reduction in weight of seed cotton/boll YS=0.035X, where X=No of nymphs/leaf. In the present study an initial population of 24 adults/top leaf caused 24% loss (i.e., 1,630 Kg/ha) in a period of 30 days. 41% reduction in the weight of lettuce plants (*Lactuca sativa*) was observed when they were colonized by 200 adult whiteflies (*B. tabaci*) and their offspring for 3 weeks (Costa *et al.*, 1993). A 48 hrs feeding by sweet potato whiteflies (*B. tabaci*), resulted in 100% of the squash (*Cucurbita pepo*) plants showing leaf vein clearing and leaf silvering (Bharathan *et al.*, 1992). In the mulberry economic analysis postulates that application of pesticides can save a net amount of 1,630 Kg leaf/ha from whitefly damage which is sufficient to produce 67.65 Kg of additional multivoltine cocoons which ultimately earn a net amount of Rs. 4193=00.

Thus it could be concluded that minimum plant protection for the sucking pest, whitefly could provide good yield of mulberry. It was also observed that only two sprays against *D. decempuncta* were neccssary under supervised spray programme.

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