



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2019; 7(5): 36-38

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Received: 19-07-2019

Accepted: 21-08-2019

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Occurrence and biodiversity of cutworms (*Agrotis* spp.) in maize agro-ecosystem in sub-mountainous hill region of North-Western Himalayas, India

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Abstract

Studies were carried out on the incidence and species diversity of cutworms (*Agrotis* spp.) on maize crop in Kullu and Mandi districts of Himachal Pradesh during *Kharif* 2018. It was revealed that in Mandi district, maximum damage to maize crop was recorded in Gohar village (28.33% plant kill and 2.67 larvae/m²) and in Kullu district, the maximum damage was recorded in Hawaii village (22.33% plant kill and 2.33 larvae/m²). Among the various localities surveyed in both the districts, Gohar (28.33% mortality), Leda (26.33% mortality) and Kigas (25.33% mortality) villages in Mandi district and Hawaii (22.33% mortality), Diyar (21.00% mortality) and Targali (18.33% mortality) villages in Kullu district were found to be the endemic localities for the incidence of cutworms on maize crop. Also, from the maize growing areas of Kullu and Mandi districts, the larvae were collected to find their species diversity. From Kullu, 134 larvae were collected and reared and it was found that out of them 71 moths of *Agrotis ipsilon* (Hufnagel) and 14 moths of *Agrotis segetum* (Denis and Schiffermuller) emerged whereas from the different localities of Mandi district 115 larvae were collected out of which 54 moths of *A. ipsilon* and 18 moths of *A. segetum* emerged. Of the two species of cutworms, *A. ipsilon* and *A. segetum*, the former was dominant in both the districts and constituted 83.53 and 75.00 per cent of the total larval population in Kullu and Mandi districts of Himachal Pradesh, respectively.

Keywords: Cutworms, *Agrotis* spp., maize, incidence, diversity

Introduction

Maize is the important grain crop of the world which is widely cultivated all over the world in different agro climatic zones. In India it is cultivated over an area of 9.65 million hectares with annual production of 25.90 million metric tons and productivity of 2.69 metric tons/ hectare (Thakur *et al.*, 2018) ^[15]. Among the many species of insect pests that damage this crop, cutworms (*Agrotis* spp.) (Lepidoptera: Noctuidae) are serious polyphagous and cosmopolitan pests of economic importance attacking maize and a large number of other crops throughout the world entailing India (Oloumi Sadeghi *et al.*, 1992; Mrowzynski *et al.*, 2003; Napiorkowska and Gawowska, 2004; Wright *et al.*, 2013, Sharma, 2016) ^[11, 9, 10, 18, 12]. In India, these insects are active from October to March in the Indian plains and during summer season in the mountainous regions of the country (Atwal and Dhaliwal, 2002) ^[2]. In Himachal Pradesh cutworms are the most serious insect pests of maize causing 23.92 per cent damage to this crop (Thakur and Kashyap, 1992) ^[13]. Here maize is mainly grown in *Kharif* season under rainfed conditions and is severely damaged by cutworms in the early stages of growth (upto 4 leaf stage). Since, the extent of damage and diversity of the pest varies from place to place and time to time so, an investigation was carried out to determine the extent of damage to maize crop and species diversity of cutworms in this crop in different agro-ecological zones of North Western Himalayas.

Materials and Methods

Investigations were carried out during *Kharif* 2018 from the last week of May to the end of June. Different maize growing localities were visited. The survey on the incidence of cutworms was conducted in open field conditions in 14 villages, with eight villages from Mandi and six from Kullu district. The observations on the cutworm larvae in the fields with growing maize seedlings were recorded on the total number of seedlings per square meter area and those cut by cutworm larvae and the per cent damage was worked out. The cutworm damaged plants were critically visualized for the presence of larvae in the vicinity of the

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affected plants. Also the extent of damage caused by cutworm larvae in these localities was recorded by pit sampling method (3 pits of 1m x 1m size from single field and 3 fields per village). Thus in all, from each village, the data were recorded from nine places/pits. The observations were initiated when the crop was at 2-3 leaf stage and continued till the crop became vigorous enough to withstand the damage.

Species diversity and proportion of each species at different maize growing localities of Kullu and Mandi (5 and 4 locations, respectively) was determined by rearing the larvae under laboratory conditions on tender maize leaves to adult stage and identifying the species. The larvae were collected from the nearby area of infested maize seedlings from different locations and brought to the laboratory. In Kullu and Mandi districts the sowing of maize is carried out from the last week of May to the 15th of June. Therefore, the incidence of cutworms coincided with the availability of seedlings in the field.

Results and discussion

Incidence of cutworms: Maize growing localities of Kullu and Mandi districts were systematically surveyed to find the cutworm incidence. The results revealed that (Table 1) that in Mandi district, the average maximum damage to maize plants was recorded in Gohar village (28.33% plant kill and 2.67 larvae/m²) followed by Leda village (26.33% plant kill and 2.67 larvae/m²) whereas, Maramaseet recorded minimum damage (14.00% plant kill and 0.67 larvae/m²). In Kullu district the data showed that average maximum damage to maize plants was recorded in Hawaii village (22.33% plant kill and 2.33 larvae/m²) followed by Diyar village (21.00% plant kill and 2.00 larvae/m²) whereas, Jibhi recorded minimum damage (10.00% plant kill and 0.33 larvae/m²). The

maximum average incidence from both the districts was recorded at Gohar with 28.33 per cent average incidence which was at par with the Leda village (26.33%), while maximum larval population was recorded at Gohar and Leda village with 2.67 larval population per square metre area which are at par with Maviseri (2.33), Kigas (2.33) and Hawaii (2.33) villages. The present results showed that the average cutworm incidence varied from 14.00 to 28.33 per cent in Mandi district and 10.00 to 22.33 per cent in Kullu district with the variation in the larval population of 1.0 to 2.67/ m² in Mandi and 0.33 to 2.00/ m² in Kullu district. The present findings are in conformity to those of Thakur and Kashyap (1992) ^[13] who observed *A. ipsilon* causing extensive damage to maize seedlings (23.92%) in some pockets of Himachal Pradesh. Likewise, Thakur and Kumar (1999) ^[14] reported 46.69 per cent yield losses in maize due to cutworm damage in Salooni area of Himachal Pradesh. Also Verma and Verma (2002) ^[17] reported that *A. ipsilon* and *A. segetum* were the two major cutworm species associated with various crops in Himachal Pradesh and infestation of 3 to 18 per cent by these species has been observed in different vegetable/ field crops (Anonymous, 2003) ^[1]. Kumar *et al.*, (2007) ^[8] reported that on an average the cutworm larvae caused 16.41, 20.24, 19.14, 17.62, 18.44, 33.50 and 19.31 per cent mortality of seedlings of vegetable crops *viz.* tomato, brinjal, capsicum, cabbage, french beans, cucumber and bitter gourd, respectively in the Kullu district whereas, the average damage to the respective crops in Mandi district was 18.24, 19.91, 30.18, 20.48, 6.60, 27.03 and 12.92 per cent. Earlier Kishore and Misra (1988) ^[7] and Das and Ram (1988)^[6] had reported damage to potato tubers by cutworms to be 9.0-16.4 per cent in Himachal Pradesh and 12.7 per cent in Bihar, respectively.

Table 1: Incidence of cutworm caterpillar on maize crop in endemic areas of Mandi and Kullu districts at 2-3 leaf stage

Locations	Average incidence (%)	Larval population / m ²
Mandi		
Gohar (1500m)	28.33	2.67
Basa (1500m)	16.00	1.33
Kanda (1500m)	18.67	2.00
Maviseri (1830m)	24.00	2.33
Dodwan (900m)	17.00	1.00
Leda (890m)	26.33	2.67
Maramaseet (900m)	14.00	0.67
Kigas (1220m)	25.33	2.33
Kullu		
Mohini (2400m)	16.00	1.33
Targali (1150m)	18.33	1.67
Jibhi (1850m)	10.00	0.33
Hawaii (1980m)	22.33	2.33
Diyar (1920m)	21.00	2.00
Siyah (1950m)	13.33	1.67
CD (P=0.05)	2.77	0.43

Species diversity

The data contained in Table 2 reveal that out of 9 localities (5 in Kullu and 4 in Mandi district) from which cutworm larvae were collected for identification of species, two in Kullu district *viz.* Baag and Bajaura had the incidence of *A. ipsilon* only, while in rest of the localities both the species were present. In Kullu district the maximum number of larvae was collected from Bajaura i.e. 31, out of which 70.96 per cent of them (22) pupated and thus 22 moths of *A. ipsilon* emerged, while no moth of *A. segetum* was recorded. In Mandi district, the maximum number of larvae were collected from Nagwain

i.e. 34, out of which 64.70 per cent i.e. 22 of them pupated and 17 moths of *A. ipsilon* and 5 moths of *A. segetum* emerged. In all, 134 and 115 larvae were collected out of which, 52.98 per cent and 46.95 per cent emerged to *A. ipsilon* and 10.44% and 15.65% emerged as *A. segetum* emerged from Kullu and Mandi districts, respectively. It was thus concluded that *A. ipsilon* was predominant and comprised 83.53 and 75.00 per cent of the total larval population of the cutworms in Kullu and Mandi districts, respectively whereas *A. segetum* accounted for 16.47 and 25.00 per cent population in Kullu and Mandi district,

respectively. It was also clearly indicated from the above results that only two species of cutworms were prevalent in maize growing areas of Kullu and Mandi district of Himachal Pradesh. These findings are in agreement with Thakur and Kashyap (1992) [13]. Who reported that two species viz. *A. ipsilon* and *A. segetum* were predominant in Salooni area of Chamba district of Himachal Pradesh, Similarly Kumar *et al.*, (2007) [8] also reported that *A. ipsilon* and *A. segetum* species of cutworms were prevalent in different vegetable growing areas of Kullu and Mandi district of Himachal Pradesh. Also Verma and Verma (2002) [17] reported two species of cutworms (*A. ipsilon* and *A. segetum*) on various crops in Himachal Pradesh. The present findings did not find support from those of Verma and Verma (2001) [16] who reported that *A. segetum* was a predominant species in different parts of the state. Chandel and Chandla (2003) [4] reported that only two species viz. *A. ipsilon* and *A. segetum* were mainly responsible for causing economic damage in potato. However, Chandel *et al.*, (2007) [5]. Reported five species of cutworm's viz. *A. ipsilon*, *A. segetum*, *A. flammata*, *A. spinifera* and *A. interacta* damaging potato crop in India but according to them the first two were the most serious threat to potato. The variance in occurrence of different *Agrotis* species could be due to the fact that their prevalence depends upon a number of biotic and abiotic factors like soil, climate, land use pattern, cropping system etc. and hence the species composition may vary between different localities in time and space. Since Himachal Pradesh offers salubrious milieu with wide diversity of climatic conditions and land use patterns, the species composition of polyphagia's pests like cutworms is likely to increase as more additional faunistic surveys are conducted on the greater number of host crops of the pest.

Table 2: Relative proportion of cutworm species in maize crop at different localities of Kullu and Mandi districts of Himachal Pradesh

Locality	No. of larvae		Moths emerged	
	Collected	Pupated	<i>A. ipsilon</i>	<i>A. segetum</i>
Kullu				
Haat	24	16	12	4
Hurla	26	19	16	3
Bajaura	31	22	22	0
Baag	28	13	13	0
Targali	25	15	8	7
Total	134	85	71	14
% age of total			85.33	16.47
Mandi				
Nagwain	34	22	17	5
Pulsehar	24	15	10	5
Balu	31	18	14	4
Kudiseri	26	17	13	4
Total	115	72	54	18
% age of total			75.0	25.0

Conclusion

It can be concluded that Gohar, Leda and Kigas villages of Mandi district and Hawaii, Diyar and Targali villages of Kullu district were the endemic localities for cutworm incidence in maize crop. Two species viz. *A. ipsilon* and *A. segetum* were recorded and *A. ipsilon* was predominant and comprised 83.53 and 75 per cent of the total larval population in Kullu and Mandi districts, respectively.

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