ECONOMIC THRESHOLD OF MUSTARD APHID, LIPAPHIS ERYSIMI (KALTENBACH)

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INTRODUCTION

The concept of economic-injury level (EIL) and economic threshold (ETH) is very useful in developing an integrated pest management(IPM) strategy for any cropping system. By definition, ETH is the pest population density above which the decision should be taken to implement control so that it does not reach the EIL,which is the lowest population density resulting in economic damage, i.e. the density of the smallest population worth controlling (Stern, 1973; Stone & Pedigo, 1972). The economic damage is amount of preventable damage which causes a financial loss equal to the cost of the control measures. ETH or EIL depend on several parameters which change very often and hence these must be considered in the context of the system's dynamism, sampling scheme and control strategy (Plant, 1986; Onstad, 1987). The influence of such factors had been experienced in several experiments conducted for determining the EIL/ETH of the mustard aphid, Lipaphis erysimi (Kalt.) in the mustard agro-ecosystem Ludhiana, Punjab (Bakhetia et al. 1989, Anonymous, 1990). An effort is made in the present communication to discuss the effect of these factors on the ETH and its application in the field.

MATERIALS AND METHODS

Two parallel experiments, using the criteria of aphid population and per cent plants infested by the aphid, were run in the randomized block design with three replications and 5 m x 2.5 m plot size. The crop was raised under the locally recommended agronomic practices. The first experiment comprised seven treatments i.e. less than 10, 10-15, 25-30, 40-45,55-60 and above 70 per cent plants infested by the aphid. Similarly the second experiment comprised seven treatments i.e. less than 10, 20-25, 50-60, 85-100, 180-200 and above 300 aphids/ 10-cm top portion of central shoot. An unprotected control was arranged in both the experiments. All other experimental details were the same as reported by Bakhetia et al. (1989).

ETH with the third criterion of aphid colony length on central shoot has been established as 0.5-1.0 cm shoot covered by aphid colony (Personal communication from Dr Balraj Singh, PAU, Ludhiana).

ETH values determined with three criteria: 1) Per cent plants infested by the aphid, ii) Aphid population on top 10-cm central shoot and iii) Colony length on top portion of central shoot, have been reported earlier by Singh et al.(1983), Bakhetia et al. (1989) & Anonymous (1990). These ETH values were tested and compared with the previous recommended prophylatic spray schedule in large scale field trials at seven locations in farmers fields and two locations at the University research farms. The cost/benefit ratio (CBR) was calculated on the basis of cost of protection measures (insecticide and labour) applied against the aphid and the price of produce in a given year.

A comparative analysis was also done for different factors influencing the EIL/ETH of the mustard aphid on mustard crop.

RESULTS AND DISCUSSION

In an earlier communication, Bakhetia et al. (1989) reported the EIL of mustard aphid as 11, 37, 22 and 22 per cent plants infested by the aphid during different years from 1984-85 to 1987-88 respectively. These values included the value calculated by Stone and Pedigo (1972) method plus the mid-value of the fixed level for the uninfested plot. The corresponding number of insecticide sprays required were 4,6,5 and 4 with the CBR of 1:16.1, 1:0.82, 1:4.45 and 1:3.80. The farmers and even the extension workers were disinclined to accept the very low EILs arrived at by the method of Stone and Pedigo (1972) and expose the crop to such heavy dosages of pesticide(4-6 sprays). In these very experiments and also in 1987-88 (Table 1), the maximum CBR of 1:41.9, 1:7.0, 1:10.40, 1:3.80 and 1:12.30 were

Table 1. Mustard yield and related parameters in the experiments for determining the economic threshold of mustard aphid at Ludhiana,Punjab (India)

Year	Yield (kg/ha)		Value of 'b'(% plant infestation	CBR for uninfested plots	Maximum CBR in Experiment	Corresponding yield(kg/ha) for column 6
	Infested crop	Uninfested crop				
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1984-85	643	2847(4)	22.30	1:16.1	1:41.90	2097(1)
1985-86	708	1067(6)	5.65	1: 0.80	1: 7.00	972(1)
1986-87	261	955(5)	6.28	1: 4.45	1:10.40	780(2)
1987-88	945	1344(4)	5.70	1: 3.80	1: 3.80	1344(4)
1988-89	709	1256(3)	9.85	1: 5.10	1:12.30	1079(1)

1, Parentheses in columns 3 and 7 are number of insecticide sprays.

2, Value of 'b' is from the regression equation (y=a+bx)

3, Data adapted from Bakhetia et al.(1989), for 1984-85 to 1987-88.

obtained in treatments with higher levels of plant infestation which required 2,1,2, 4 and 1 sprays of the insecticide. Hence the EIL values of these treatments were considered with a view to control the aphid with minimum possible number of insecticide sprays. Phadke and Ramkishore (1988) reported that EIL on the basis of best fit semi $\log_e$ x shape of the curve was estimated as 1.64 or 2 aphids/plant. Since EIL/ETH are never static and changes very often, aphid population level up to which yield was non-significant with the maximum yield was taken as the critical injury level (53 aphids per plant).

As seen in Table 1, the yield of unprotected crop varied from 261 to 945 kg/ha against 955-2847 kg under uninfested conditions. Regression analysis showed that the value of 'b'

varied from 5.65 to 22.30 per cent, which had a direct bearing on the yield levels in the field. Other factors influencing the EIL/ETH are given in Table 2. The aphid incidence is directly influenced by the weather. It varied form 192-895 aphids/10-cm shoot and 70-86% plants infested by the aphid in different years. The cost of the insecticide ranged between Rs.84 to 99 per litre. The labour charges were Rs.18 per man per day in 1984-85 and increased to Rs.28 in 1988-89. Similarly the price of the mustard produce was Rs.425 in 1984-85 and rose to Rs.700 in 1987-88. All these parameters had a direct bearing on the ETH values calculated over different years.

Table 2. Fluctuations in aphid incidence and price of protection inputs and produce in Punjab (India) during different years

Years	Aphid pop. on 10-cm shoot*	% Plant infestation*	Insecticide (Dimethoate) (Rs./l)	Labour (Rs./man/day)	Produce (Rs./Q)
1984-85	196	70	92	18	425
1985-86	213	75	84	20	400
1986-87	895	77	84	20	600
1987-88	431	86	92	28	700
1988-89	274	80	99	28	600

*Under unprotected conditions, US $ 1=Rs.25.00

On the basis of the experimental data discussed above and also those published by Singh et al. (1983), the ETH values with three different parameters were established and tested in the field (Table 3). The yield in ETH-based treatments varied from 1541-1581 kg /ha and was on a par with that

Table 3. Economics of mustard aphid control in ETH based treatments and prophylatic sprays at Ludhiana, Punjab, India during 1989-90

Sr.No.	Treatments	Yield* (kg/ha)	Cost/ benefit*
1.	40-50% Plants infested (2)	1542	1:8.01
2.	50-60 aphids/10 cm shoot(1-2)	1551	1:10.27
3.	0.5-1.0 cm colony length on central shoot (1 - 2)	1581	1:10.67
4.	Prophylactic sprays (3-5)	1679	1:5.80
5.	Unprotected	1016	-

*Mean of 9 trials conducted at different locations.
Figures in parentheses indicate the number of insecticide sprays

of the previously recommended prophylactic spray schedule (1679 kg). However, the CBR in the ETH treatments ranged from 1:8.01 to 10.67 as against 1:5.80 in the prophylactive sprays. The number of insecticide sprays in former case was reduced to 1 or 2 from 3-5 in latter case. Hence, the ETH based decision to use insecticide for mustard aphid control on mustard crop proved more economical. It will further help in minimizing the hazards to human and cattle, toxicity to natural enemies and insect pollinators and pollution in environment.

CONCLUSION : EIL/ETH based decisions to use insecticide for mustard aphid control in mustard crop are economical.However, these values are never static and should be considered in the context of dynamic nature of the cropping system, sampling plan and the control strategy.

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