

# Economic Injury and Threshold Level of *Lipaphis Erysimi* (Kalt.)

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**Abstract:** The population dynamics of mustard aphid *Lipaphis erysimi* (Kalt.) on three varieties Varuna, Rohini and Vardan which were selected to carry out during the Rabi crop season 2004-2005 at mustard crop field and the insectary of department of the D.V. (P.G.) College Orai. The investigation on ecological studies of mustard aphid to study its economic injury and threshold level for making judicious and timely use of plant protection technology. The study will provide an opportunity to face the pest challenge by manipulating the manageable ecological parameter in the form of planting or harvesting time adjustment, varieties selection and economic injury level and economic threshold of aphid on variety Varuna, Rohini and Vardan.

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## I. INTRODUCTION

Oil seeds constitute a major source of dietary requirements of lipids for human health. Up to mid-seventies; the emphasis was to increase the production of cereals. But after the success of "Green revolution", major attention has now been shifted to increase the production of oil seeds.

Among the oilseeds, the rape seed- mustard comprises the most important edible oilseed, cultivated mainly for its seeds owing to edible quality of the oil. The productivity of this crop in U.P. is 1009 kg/ha against 944 kg/ha of the country [1].

Mustard aphid, *L. erysimi* has a prime importance infesting at flowering stage and causes up to 91.3 percent yield loss in different parts of the country [2] and [3]. Its losses to mustard crop are 34.68 percent at Kanpur, 59.49 percent at Pant Nagar, 72.61 percent at Ludhiana, 29.43 percent at Navgaon [1] and may be as high as 27-96 percent [4].

Many workers have recommended chemical control measures against the aphids in order to save the crop from terrible yield losses [5]; [6]; [7]; [8]; [9] and [10]; [11]; [12]; [13]; [14]; [15]; [16]; [17]; [18]; [19]; [20].

## II. MATERIALS AND METHODS

*L. erysimi* is a cosmopolitan species. In India, it is more prevalent in Punjab, Haryana, Bihar, Uttar Pradesh, Himachal Pradesh, West Bengal, Assam, Gujarat and Rajasthan.

The investigation on ecological studies related to distribution and assessment of injury level of aphid, *Lipaphis erysimi* Kaltenschmidt infesting *Brassica campestris* for making judicious use of insecticides, were carried out at the Insectary of Department of Zoology and the laboratory of Department of Zoology, D.V. College.

## III. OBSERVATIONS

The economic injury level was estimated by comparing the total aphid intensity (X) and yield (Y) in corresponding treatments as per technique of [21] and [22]. The following formula was used.

$$\text{Economic threshold (ET)} = \frac{\text{Cost of insecticidal treatment/ha}}{\text{Cost of produce per Kg} \times \text{Grain threshold}}$$

$$\text{Economic injury level (EIL)} = \frac{\text{Coefficient of regression (Aphid intensity Vs yield)}}{\text{Grain threshold}}$$

As the systematic insecticides require at least 3 days for complete translocation in plant system and creating toxicity against sucking pests like aphid on *B. campestris* (Khurana and Saini, 1970) (25). Therefore, the economic threshold (ET) was determined as the population three days prior to economic injury level (EIL) from the regression equation of the aphid intensity and age of the crop. The prevailing aphid indices and infestation were obviously recorded against the calculated economic threshold from respective regression equation. The economic threshold of aphid intensity, infestation and indices were determined separately for each variety.

The equivalent value of economic injury level to aphid infestation and indices were calibrated by incorporating the aphid intensity level in the regression equations of aphid intensity (X) Vs aphid infestation (Y) and aphid intensity (X) Vs aphid indices (Y) respectively for all the three varieties during both the years.

#### IV. RESULTS AND DISCUSSION

##### A. Economic Injury Level

The investigation of economic injury level of *Lipaphis erysimi* Kaltenbach (Aphididae- Homoptera) was carried out on three most popular varieties of mustard *Brassica juncea* Czern and Coss being grown in Orai (Jalaun) in sole and mixed cropping systems under both irrigated and rainfed conditions. A series of experiments was laid out during 2003-2004 and 2005-2006 at mustard crop field and the insectory of Department of Zoology of the D.V. College, Orai.

It is evident from (Tables 1, 2 & 3) that the economic injury level of the aphid intensity was 28.33 aphids per 10 cm. central shoot on variety Varuna, 28.0 on Rohini and 27.82 on Vardan, though there was slight difference in these values during both the years, as these were 27.03 and 29.63 on Varuna, 26.80 and 29.37 on Rohini and 26.60 and 29.03 aphids per plants on Vardan during respective years. This slight variation in economic injury level might be due to variation in environmental factors influencing the population fluctuations (Figs. 1, 2 & 3).

The aphid infestation was taken as the second parameter for describing the economic injury level was calculated to be 39.76 and 34.05 during respective years with an average 36.91 percent aphid infestation on variety Varuna, 41.09 and 32.16 with an average of 36.63 percent on variety Rohini and 37.97 and 30.73 with an average of 34.35 percent on variety Vardan showing slightly higher values during 1st year in comparison to second year (Tables 1, 2 & 3, Figs. 1, 2 & 3). As the aphid indices are being considered as very common practice for assessing the aphid infestation in the present time, therefore, it has also been considered important for explaining the infestation indices 0.50 and 0.75 observed as the economic injury level during 1st and 2nd year with an average of 0.63 on variety Varuna.

Meanwhile, variety Rohini also responded in the similar fashion showing 0.58 and 0.66 indices with an average of 0.62 and these values were 0.55, 0.64 and 0.60 on variety Vardan, respectively (Tables 1, 2 & 3) on the basis of these results economic injury level may be expressed as 28.33, 28.09 and 27.82 aphids on 10 cm central shoot per plant on variety Varuna, Rohini and Vardan, at these levels the aphid infestation will be 36.91, 39.63 and 34.35 percent along with aphid indices 0.63, 0.62 and 0.60 cm on the respective varieties of mustard.

According to the present investigations, assessment of economic injury levels on the basis of aphid intensity, aphid infestation and indices, is an appropriate idea but aphid intensity and indices were more reliable than infestation of aphid incidence. In contrary to it, [23] reported that population percent and percent of plant infested by *L. erysimi* were equally reliable for estimating aphid incidence. On the other hand, [24] advocated a sample size of 10 central stalks (10 cm long)

for estimating the aphid population. Economic injury level was recorded to be 28.33 aphids per plant with its infestation 36.91 percent and on index of 0.63 on var., Varuna, 28.09 aphids per plant with its infestation 36.63 percent and index of 0.62 on Rohini and 27.82 per plant with its infestation of 34.35 percent and index of 0.60 on Vardan. [25] also reported EIL as 30 to 40 aphids per 10 cm of the shoot when 17.00 to 28.67 percent of the plants were infested by aphids on toria.

### B. Economic Threshold

As the economic threshold is a level from where there are chances of reaching the pest intensity, infestation and indices to the economic injury level within a period of effectiveness of the insecticidal became effective against the aphid population at least in there days after its economic injury level, the economic threshold became effective against the aphid population at least in three days after its treatments [26]. Three days earlier to injury level, the economic threshold of the aphid intensity were determined 11.57 and 19.65 during respective years with an average of 15.61 aphids per plant on variety Varuna, 20.63 and 63.54 with an average of 22.08 on variety Rohini and 15.78 and 23.20 with an average of 19.49 aphids per plant on Vardan, respectively (tables 1, 2 & 3). The threshold of the aphid infestation was determined as 36.55 percent during Ist year and 30.57 percent during second year with an average value of 36.56 percent on variety Varuna, 39.35 and 30.15 percent with an average of 30.07 percent on Vardan, respectively (1, 2 & 3).

Similar to that of aphid infestation its indices were also calibrated to represent economic threshold by inducing equation thresholds in terms of aphid intensity to its regression equation with infestation index. These were 0.38 and 0.73 with an average of 0.55 cm. on Varuna, 0.52 and 0.53 with an average of 0.55 on Rohini and 0.44 and 0.59 with an average of 0.51 on Vardan.

The economic threshold of aphid intensity was 15.61, 22.06 and 19.49 aphids on 10 cm terminal central shoot per plant when the mustard varieties were having 36.56, 34.75 and 32.07 percent aphid infestation with its indices of 0.55, 0.55 and 0.51 on varieties Varuna, Rohini and vardan, respectively. As regards the aphid intensity at economic threshold level, the present figures are in accordance with those of [27] who have reported this level as aphids per plant at an infestation level of 10 percent. [28] and [29] suggested economic threshold of *L. erysimi* as high as 50 aphids per shoot [30]. Obtained no reduction in yield when infestation level was 30 perecnt on cabbage and mustard leaves. The recent estimates made under all India Coordination Research Project on Rapessed-Mustard, the present views are in full support, as ET level of 50 aphids, having 30 percent infestation was found on *B. juncea* in Punjab 9-19 (Av. 14) aphids per plant on *B. juncea* Cv. - RH 30 and *B. napus* Cv. GSL-1[31].

**Table: 1**

**Economic injury level and economic threshold of aphid on variety Varuna.**

Aphid population	Year	Economic injury level	Economic threshold
Aphid intensity	2003 - 2004	27.03	11.57
	2004 - 2005	29.63	19.65
	<b>Average</b>	28.33	15.61
Aphid infestation	2003 - 2004	39.76	36.55
	2004 - 2005	34.05	30.57
	<b>Average</b>	36.91	33.56
Aphid infestation index	2003 - 2004	0.5	0.38
	2004 - 2005	0.75	0.73
	<b>Average</b>	0.63	0.55

Table: 2

Economic injury level and economic threshold of aphid on variety Rohini .			
Aphid population	Year	Economic injury level	Economic threshold
Aphid intensity	2003 - 2004	26.8	20.63
	2004 - 2005	29.37	23.54
	Average	28.09	22.08
Aphid infestation	2003 - 2004	41.09	39.35
	2004 - 2005	32.16	30.15
	Average	36.63	34.75
Aphid infestation index	2003 - 2004	0.58	0.52
	2004 - 2005	0.66	0.59
	Average	0.62	0.55

Table: 3

Economic injury level and economic threshold of aphid on variety Vardan.			
Aphid population	Year	Economic injury level	Economic threshold
Aphid intensity	2003 - 2004	26.6	15.78
	2004 - 2005	29.03	23.20
	Average	27.82	19.49
Aphid infestation	2003 - 2004	37.97	35.19
	2004 - 2005	30.73	28.96
	Average	34.35	32.07
Aphid infestation index	2003 - 2004	0.55	0.44
	2004 - 2005	0.64	0.59
	Average	0.6	0.51

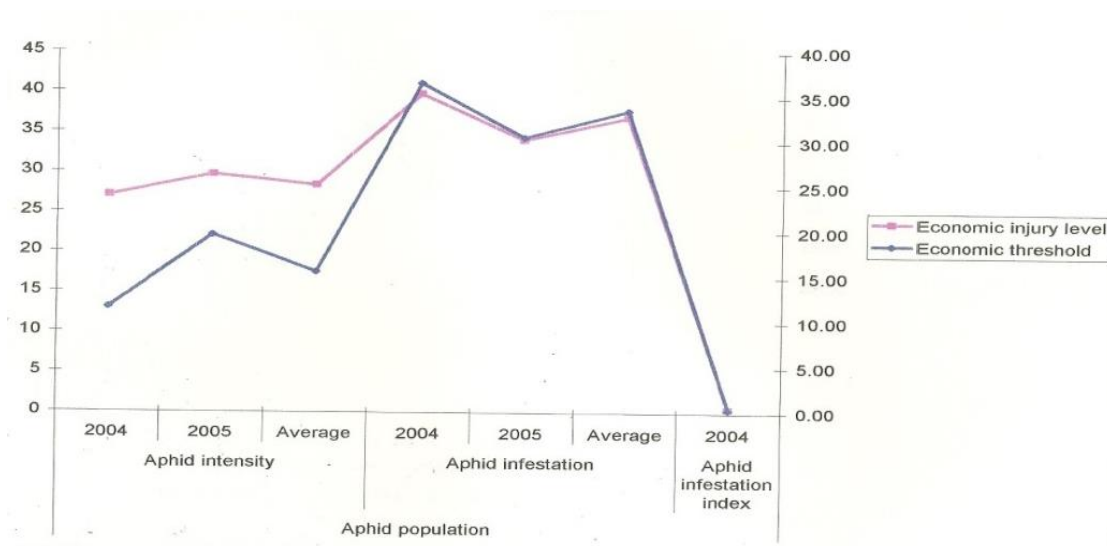


Fig.1. Economic injury and threshold of aphid on variety Varuna

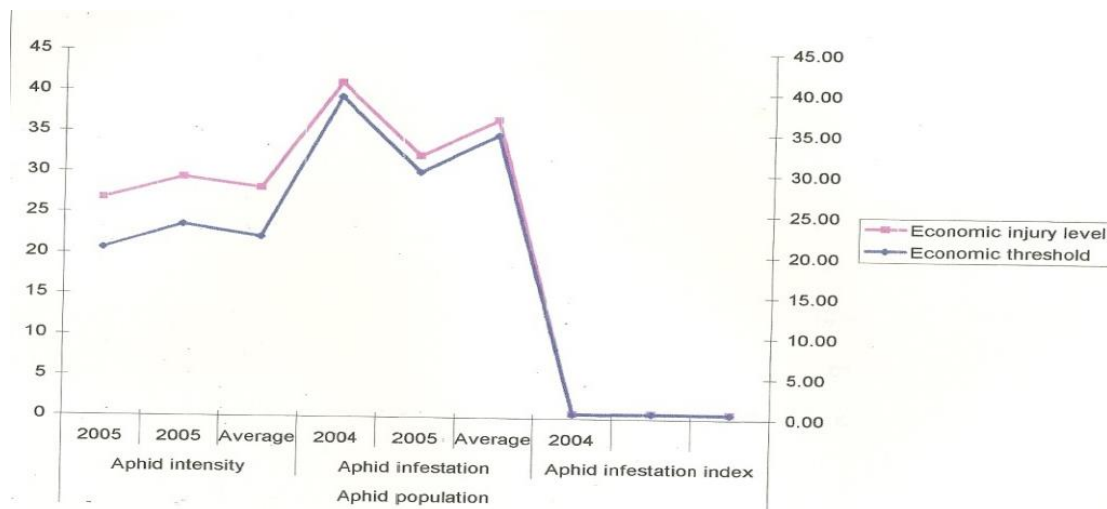


Fig.2. Economic injury and threshold of aphid on variety Rohini

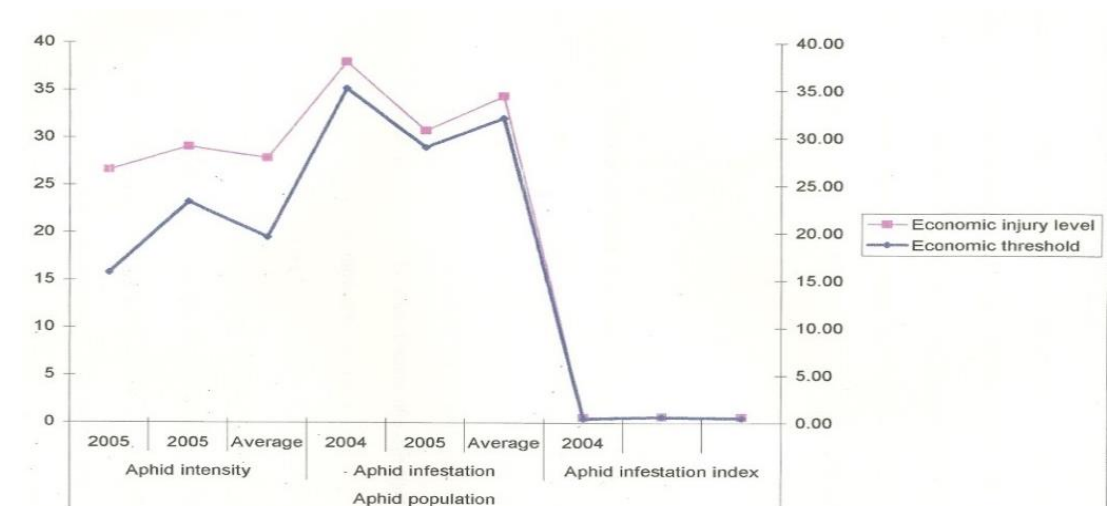


Fig.3. Economic injury and threshold of aphid on variety Vardan

## V. SUMMARY

The assessment of economic losses in yield and oil content were estimated by creating varying insecticidal pressures through repeated weekly application of phosphamidon to determine the economic injury level, economic threshold and extent of losses, simultaneously. The time for making judicious and economical application of the insecticides was determined consequently for effective management of this severe pest. The salient features of the results are being summarized under here:

1] The economic injury level was determined as 28.33, 28.09 and 27.82 aphids on aphids on 10 cm central shoots per plant on varuna, Rohini and Vardan, respectively. In term of infestation, this level may be explained as 36.91, 36.63 and 34.35 percent, while its indices were 0.63, 0.62 and 0.60 on the respective varieties. The aphid intensity per plant and aphid indices were found to be more reliable parameters for expressing the aphid incidence while its infestation was not much stable, because of its rapid increase in comparison to earlier ones.

2] Economic threshold of aphid intensity was 15.61, 22.08 and 19.49 aphids on 10 cm terminal central shoot per plant on var. Varuna, Rohini and Vardan, along with 36.56, 34.75 and 32.07 percent down the pest population for about three weeks and the repetition of the same treatment a fortnight later was quite effective in keeping down the GEP below economic injury level. Neither further repetition of the treatment nor its deletion was found advisable for suppression of pest population. The deletion of these treatments was not effective to keep down the GEP below economic injury level.

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