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Population dynamics of Mango hopper *Amritodus atkinsoni* Leth. and its relationship with temperature

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ABSTRACT

The present investigation revealed that the mango hoppers were found in maximum number on leaves in early morning and they gradually migrated to branches and stem when the temperature increased, but they again came back on leaves when the temperature decreases. It was recorded that the population of hoppers was maximum in the first week of April which continuously to decrease and reached to minimum in the last week of May. The consideration reduction was found in the population from April to May. In first peak, Amritodus atkinsoni (Leth.) showed an increase from March onwards and it also reached its peak in May in the survey. After this, population of Amritodus atkinsoni (Leth.) showed a fall and then a second peak was recorded in its population in the month of August, after which population of Amritodus atkinsoni (Leth.) showed a fall till the end of December, then the hoppers disappeared. And Amritodus atkinsoni (Leth.) showed its abundance for the next five months (from August to December) in the month of January, no hopper was found on mango trees.

Keywords: *Amritodus atkinsoni Leth., Population, Species composition Mangifera indica Linn., Mean Value, Temperature*

INTRODUCTION

The Mango, *Mangifera indica* (Linn) is the most important member of family *Anacardiaceae*. It is regarded as the delicious fruits and is one of the important fruit crops in tropical and subtropical regions of the world. India, Pakistan, Brazil, is among the top three major producers of mango crop,[12] It is national fruit of Pakistan, India and Philippines, while it is the national tree of Bangladesh, [1] Mango is cultivated in about 87 countries. India has third position in mango production in the world, next to Brazil and USA. It grows equally well under tropical and subtropical climates. It is utilized at all stages of its development i.e. from immature to the mature stage. The unripe fruit are used for making pickles and chantey. Mango juice is served as a soft drink. Ripe fruits are used in preparing squash, jam, custard powder toffees etc. The seeds of mango are used for medicinal purpose. The wood is used in many ways like timber and furniture. Mango is grown in almost all stages of India and comprises about [42] percentage area under fruit. Several insect- pests cause a considerable damage to mango crop every year. Tandon [23] reported as many as 492 insect species infesting mango crop where 12 species are important insects particularly in the oriental region. Among the insect-pests, mango mealy bug (*Drosicha* [*Monophlebus*] *mangiferae* Green) and mango hoppers (*Amritodus atkinsoni* Leth. and *Idioscopus* spp.) are most destructive and may lead to complete failure of the crop. Among the mango pests mango leaf hopper *Amritodus atkinsoni* (Leth.) is a very serious pest of mango in India. The damage is mainly caused by the hoppers due to the sucking of sap from tender shoots, leaves and inflorescence which ultimately affects the fruit setting.

Prasad and Singh [15] recorded maximum population of pest during 9th and 12th January on tree trunk and during 30th January to 2nd February on shoots. The attack of mealy bug at any place was variable. Moderate rainfall of 55-60 mm at egg laying and hatching might be favorable for it. Kumar *et al*.[9, 10] studied the population of mango mealy bug *Drosicha mangiferae* and mango hopper *Amritodus atkinsoni* on different part of mango plant. Godase et al.[5] evaluated the yield loss in mango caused by the mango hopper *Idioscopus niveosparsus* during 1998, 1999 & 2001 in Maharashtra and Rahman and Singh [16] obtained the effective control of mango hopper (including *Amritodus atkinsoni, Idioscopus niveosparsus and Idioscopus clypealis).* Kumar et al.[11] studied the distribution and seasonal incidences of *Amritodus atkinsoni in a mango orched in valsad, Gujrat.* Joshi and Kumar8 also studied on effect of some meteorological factors on seasonal abundance of *Idioscopus nitidulus* (Walker) (Hemiptera:Cicadellidae) in mango orchards of Haridwar (India). Akash Varshney [24] studied on species composition and relative abundance of *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni* (Leth.) in Western Uttar Pradesh.

MATERIAL AND METHODS

The experiment was carried out during the year 2008-09 (March 08-February 09) in the mango orchard of Department of Agriculture and Department of Zoology, B.U., Jhansi, U.P. with fruitful collaboration for conducting experiment. In orchard, selected some trees having good size and shape which were sufficient for taking data for the study. For taking the data from the mango tree, firstly and randomly selected some branches and stem of the tree. The observations from branches and stem were taken in number of mango hoppers per cm^2. There was some precaution keep in mind at time of experiment in mango orchard. The simply counting the mango hopper from the branches and stem very gently, because the hopper flew by simple touch with hand or finger to the branches. It was kept in mind that all the hoppers were sitting condition at time of taking observation, there were no any movement to be found because flight mango hoppers make experiment incorrect.

The observation were taken without any disturbance of branches and stem, carefully counting to be done with the help of hand lens for making the experiment very clear and correct. All observation was taken from 6 AM. to 6 PM. with two hours intervals in a day. The mean population of adults was worked out.

OBSERVATIONS AND RESULTS

Mango hoppers are the serious monophagous pests of mango causing heavy damage of inflorescences, flowers, young fruits and young tender foliage and study was conducted to understand the seasonal migratory behaviour of mango hoppers from main tree trunk to flowering panicles in relation to host plant flowering phenology. In Mango hoppers two population peaks are found in a year. The present study is depending on only first peak from March to May, the observations of selected insect pest were taken from branches and stem of mango tree at weekly interval. The mean population of mango hopper *Amritodus atkinsoni* was worked out.

Branches

It is clear from Table-1; Fig.-1 on branches at 6.00AM indicated that the higher at par population in decrease order i.e. 6.00, 4.00, 3.00 and 3.66 hoppers per square cm was recorded in 13th May, 29th April, 15th April and 22th April respectively. It is further clear from the data on branches at 8: 00AM, the highest significant superior population 6.33 hoppers per square cm and lower population 3.00 and 2.33 was recorded in 15th April and 20th May, 27th May respectively. At 10:00 AM showed that the higher at par population 10.66 and 10.00 hoppers per square cm was recorded in 15th and 22nd April. After that the population of hopper decreases up to 8.33 hoppers in 29th April. The lower equal population 4.33 and 4.00 hoppers per square cm were recorded in 20th and 27th May, which was also at par with the observation taken 13th May.

The data on branches at 12:00 Noon indicated that the higher at par population 13.33 and 12.66 hoppers per square cm was recorded in 15th and 22nd April. After that the population of hopper regularly decreased up to 11.00 hoppers / cm^2 which were also similar to the population recorded in 22th April.

The lower similar population 9.00 and 7.66 hoppers per square cm were recorded in 6th and 27th May, which was also similar with the population in 13th 20th May. The data recorded the same table on branches at 2:00 PM indicated that the higher at par population 14.66, 14.00, 14.00, 13.66 and 13.33 hoppers per square cm was recorded in 22th ,15th, 29thApril 6th and 13th May. After that the population of hopper regularly decreased up to 11.66 hoppers / cm^2 in 20th May which was also at par with the population recorded in 13th May. The significant population 9.33 hoppers per square cm were recorded 27th May The observation on branches at 4:00 PM showed that the enhanced similar population 13.00 and 11.66 hoppers per square cm were recorded in 15th and 22th April. After that the population simultaneously decreased up to 11.00and 10.00 hoppers / cm^2 found in 29th April and 6th May, which was equally similar with the population recorded in 22th April. And after that the population continues decrease and reached to lower. The data recorded on branches at 6:00 PM indicated that the higher similar population 12.00 and 11.00 hopper per square cm was recorded in 15th, and 22thApril. The population 9.33 hoppers / cm^2 were significantly superior recorded in 29th April. The other similar population 8.00 and 7.66 hoppers/cm^2 was recorded in 6th and 13th May. The statistically similar population 6.33 and 6.00 hoppers per square cm were recorded 20th and 27th May

Stem

The observations on Table -2; Fig.-2 Showed that the higher at par population in decrease order i.e. 2.66, 2.33, 2.00 and 2.00 hoppers per square cm was recorded on stem at 6.00AM in 22nd April , 6 May, 29th April and 13th May respectively. The lower similar population 1.33 hopper per square cm was recorded in 27th May, which also at par with the population recorded in 29 April, 13th April and 20th May. It is further clear from the data on branches at 8: 00AM; the highest significant superior population 3.00, 2.33, 2.33 and 2.33 hoppers per square cm was recorded in 29th, 22th April, 6th May and 13th May respectively. The next observations on stem at 10:00 AM showed that the at par population 3.00, 2.60, 2.60, 2.30, 2.30 and 2.00 hoppers per square cm was recorded in 22nd April 13th May, 29th , 15th April, 20th , 6th and 27th May respectively. The data on stem at 12:00 Noon indicated that all the observation having similar population i.e. 4.00, 4.00, 3.66, 3.33, 3.33 3.00 and 3.00 hoppers per square cm was recorded in 15th April , 6th May, 22nd 29th April, 20th 13th and 27th May respectively. Observations on stem at 2:00 P.M. indicated that the similar population 5.33, 5.33, 4.66, 4,66,4.66 4.33 and 4.33 hoppers per square cm was recorded in all date's i.e. 15th, April to 27th May. The data on stem at 4:00 PM showed that the enhanced similar population 6.00, 6.00, 5.66, 5.66, 5.33 and 5.00 hoppers per square cm were recorded in reducing order on different date's i.e. 29th April 20th May 15th April 6th May, 13th May and 22th April respectively. After that the population simultaneously decreased up to 4.66 hoppers / cm^2 found in 27th May, which was also at par with the population recorded in 15th April, 6th , 13th May and 12th April respectively . The last data recorded from same on table-2 on stem at 6:00 P.M. indicated that the similar population 4.33, 4.33,4.33, 4.00, 4.00 and 3.66 hopper per square cm was recorded in 15th , 29th April 13th 19th 20th 27th May and 22nd April respectively.

Table- 1: Mean number of Mango hoppers cm^2/ Branches in different periods

TIME / DATE	6:00AM	8:00AM	10:00AM	12:00NOON	2:00PM	4:00PM	6:00PM
April 15,2008	3.66	6.33	10.66	12.66	14.00	13.00	12.00
April 22,2008	3.66	4.66	10.00	12.66	14.66	11.66	11.00
April 29,2008	4.00	5.00	8.33	11.00	14.00	11.00	9.33
May 06,2008	4.00	4.00	6.33	9.00	13.66	10.00	8.00
May 13,2008	6.00	4.33	5.00	9.33	13.33	9.66	7.66
May 20,2008	2.33	3.00	4.33	9.33	11.66	8.33	6.33
May 27,2008	2.66	2.33	4.00	7.66	9.33	7.00	6.00
S.E.(d)	1.43	0.35	0.77	0.90	0.78	0.79	0.54
C.D.	3.12	0.77	1.69	1.96	1.69	1.72	1.18

*Means following the same letter do not differ significantly, based on C.D. values.

Table- 2: Mean number of Mango hopper cm^2/ Stem in different periods

TIME / DATE	6:00AM	8:00AM	10:00AM	12:00NOON	2:00PM	4:00PM	6:00PM
April 15,2008	1.66	2.00	2.66	4.00	5.33	5.66	4.33
April 22,2008	2.66	2.33	3.00	3.66	5.33	5.00	3.66
April 29,2008	2.00	3.00	2.66	3.33	4.66	6.00	4.33
May 06,2008	2.33	2.33	2.33	4.00	4.66	5.66	4.00
May 13,2008	2.00	2.33	3.00	3.00	4.66	5.33	4.33
May 20,2008	1.66	2.00	2.33	3.33	4.33	6.00	4.00
May 27,2008	1.33	1.66	2.00	3.00	4.33	4.66	4.00
S.E.(d)	0.42	0.41	0.60	0.55	0.61	0.47	0.54
C.D.	0.93	0.91	1.31	1.21	1.34	1.02	1.19

*Means following the same letter do not differ significantly, based on C.D. values.

Fig.- 1: Mean value of Mango hopper cm^2/ branch in different periods (6.00AM-6.00PM)

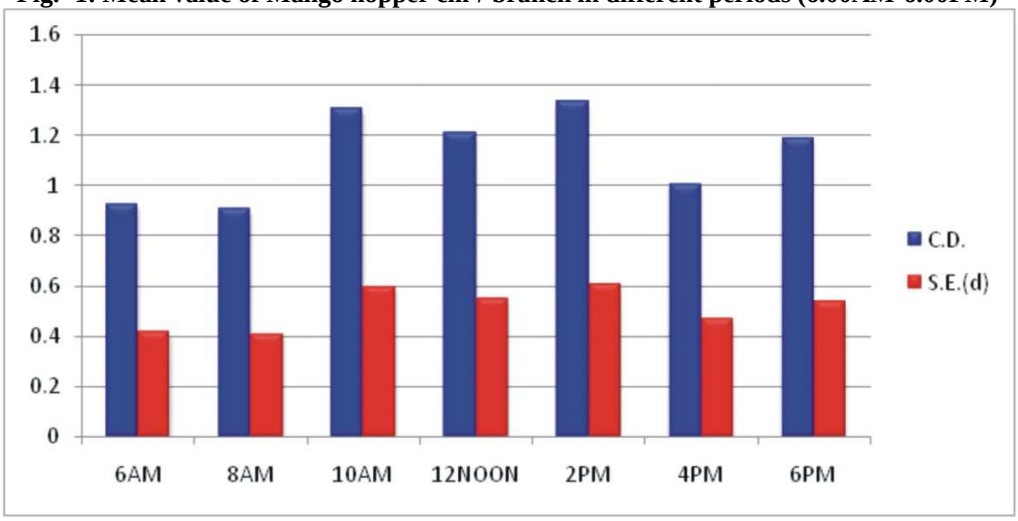
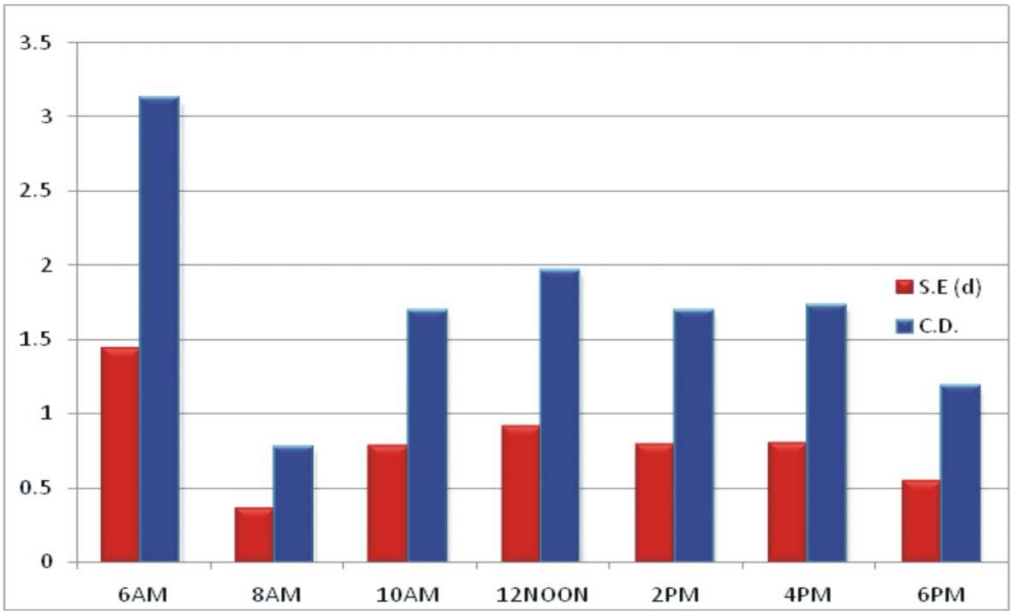


Fig. - 2: Mean value of Mango hopper cm^2/ stem in different periods (6.00AM-6.00PM)



DISCUSSION

In the present findings it has been observed that the population of mango hoppers varied from 2.33 to 6.00 hoppers per square cm on branches at 6:00AM (Table-1) which gradually decreased at the advent of the day time at 2:00PM varying from 9.33 to 14.66 hoppers per square cm. Again the number of hopper per square cm was decreased at the advent time of sunset that is at 6:00 PM. This showed that the hopper prefer to shelter under barks during high temperature of the mid-day. Similar to these findings, Jhala et al. [7] also reported that the population of mango hoppers was abundant throughout the year, but were greater in old orchard, compared to new orchards. Shekh et al.[20] observed that a minimum temperature of 20^0C kept population of *A. atkinsoni* under control.out break of the pest start, when minimum temperature ranged 20-25^0 C. Sharma et al.[19]; Sharma and Sharma [17]; Sharma and Tara [18] have observed the effect of abiotic factors on mango hopper, *Idioscopus clypealis* (Leth.) and *Amritodus atkinsoni (Leth*.) population in different climatic conditions of Jammu region. Kumar et al.[9,10] have observed the population of mango mealy bug *drosicha mangifera*, Mango hopper, *Amritodus atkinsoni (Leth*.) in Bundelkhand region. The present findings are in agreement with earlier studies [25, 22, 21, 6] that reported the phenological relationship in mango between *Idioscopus spp* and occurrence of inflorescence as well as fruits. They reported significant positive correlation between hopper population and inflorescence. Viraktamath et al. [26] reported that *I. nitidulus* breeds during January on inflorescence which is also the reason for the abundance hoppers on inflorescence. This clearly indicates that appearance of new leaves and inflorescence on the mango tree is the critical event for the migration of hoppers.

Dalvi and Dumbre3 reported that the population of *A. atkinsoni* gradually decreased from April to May after which they increased slightly in June-July. Patel et al.[13] observed that *A. atkinsoni* remain active throughout the year in the cracks and crevices of the mango trunk and population on twinges were found only during the period when young leaves and inflorescences were available. Akash Varshney [24] *Amritodus atkinsoni* (Leth.) showed an increase from March onwards and it also reached its peak in May in all the study areas; thus, confirming the results of present authors. During their study on *Amritodus atkinsoni* (Leth.), Patel et al.[14], Babu *et al.*[2] and Dwivedi *et al.*[4] reported that the adult hopper population of this pest was observed from March onwards; thus, confirming the findings of the present author. Dwivedi *et al.* [4] and Sharma and Sharma [17] recorded the peak population of *Amritodus atkinsoni* (Leth.) in June.

CONCLUSION

In the present finding it has been observed that the population of mango hoppers varied from 2.33 to 6.00 hoppers per square cm on branches at 6.00 A.M. Table-1; Fig.-1 Which gradually increased at the advent of day time at 2.00 P.M. from 9.33 to 14.66 hoppers per square cm. Again the number of hoppers per square cm was decreased at the advent on sunset that is at 6.00 P.M. In stem the population of mango hoppers varied from 1.33 to 2.66 hoppers per square cm at 6.00 A.M. Table-2; Fig.-2 which gradually increased at the advent of day time at 4.00 P.M. varying from 4.66 to 6.00 hoppers per square cm. Again the number of hoppers per square cm was decreased at the time of sunset that is at 6.00 P.M .It was confirmed that the high temperature of the mid–day compels to the hopper to migrate from leaves to the stem for sheltering under the bark. On the basis of various shelters at the same time, the mango hoppers were maximum on branches (14.66/ cm2) and stem (6.00/ cm2) April 15th to May 27th. It was also observed that the number of mango hoppers decrease April to May. It means that the populations of hoppers were greater in April than the month of May. It indicated that when the temperature increased the hoppers also migrate to the cold shady places. These finding ultimately indicated that the mango hoppers prefer cold weather and shady place for sheltering and they migrate towards with the increase of temperature. These findings proved that the maximum population (6 .00 hopper/cm2) of mango hopper was recorded between 2.00P.M to 4.00P.M. as compared to minimum Population (1.33 Hoppers/ cm2) at 6.00A.M on Branches. Among the availability of inflorescence and new leaves, the former is the most important phenomenon that directs the shifting of hoppers from stem to flower panicles by branches. This migration of hoppers intern may be influenced by the specific volatiles emitting from inflorescence.

Such pronounced local movement of mango hoppers from stem to inflorescence indicates the need for management of residual population on stem during off-season to bring down the hopper infestation in main cropping period.

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