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Determination of Economic Threshold Level of Linseed Budfly, *Dasyneura lini* (Barnes)

V. K. Biradar, A. Y. Thakare, P. P. Deshpande

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Abstract A field experiment was conducted to determine the economic threshold level of linseed budfly, *Dasyneura lini* (Barnes) in *rabi* season for five consecutive years during 2007-08 to 2011-12. The results revealed that the economic injury level (EIL) of linseed bud fly was found to 11.70% bud infestation. The economic threshold level (ETL) was worked out as 8.77% bud infestation. The correlation coefficient between per cent budfly infestation (BFI) and seed yield of linseed was significant and negative having r=(-) 0.977** and b = (-) 17.82* in the agroclimatic conditions of Nagpur, Maharashtra.

Keywords *Dasyneura lini*, Economic injury level, Economic threshold level, Linseed.

V. K. Biradar*
All India Coordinated Research Project on Linseed,
College of Agriculture, Nagpur 440001,
Maharashtra, India
e-mail : vkbiradar@gmail.com

A. Y. Thakare
Department of Entomology,
Dr Panjabrao Deshmukh Krishi Vidyapeeth,
Akola 444104, MS, India

P. P. Deshpande
Krishi Vigyan Kendra, Sagroli, Sharda Nagar, Tq. Biloli
Dist. Nanded 431731, MS, India
*Correspondence

Introduction

Linseed (*Linum usitatissimum* L.) is one of the important *rabi* oilseed crop which is used for various industrial purposes. The crop is grown under rainfed and irrigated conditions. The crop is damaged by 28 pest species throughout its growth stage. Of these, the budfly, *Dasyneura lini* Barnes is the most destructive and specific pest of linseed. The maggots of bud fly feed upon the reproductive parts of the flower buds. The infested buds turn hollow due to crumpling of the corolla and their reproductive parts become emaciated at green bud stage. These buds remain unfertilized and no seed formation takes place. yield losses in linseed due to bud fly have been estimated to the tune of 90% in Maharashtra [1]. The EIL is the most pervasive and influential element in pest management. Indeed , EIL and ETL continue to function as the primary mechanisms for making pest management decision. Various workers [2—4] highlighted the importance of EIL and ETL in the pest management of different crop plants. Keeping in view the importance of economic injury level (EIL) and economic threshold level (ETL) in effective management of *D. lini*, the present study was undertaken.

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Materials and Methods

The field experiment was carried out at Linseed Re-

Table 1. Effect of different exposure periods on bud fly infestation and seed yield and cost of protection in linseed. Figures in parentheses are arc sine transformed values. Cost of treatment application (wages and rent of spray pump) (Rs spray^{-1} ha^{-1}) was 451/-, Cost of monocrotophos 36 SL @ Rs 347/- per lit, Price of linseed @ Rs 4,024/-per quintal (average of five years).

No. of sprays	Exposure period (days)	Bud fly infestation (%) 2007-08	2008-09	2009-10	2010-11	2011-12	Pooled
6	0	9.46	10.10	9.82	7.58	13.1	10.01
		(17.98)	(18.53)	(18.19)	(15.96)	(21.12)	(18.38)
5	7	14.24	13.40	15.80	13.67	18.2	15.06
		(22.15)	(21.47)	(23.41)	(21.68)	(25.13)	(22.80)
4	14	16.82	17.20	19.73	16.81	24.5	18.91
		(24.03)	(24.50)	(26.32)	(24.18)	(29.61)	(25.72)
3	21	21.52	22.10	24.76	21.15	28.3	23.57
		(27.61)	(28.04)	(29.80)	(27.37)	(32.12)	(29.01)
2	28	27.78	26.40	31.70	29.44	32.6	29.58
		(31.80)	(30.92)	(34.59)	(32.84)	(34.80)	(32.93)
1	35	38.42	31.70	35.76	32.09	39.3	35.45
		(38.31)	(34.27)	(35.66)	(34.50)	(38.81)	(36.52)
0	42	46.14	36.90	40.22	36.44	47.6	41.46
		(42.78)	(37.41)	(39.32)	(37.11)	(43.62)	(40.06)
	SE (m) ±	0.84	2.19	0.81	0.83	1.75	0.52
	CD (p=0.05)	2.54	9.84	2.45	2.47	3.82	1.52

Table 1. Continued.

No. of sprays	Exposure period (days)	Seed yield (kg ha^{-1}) 2007-08	2008-09	2009-10	2010-11	2011-12	Pooled	Increase in yield over control (kg ha^{-1})	(Rs ha^{-1})	Cost of protection (Rs ha^{-1}) Insecticide	Labor charges	Total
6	0	1210	1140	1287	1167	989	1159	629	25286	924	2706	3630
5	7	1078	950	1219	1118	950	1063	534	21467	770	2255	3025
4	14	916	826	1059	1053	910	953	424	17045	616	1804	2420
3	21	866	790	947	957	860	884	355	14271	462	1353	1815
2	28	794	773	825	913	854	832	303	12181	308	902	1210
1	35	712	770	795	832	728	767	238	9568	154	451	605
0	42	605	436	481	514	610	529	-	-	-	-	-
	SE (m) ±	43	53	110	75	19	31					
	CD (p=0.05)	127	162	330	226	41	90					

search Farm, College of Agriculture, Nagpur, Maharashtra (India) during *rabi* seasons of 2007-08 to 2011-12 using Neelum cultivar of linseed. The crop was sown in first to third week of November during each year and raised under recommended agronomic practices except insect pest management. The experiments were executed in randomized block design having seven treatments replicated thrice. Seven exposure periods for bud fly infestation were maintained by spraying monocrotophos 36 SL at (0.04%) at weekly intervals. Treatment having 42 days exposure to bud fly was considered as untreated check having no insecticide application. Treatment having zero day exposure to bud fly received six insecticide applications. two fortnightly sprays of mancozeb (0.25%) were also provided to the crop starting from bud initiation stage for the management of *Alternaria* bud blight. Observation on total number and number of damaged buds were recorded at dough stage from five randomly selected plants in each replication for calculating percentage of infestation. Seed yields recorded after harvest and analyzed. Linear regression equation was developed between bud infestation (x) and seed yield (y). Treat-

ment cost of two sprays of insecticide and market price of linseed were considered for computing the gain threshold (GT). Economic injury level (EIL) was calculated by dividing gain threshold from regression coefficient (b). The economic injury level of bud fly infestation was determined as per Stone and Pedigo [3], while economic threshold level as per Pedigo [5].

The mathematical procedures and steps for calculating economic injury level (EIL) are mentioned below :

1. Gain threshold (GT)

$$GT = \frac{\text{Cost of treatment (Rs ha}^{-1})}{\text{Price of Linseed (Rs kg}^{-1})}$$

2. Regression equation between percentage bud infestation (x) and seed yield of linseed (kg ha^{-1}) (y) : $y = a \pm bx$

Where as, a = pure constant; b = regression coefficient

3. Calculated EIL = Gain Threshold/b (yield loss per insect)

4. Actual EIL = EIL (Cal.) + UBFI
Whereas, UBFI = Unavoidable bud fly infestation

Results and Discussion

Economic injury level (EIL) of linseed bud fly

The crop exposed to different periods showed varied degree of bud infestation. Significantly lower bud infestation was noticed being 9.46, 10.10, 9.82, 7.58 and 13.10% during five consecutive years, when the crop was under complete protection against bud fly (Table 1). This quantum of bud fly infestation under complete protection was unavoidable losses for individual year with the mean of 10.01% infestation. The bud fly infestation was increased with enhancement in exposure to the pest and significantly higher bud infestation 46.14, 36.90, 40.22, 36.44 and 47.60 was recorded when the crop having 42 days exposure period during five consecutive years with an average of 41.46% bud infestation. Seed yield decreased with the increase in bud infestation during each year. Significantly maximum seed yield (1159 kg ha^{-1}) (Table 2) on over years mean basis was obtained from the crop treated completely, against lowest yield (529 kg ha^{-1}).Highly significant negative correlation (*r*) -0.977 was found between bud fly infestation and seed yield (Table 2). The Gain Threshold (GT) value were calculated to be 22.81, 25.30, 34.21, 37.46 and 30.85 kg ha^{-1} for different years with their mean value of 30.07 kg ha^{-1} based on the cost of treatment for two sprays of monocrotophos 30 SL @ 0.04% and the price of linseed during the respective years (Table 1). The yield (*b*) decreased from 10.83 to 24.12 kg ha^{-1} with every percent increase in bud infestation due to this pest and average reduction of 17.82 kg ha^{-1} was noticed over years. Mean linear regression model as y (yield) = 1327 – 17.82 × (bud infestation) was established and economic injury level (EIL) was calculated to be 1.69 bud infestation, but there was 10.01% unavoidable bud infestation for the experimental period. So the actual EIL will be the sum of calculated EIL and unavoidable bud infestation which is 11.70% bud infestation. These results corroborate with the findings of Malik [6] who reported economic injury level of linseed bud fly as 10.6% bud infestation by two foliar applications of deltamethrin 2.8 EC (0.002%)

Table 2. Economic threshold levels based on seed yield and bud fly infestation in linseed.

Year	Gain threshold (kg ha^{-1})	Pure intercept (a)	Regression coefficient (*b*)	Correlation coefficient (*r*)	Unavoidable bud fly infestation (%)	EIL Calculated	EIL Actual	ETL
2007-08	22.81	1250	-14.76	-0.946	9.46	1.55	11.01	8.25
2008-09	25.23	1259	-19.82	-0.909	10.10	1.27	11.37	8.53
2009-10	34.21	1555	-24.12	-0.970	9.82	1.42	11.24	8.43
2010-11	37.46	1365	-19.10	-0.917	7.58	1.96	9.54	7.16
2011-12	30.85	1158	-10.83	-0.977	13.10	2.85	15.95	11.96
Mean	30.07	1327	-17.82	-0.977	10.01	1.69	11.70	8.77

at weekly interval. The present results get support from the observations of Prasad et al. [7] who assessed the economic injury level of linseed bud fly as 4.53% bud infestation on linseed in the agroclimatic conditions of Ranchi, Jharkhand, India with two foliar applications of imidacloprid (0.003%). These findings are in tune with those of Naga and Kumawat [8] who estimated the EIL as 9.48 aphids/central shoot on fenugreek. Gadad et al. [9] estimated EIL for thrips on groundnut as 7.28 thrips per terminal bud.

Economic threshold level (ETL) of linseed bud fly

Economic threshold level (ETL) indicates the pest population density at which control measures should be initiated to check the further increase of the pest population in reaching ETL. According to Pedigo [5] We may choose to set ETL conservatively below EIL, say at 75% of EIL. Accordingly in present study, ET values from EIL's were determined being 8.25, 8.53, 8.43, 7.16 and 11.96% bud fly infestation (Table 2) for the respective years with the average value of 8.77% bud infestation. Earlier work on ETL by Malik [6] and Prasad et al. [7] support strongly these findings, who reported economic threshold level of linseed bud fly as 8.0 and 4.41% bud infestation, respectively. Naga and Kumawat [8] estimated the ETL of aphids on fenugreek as 9.48 aphids/central shoot.

Results of the present study showed that the control measures should be initiated in linseed for bud fly management when the bud fly infestation reaches at 8.77%, in order to prevent the pest infestation in reaching economic injury level (11.70%). The bud fly threshold is determined for a specific area, which can be utilized as guideline for other areas. The location, cost of treatment, degree of prevention of loss in yield and the price of crop produce often influence the economic threshold of any pest. Any increase in the price of the crop produce or the cost of treatment will lead in change of the threshold level.

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