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Determination of Economic Threshold Level of Whitefly, *Dialeuropora decempuncta* (Quaintance and Baker) in Mulberry, *Morus alba* L.

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Whitefly, *Dialeuropora decempuncta* (Quaintance and Baker) (Homoptera: Aleyrodidae) has attained the major pest status in mulberry, causing 24% crop loss by sucking the leaf juice and manifesting leaf curl, chlorosis and sooty mould desease during monsoon season in West Bengal, India. The assessment of economic threshold level is an essential component for formulating the management practices. Experiments were carried out by inoculating five different densities of whitefly viz., 10, 20, 30, 40 and 50 adults on covered mulberry plants in glass houses. From the findings, it was observed that irrespective of released density, no crop loss was observed in the initial period. But with the passing of days, the percent crop loss was increased rapidly. The linear relationship between percent crop loss and number of adults released was established to highlight the significance of economic threshold. The statistical analysis in the linear form of equation showed that initial population of 10, 20, 30, 40 and 50 whiteflies/plant causes 3%, 12%, 21%, 30% and 40% crop loss in a period of 28 days which is equivalent to 57 kg, 247 kg, 437 kg, 626 kg and 816 kg leaf/acre. Execution of management practices (spray of 0.01% monocrotophos) are economical to the farmer whenever the loss is above 247 kg/acre, but below which application of control measures is not economical. From this study, it can be inferred that the economic threshold level for whitefly is 20 individuals/plant beyond which a farmer has to take appropriate control measures.

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Introduction

Mulberry, *Morus alba* L. has become a popular agricultural crop in three traditional districts of West Bengal. It is reported to be attacked by numerous pests. Amongst the various pests, whitefly *Dialeuropora decempuncta* Quaintance and Baker (Homoptera: Aleyrodidae) has assumed to be a major pest in mulberry growing areas of West Bengal, Assam, and Manipur. The status of the pest is evident from the assessment of the leaf yield losses caused 24% in mulberry (Bandyopadhyay *et al.*, 2001). The excessive use of pesticides not only results in extra expenditure but also causes several secondary problems such as mortality of non target insects, premature appearance of resistance, resurgence of secondary pests, ecological upsets and side effects on the environment like pesticidal hazards. One of the crucial features of the implementation of the Integrated Pest Management (IPM) programes is to select time and appropriate IPM components on the basis of Economic Injuiry Level (EIL) and Economic threshold based on economic injuiry levels (Stern, 1993). It defines the level of a pest population below which damage is tolerable and above which emergency pest control elements must be invoked or avoid economic damage and an outbreak of the pest (US National Academy of Sciences, 1969). Lack of economic threshold for key pests can easily lead to excessive treatments, which in turn may cause outbreaks of secondary pests; oftentimes these species may rise to major pest status in annual cycles of outbreak (Stern, 1993). Economic threshold need to be qualified in terms of local climatic conditions, time of year, stage of plant development, the crop involved, plant variety, cropping practices, the purpose for which the crop is to be used the desire of man and economic variables. Chiang (1993) defined economic threshold as the pest population level, which is capable of causing sufficient damage so that the value of increased crop yield resulting from the control operation will be double the cost of control.

Insecticides, such as monocrotophos, carbaryl, quinalphos, acephate and triazophos have been experimented to control this pest (Bandyopadhyay *et al.,* 1999; Bandyopadhyay and Santhakumar, 2000). These insecticides are used by the pheasants to control whitefly on mulberry whenever the incidence is noticed. Economic threshold level of maize stock borer, *Chilo partellus* Swinhoe, was studied by Sarup *et al.* (1977), *Helicoverpa armigera* on chickpea by Choudhury and Sharma (1982), thrip, *Thrips flavus* Scharank, on apple blossom by Singh (1989), cotton bolworm, *Heliothis armigera,* by Butler *et al.* (1990), aphid, *Lypaphis erysimi,* on mustard by Singh and Malik (1998) and sunflower jassid, *Amrasca biguttula* Ishida, by Men and Kandalkar (1999). No economic threshold has been determined in respect of current species of whitefly so far. The concept of an "economic threshold" as the major criterian for pesticide use has been essentially ignored. The review of literature reveals that information on the economic significance of injury caused by a large number of pests and their economic threshold value is scanty. Realizing the serious nature of the whitefly problem for which farmers have to undertake control operation while growing high yielding varieties, the present studies were planned and conducted to advocate need-based application of the recommended chemicals to determine the economic threshold level for the whitefly, *D. decempuncta.*

Materials and Methods

The study was undertaken in the glass house of Central Sericultural Research & Training Institute, Berhampore West Bengal during 1999 - 2000 and 2000 - 2001. Five sets of adult whitefly were released on one-year-old mulberry plants (1 set = 5 pots with 5 plants) after 30 days of

Table 1. Different type of symptoms and percent leaf loss by realease of different population of whitefly

Observation time	Treatments	No. of nymphs infested leaf	No. of leaf with chlorosis	No. of leaf with leaf curl	No. of leaf with sooty mould	Total no. of leaf	Percent leaf loss
After	A	-	-	-	-	37.8	-
7 days	B	-	1.6	-	-	37.2	3.46
	C	-	2.6	-	-	37.6	6.02
	D	-	3.2	-	-	35.4	8.58
	E	-	3.6	-	-	36.0	8.33
	Cont	-	-	-	-	37.4	-
After	A	3.8	-	-	-	45.4	-
14 days	B	5.6	1.6	-	-	46.2	3.07
	C	8.8	2.8	1.2	-	45.6	8.88
	D	10.8	3.2	1.8	-	45.6	10.95
	E	12.8	3.2	2.6	-	46.00	12.16
	Cont	-	-	-	-	46.6	-
After	A	5.4	-	-	-	56.00	-
21 days	B	8.2	1.0	1.2	-	52.6	4.08
	C	10.2	1.4	3.2	3.0	55.00	14.09
	D	13.4	2.0	4.2	5.2	57.00	20.21
	E	16.2	2.8	6.6	6.0	56.00	27.50
	Cont	-	-	-	-	58.4	-
After	A	5.4	-	-	-	63.00	-
28 days	B	1.2	-	1.8	7.8	60.80	15.79
	C	2.0	-	4.2	8.8	61.4	21.41
	D	3.8	-	5.2	13.2	63.00	29.51
	E	5.4	-	7.4	16.4	61.6	39.10
	Cont	-	-	-	-	64.4	-

pruning with 5 different densities viz., 10, 20, 30, 40 and 50 adults/plant. The sixth set of plants having free of pest infestation was maintained as control. The pots were covered with the cage sized 3 inches in height and 12 inches in width to avoid natural infestation. The cages were set not to interrupt ventilation and aeration for the growing plants inside. The bottom edges of the cages were covered with soil to prevent the fly from escape. These nylon net cages were errected on an iron frame. The cages were removed according to the crop harvest time. Data have been recorded weekly on the whitefly (nymph and adults) population, manifested symptom, percent leaf loss and leaf yield during the period from August - September. Pooled results of two years are presented in Table 1. Data collected were statistically analysed with the help of regression analysis. Linear prediction equation for percent crop loss in relation to number of adults released was also worked out (Panse and Sukhatme, 1967).

Results and Discussion

The observations taken on the mode of damage revealed that the adult whitefly attacked the tender mulberry leaf and sucked the juice. The damaged leaves showed yellow appearance, become curled and fall of prematurely.

It was observed that nymphal population and symptoms like leaf curl, sooty mould disease, yellowing of leaves have been increased with the release of more number of whitefly alongwith the increase of observation period (Table 1). The severity of damage was more in the plants after 28 days of release of whitefly (Table 1). Sarup *et al.* (1977) and Singh (1989) reported this type of damage by maize stalk borer *Chilo partellus,* in maize and by thrips, *Thrips flavus* Schrank, in apple blossom. Stern (1993) stated that in some cases pest density can be expressed as a regression equation. An attempt has been made to establish the relationship between the number of adults released and percent leaf loss, and through regression analysis it was found that the recorded data fitted well in "linear form of equation" *i.e.,* (Y = a + bx) in all the case

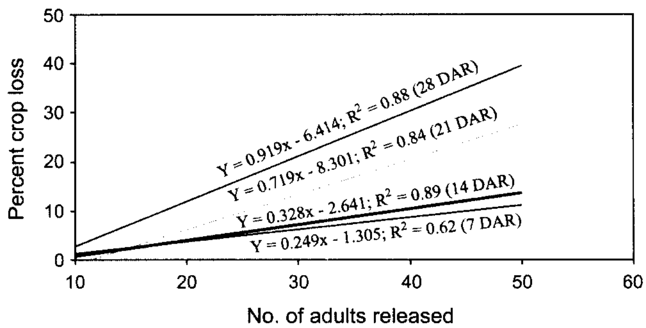

Fig. 1. Dynamics of adults of white fly released and percentage of crop loss.

which has estimated the percent crop loss at different level of release (Fig. 1). Similar type of observations through regression analysis were found by Reddy and Sum (1991) on maize stem borer, *Chilo partellus,* and by Singh and Malik (1998) on mustard aphid, *Lypaphis erysimi.* If the graphic regression is linear, the plant destruction or the loss of the desired product is propertional and "straight forward". From the findings it was observed that with the release 10, 20, 30, 40 and 50 adults/plant there is no significant loss up to 7 days of release. Even up to 14 days of release the loss was below 10%, which is non significant (Fig. 1). But, with the passing of days (21 days after release), the loss abruptly increased and boosted up to 28 days after release in all replications. From the findings it was observed that irrespective of released density, no loss was found initially. But loss was increased with the passing of days. This type of result was found by Men and Kandalkar (1999) in sunflower infested by jassid, *Amrasca biguttula* Ishida. In the present study, it was observed that with the release of initial population of 10, 20, 30, 40 and 50 whiteflies/plant causes 3%, 12%, 21%, 30% and 40% crop loss in a period of 28 days (Table 2) which is equivalent to 57 kg, 247 kg, 437 kg, 626 kg and 816 kg/acre (Table 2). The cost of chemical application is Rs 240/acre (0.01% monocrotophos + mandays + depreciation cost of spray equipment). Hence, a farmer gets benefitted by spraying 0.01% monocrotophos whenever the loss is

Table 2. Potential economic loss in relation to differential release of adult whitefly

Released no. of whitefly	Crop loss %	Leaf yield loss (in kg)	Cost of Leaf (@Rs.2/-per kg)	Cost of Spray (in Rs.)	Profit (in Rs.)
10	3	57	114/-	240/-	-126/-
20	12	247	494/-	240/-	+254/-
30	21	437	626/-	240/-	+634/-
40	30	626	1252/-	240/-	+1012/-
50	40	816	1632/-	240/-	+1392/-

above 247 kg/acre. Below which the farmer has no need to spray chemicals as it is not economical. Some insecticides treatments were initiated by grower based on counts of 10 adults of whitefly *Bemisia argentifolii* per leaf on cotton (Hardee and herzog, 1995). Results support the use of 10 adults per leaf threshold, although a threshold close to 15 adults may also be acceptable (Yee *et al.*, 1996).

From the experimental findings we can infer that the economic threshold level for whitefly, *Dialeuropora decempuncta* Quaintance and Baker, is 20 individuals/ plant. Beyond this population a farmer has to take appropriate control measures.

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