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Species makeup and percent proportion of Mango Leafhoppers *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) in Terai Region of Uttar Pradesh

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Abstract
Mango leafhoppers are among the economically important mango pests. In the terai region of Uttar Pradesh there are a lot of mango orchards. The present study was conducted at two sites - Lakhimpur Kheri and Shahjahanpur of Terai region of Uttar Pradesh. The collection of hoppers was done by Bag Trap and Sweep Net methods and they were identified on the basis of morphological variations. Leaf hoppers belonging to *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) were recorded during the study. At both the sites, *Idioscopus clypealis* (Leth.) population increased from second fortnight of February and with the peak being recorded in first fortnight of May in both the study areas viz., Lakhimpur Kheri (19-184) and Shahjahanpur (27-176). Afterwards the population of *Idioscopus clypealis* (Leth.) kept declining till first fortnight of November at both the areas, thereafter that they were not recorded from mango trees. *Amritodus atkinsoni* (Leth.) population also increased from second fortnight of February and the highest population was recorded in first fortnight of May too in both the study areas, viz., Lakhimpur Kheri (10-114) and Shahjahanpur (11-147). After this, population of *Amritodus atkinsoni* (Leth.) declined till first fortnight of July but again began to increase with another peak being recorded in the first fortnight of August and the number of adult hoppers of *Amritodus atkinsoni* (Leth.) was 106 and 114 at Lakhimpur Kheri and Shahjahanpur respectively, then the population of *Amritodus atkinsoni* (Leth.) declined till the end of December in Lakhimpur Kheri and till first fortnight of December in Shahjahanpur, after which the hoppers disappeared. *Idioscopus clypealis* (Leth.) was dominant species in Lakhimpur Kheri from February to July and in second fortnights each of August and September and in Shahjahanpur from February to first fortnight of July; whereas, *Amritodus atkinsoni* (Leth.) was more abundant in the remaining months till December. In the January and first fortnight of February, there was no hopper on the mango trees.

Keywords: Mango Leafhoppers, *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.), Species Makeup, Percent Proportion

Introduction

The mango is an ancient fruit of India. In our country maximum production of mango is recorded from Uttar Pradesh. In the terai region of Uttar Pradesh there are a lot of mango orchards. Mango production is not up to the mark because of insect pests. Mango leafhoppers are one of the most harmful pests of mango. The nymphs and adults of the hoppers puncture and suck the sap from tender shoots, leaves and inflorescence of the trees, due to which flowers are unable to develop normally and fruits drop off from the trees before maturity. This results in reduction in overall mango production (Gundappa and Shukla, 2016) [6]. Hoppers also excrete honey dew, which attracts fungi like *Meliola mangiferae* (Earle). It produces black mould on various parts of mango trees. It affects the photosynthesis of the trees due to which flowers do not set at normal and fruits drop off from the trees before they get matured. This condition is named as Honey Dew Disease (Butani,1993) [3]. As these hoppers feed on fresh leaves and inflorescence, they were recorded on branches of trees when trees bloom otherwise they hide in cracks and crevices of mango trunk (Patel *et al*., 1994) [11]. In Uttar Pradesh *Idioscopus clypealis* (Leth.) & *Amritodus atkinsoni* (Leth.) are reported so far by various workers but no study is done in terai region. So, in the present study species makeup and percent proportion of *Idioscopus clypealis* (Leth.) & *Amritodus atkinsoni* (Leth.) was worked out in Lakhimpur Kheri and Shahjahanpur of Terai region of Uttar Pradesh.

Materials and Method

The experimentation was done in Terai region of Uttar Pradesh from April 2021 to March 2022. The hoppers were collected from Lakhimpur Kheri and Shahjahanpur Districts. The geographical location of Lakhimpur Kheri is at 27.94° North and 80.77° East, whereas, that of Shahjahanpur is 27.35° North and 79.37° East. A mango orchard was selected for the study at the both the districts. In each orchard, five trees were first selected and no control measures were used on those trees. Five inflorescences from each tree were then selected at random from four sides and one from the interior of each mango tree. Hoppers were collected fortnightly. From January to April, Bag trap method (Verghese and Rao, 1987) [17] was used for collection of nymphs and adults of hoppers, as nymphs are more abundant during these months. In this method a polythene was tied around each of the selected inflorescence containing a piece of cotton dipped in ethyl acetate. All the life stages of hoppers were collected inside the bags and after segregation the nymphs and adults were counted. The sweep net method was employed during remaining months of year, as adult hoppers were more abundant. Sweeps were undertaken from each of the four geographical directions and on the tree trunk on each mango tree by using an insect collecting net. Overall, there were 5 bag traps or 5 sweeps undertaken in each study area. After collection hoppers were preserved and identified. *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) were differentiated according to the differences in morphology. *Idioscopus clypealis* (Leth.) is comparatively small and its body color is on lighter node.

Its scutellum is cream in color with two dark spots of triangular shape (Fig. – 1). However, *Amritodus atkinsoni* (Leth.) is larger and has darker body. Its scutellum has an arrow like spot (Fig. – 2). Hoppers of *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) were sorted out and their species makeup and percent proportion were exercised.

Fig 1: Adult of *Idioscopus clypealis* (Leth.)

Fig 2: Adult of *Amritodus atkinsoni* (Leth.)

Results and Discussion

At both the sites, hoppers belonging to *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) were found in the collection. The hoppers of both the species were sorted and counted fortnightly from April 2021 to March 2022 at both the collection sites. Highest number of *Idioscopus clypealis* (Leth.) was recorded in first fortnight of May at both the sites (184 and 173 at Lakhimpur Kheri and Shahjahanpur respectively); whereas, maximum number of *Amritodus atkinsoni* (Leth.) was also recorded in first fortnight of May at both the sites (114 and 147 at Lakhimpur Kheri and Shahjahanpur respectively) (Table-1&2 and Fig. 3&4). At both the sites, *Idioscopus clypealis* (Leth.) population increased from second fortnight of February and with the peak being recorded in first fortnight of May in both the study areas *viz*., Lakhimpur Kheri (19-184) and Shahjahanpur (27-176). Afterwards the population of *Idioscopus clypealis* (Leth.) kept declining till first fortnight of November at both the areas, thereafter that they were not recorded from mango trees. (Table-1&2, Fig.-3&4). Verghese and Rao (1987) reported that when fruits were of the pea size the population of mango leafhoppers was maximum. In the present study, it has been found that the fruits attained the pea size in the month of May, thus confirming current findings. These results are also in tune with Dalvi and Dumbre (1994) [4] and Hiremath and Hiremath (1994) [7]. Sharma and Tara (2014) [16] also reported that *Idioscopus clypealis* (Leth.) bred only on the inflorescence of the mango trees in February and March, confirming the present findings.

Amritodus atkinsoni (Leth.) population also increased from second fortnight of February and the highest population was recorded in first fortnight of May too in both the study areas, viz., Lakhimpur Kheri (10-114) and Shahjahanpur (11-147). After this, population of *Amritodus atkinsoni* (Leth.) declined till first fortnight of July but again began to increase with another peak being recorded in the first fortnight of August and the number of adult hoppers of *Amritodus atkinsoni* (Leth.) was 106 and 114 at Lakhimpur Kheri and Shahjahanpur respectively, then the population of *Amritodus atkinsoni* (Leth.) declined till the end of December in Lakhimpur Kheri and till first fortnight of December in Shahjahanpur, after which the hoppers disappeared. (Table-1&2, Fig.-3&4). This second peak in the population was not high as the first one and it occurs due to second generation of hoppers, as *Amritodus atkinsoni* (Leth.) breeds twice in a year. During their work on *Amritodus atkinsoni* (Leth.), Babu *et al*. (2002) [2] and Dwivedi *et al*. (2003) [5] also recorded these hoppers from March onwards. Further the finding also coincides with the work of Sharma and Sharma (2011) [14], Sharma and Tara (2013) [15] and Kumar *et al*., (2014) [9]. Sharma and Sharma (2011) [14] and Sharama and Tara (2013) [15] reported the first appearance of this hopper species in February and March with the peak population Recorded in May and June, thereafter population declined but a second peak was observed in August-September. Kumar *et al*., (2014) [9] reported that number of hoppers gradually drop towards end of May. Namni *et al*., (2017) [10] reported the abundance of this species was maximum in April and May. Mango hopper population was maximum in the month of May. Patel *et al*., (2018) [12] recorded highest hopper population in April. Roy and Arivudainambi (2019) [13] reported the highest hopper population in first week of May in Tamil Nadu, whereas, Anant *et al*., (2019) [1] recorded maximum hopper population in 3rd week of February. Kaushik and Nirmalkar (2021) [8] recorded maximum hopper population in 2nd fortnight of March in Chhattisgarh.

Idioscopus clypealis (Leth.) was dominant species in Lakhimpur Kheri from February to July and in second fortnights each of August and September and in Shahjahanpur from February to first fortnight of July; whereas, *Amritodus atkinsoni* (Leth.) was more abundant in the remaining months till December. In the January and first fortnight of February, there was no hopper on the mango trees. (Table 1&2).

Table 1: Species Makeup and Percent Proportion of Mango Leafhoppers *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) in Lakhimpur Kheri

Fortnights	Number of Hoppers		% Proportion	
	***Idioscopus clypealis* (Leth.)**	***Amritodus atkinsoni* (Leth.)**	***Idioscopus clypealis* (Leth.)**	***Amritodus atkinsoni* (Leth.)**
April 1-15 16-30	148 161	50 97	74.75 62.40	25.26 37.60
May 1-15 ,16-31	184 173	114 101	61.74 63.14	38.26 36.86
June 1-15 16-30	135 126	74 51	64.59 71.19	35.41 28.81
July 1-15 16-31	107 103	48 94	69.03 52.28	30.97 47.72
Aug. 1-15 16-31	97 92	106 81	47.78 53.18	52.22 46.82
Sep. 1-15 16-30	88 70	76 61	47.83 53.44	52.17 46.56
Oct. 1-15 16-31	40 20	50 42	44.44 32.26	55.56 67.74
Nov. 1-15 16-30	4 0	31 24	11.43 0.00	88.57 100.00
Dec. 1-15 16-31	0 0	18 10	0.00 0.00	100.00 100.00
Jan. 1-15 16-31	0 0	0 0	- -	- -
Feb. 1-15 16-28	0 19	0 10	- 65.52	- 34.48
Mar. 1-15 16-31	45 119	25 36	64.29 76.77	35.71 23.23

Table 2: Species Makeup and Percent Proportion of Mango Leafhoppers *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) in Shahjahanpur

Fortnights	Number of Hoppers		% Proportion	
	***Idioscopus clypealis* (Leth.)**	***Amritodus atkinsoni* (Leth.)**	***Idioscopus clypealis* (Leth.)**	***Amritodus atkinsoni* (Leth.)**
April 1-15 16-30	148 171	70 110	67.89 60.85	32.11 39.15
May 1-15 16-31	176 169	147 126	54.49 57.29	45.51 42.71
June 1-15 16-30	124 106	106 87	53.91 54.92	46.09 45.08
July 1-15 16-31	97 81	72 106	57.40 43.32	42.60 56.68
Aug. 1-15 16-31	76 72	114 87	40.00 45.28	60.00 54.72
Sep. 1-15 16-30	56 50	79 64	41.48 43.86	58.52 56.14
Oct. 1-15 16-31	30 15	55 49	35.29 23.44	64.71 76.56
Nov. 1-15 16-30	7 0	27 21	20.59 0.00	79.41 100.00
Dec. 1-15 16-31	0 0	11 0	0.00 -	100.00 -
Jan. 1-15 16-31	0 0	0 0	- -	- -
Feb. 1-15 16-28	0 27	0 11	- 71.05	- 28.95
Mar. 1-15 16-31	42 127	20 38	67.74 76.97	32.26 23.03

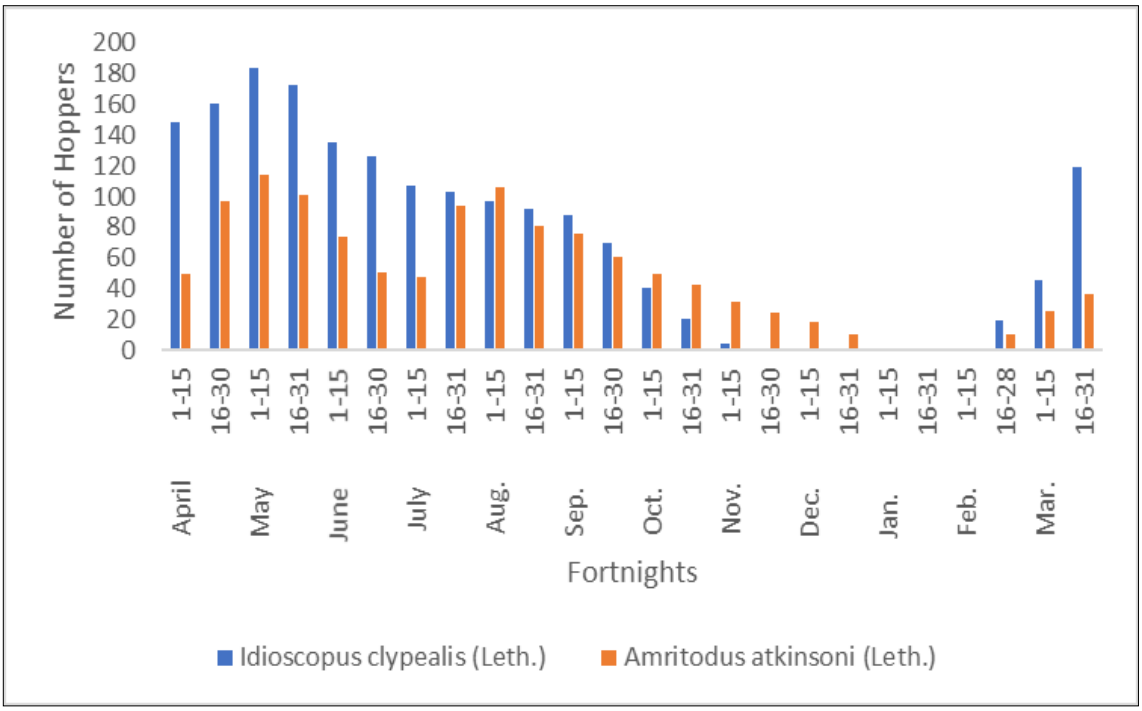

Fig 3: Species Makeup of Mango Leafhoppers *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) in Lakhimpur Kheri

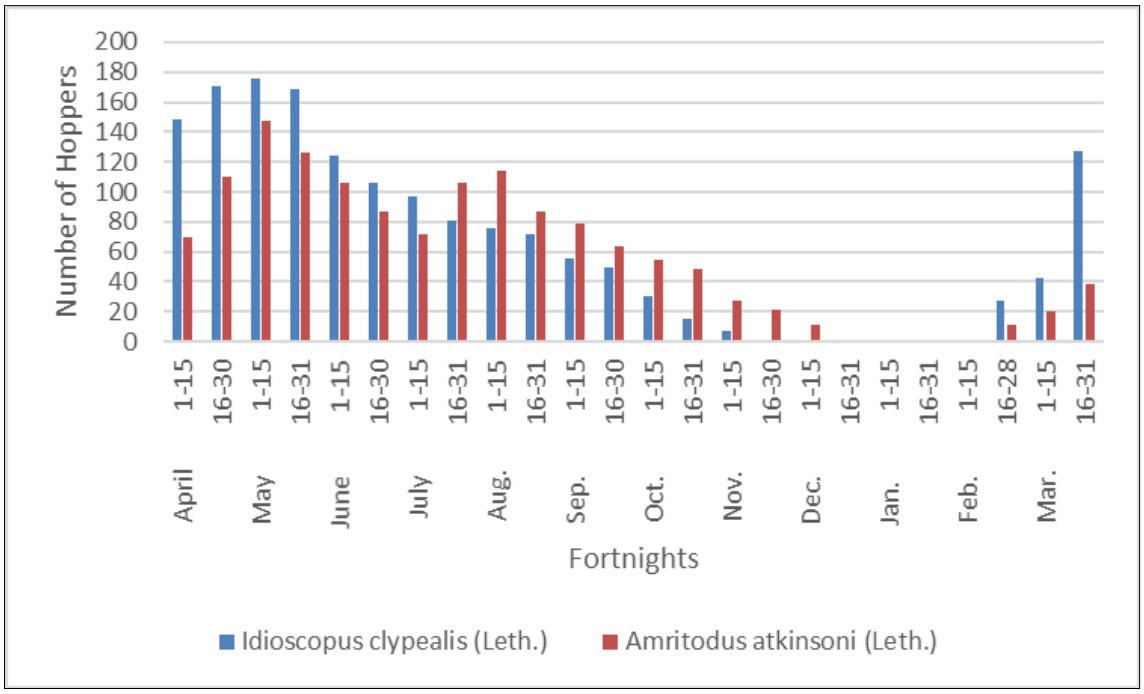

Fig 4: Species Makeup of Mango Leafhoppers *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) in Lakhimpur Kheri

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