



Population dynamics and dominance of leafhopper species on mango

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ABSTRACT: Studies on population dynamics and dominance of leafhopper species on 'Alphonso' mango were conducted from May 2016 to April 2017 at mango orchard of Agriculture College, Shivamogga and Doddabbigere village of Davanagere district, Karnataka, India. Maximum population of leafhoppers was recorded during second fortnight of February 2017 (33.54 leafhopper / inflorescence) in mango orchard of Agriculture College, Shivamogga followed by first fortnight of February 2017 (29.98 leafhopper/ inflorescence). Lowest number of leafhoppers was found during second fortnight of August 2016 (1.35 leafhopper / five sweeps in each direction). While at farmers orchard, the leafhopper population during first fortnight of February 2017 was highest (35.47/ inflorescence) followed by first fortnight of January 2017 (34.49/ inflorescence). Lowest leafhopper was found during first fortnight of September 2016 (2.05 leafhoppers/ five sweeps in each direction). Irrespective of seasons in both the locations the overall per cent dominance of mango leafhopper species was highest in *I. nitidulus* followed by *I. nagpurensis* and *A. atkinsoni*. Correlation analysis with various weather parameters in both the locations indicated that, maximum temperature and minimum temperature showed significant positive, whereas morning relative humidity had significant negative correlation with the incidence of hoppers.

Keywords: Mango leafhopper, population dynamics, species dominance, Karnataka

INTRODUCTION

Mango, *Mangifera indica* L. (Anacardaceae) is the major fruit of Asia and this fruit has developed its own importance all over the world. This fruit has been in cultivation in India sub-continent for well over 4000 years and has been the favourite of the kings and commoners because of its nutritive value, taste, attractive fragrance and health promoting qualities. Over 492 species of insects have been reported to infest mango crop (Tandon and Verghese, 1985). Among the pests that occur on mango, leafhoppers are economically important (Gangolly *et al.*, 1957). The loss caused by mango leafhoppers, *Amritodus atkinsoni* (Lethierry), *Idioscopus nitidulus* (Lethierry) and *I. clypealis* (Lethierry) was estimated to range from 20-100% of inflorescence (Haseeb, 2006 and Rahman and Kuldeep, 2007). Therefore in order to develop suitable management techniques, it is essential to have thorough understanding of the population dynamics and damage potential of the leafhoppers hence the present investigation was carried out to study the seasonal incidence of mango leafhoppers.

MATERIALS AND METHODS

A field experiment was conducted during 2016-17 in mango orchards of two locations one at College of Agriculture, Shivamogga and the other one at

Doddabbigere village. The variety Alphonso was selected for the study in both the locations. In this variety five trees were selected and marked. Observations were made on the incidence of different species of leafhopper on these trees at fortnight intervals starting from first fortnight of May 2016 to second fortnight of April 2017 by using fixed plot survey. The following methods were employed for sampling during offseason and flowering.

Sampling during off season

During off season five sweeps in each direction on the foliage were taken with an insect collecting net on the selected trees separately and leafhoppers were collected with an aspirator. Five sweeps were also taken on the tree trunk and this population was added to the total count of leafhoppers. Later leafhoppers were identified and recorded species wise and data was correlated with the weather parameters.

Sampling during flowering period

During flowering period two inflorescences in each direction (North, West, East and South) were selected. Total adults and nymphs (species wise) were recorded separately by visual counting. Observations were also recorded on the tree trunk by taking five sweeps with standard insect collecting net and the population was added to the total count.

Table 1. Population dynamics of mango leafhoppers at College of Agriculture, Shivamogga (Variety: Alphonso)

Date of observation	Mean no. of leafhoppers /inflorescence or five sweeps in each direction			Total mean
	<i>Idioscopus nitidulus</i>	<i>Idioscopus nagpurensis</i>	<i>Amritodus atkinsoni</i>	
I FN May 2016 **	18.16	3.50	1.51	23.17
II FN May 2016	9.39	4.27	0.92	14.58
I FN June 2016	0.76	4.43	0.27	5.46
II FN June 2016	0.61	3.29	0.20	4.10
I FN Jul 2016	0.40	2.86	0.09	3.35
II FN Jul 2016	0.23	1.97	0.05	2.25
I FN Aug 2016	0.14	1.33	0.03	1.50
II FN Aug 2016	0.05	1.28	0.02	1.35
I FN Sept 2016	0.35	1.20	0.12	1.67
II FN Sept 2016	0.41	1.36	0.13	1.90
I FN Oct 2016	1.00	1.98	0.32	3.30
II FN Oct 2016	1.04	2.06	0.45	3.55
I FN Nov 2016	1.64	2.12	0.60	4.36
II FN Nov 2016	2.80	3.60	0.75	7.15
I FN Dec 2016 ***	3.90	3.80	0.95	8.65
II FN Dec 2016	4.80	3.14	1.18	9.12
I FN Jan 2017	10.24	4.12	1.76	16.12
II FN Jan 2017	14.38	3.20	2.30	19.88
I FN Feb 2017	24.59	2.91	2.48	29.98
II FN Feb 2017	28.32	2.67	2.55	33.54
I FN March 2017	22.19	1.54	1.40	25.13
II FN March 2017	25.64	1.24	1.20	28.08
I FN Apr 2017	26.00	1.04	0.94	27.98
II FN Apr 2017	25.10	3.12	1.31	29.53
Mean ± SD	9.26 ± 10.38	2.58 ± 1.06	0.90 ± 0.78	12.74 ± 11.06

*FN- Fortnight (15 days interval), ** - Off season observations started, *** - On season observations started , During off season- Mean no. of leafhoppers / five sweeps in each direction, During flowering season- Mean no. of leafhoppers / inflorescence

RESULTS AND DISCUSSION

Irrespective of species of mango leafhoppers, the total number of leafhoppers found in Alphonso variety during second fortnight of February 2017 was highest (33.54 leafhopper / inflorescence) in mango orchard of Agriculture College, Shivamogga followed by first fortnight of February 2017 (29.98 leafhopper / inflorescence). Lowest leafhopper was found during second fortnight of August 2016 (1.35 leafhoppers / five sweeps in each direction). Species *Idioscopus nitidulus* Leth. was found throughout the study period, whereas, highest number of *I. nitidulus* was found during second fortnight of February 2017 (28.32 leafhopper) followed by first fortnight of April 2017 (26.00 leafhopper). More number of *Idioscopus nagpurensis* (Pruthi) was found during first fortnight of June 2016 (4.43 leafhopper) followed by second fortnight of May 2016 (4.27 leafhopper). Whereas, highest number of *Amritodus atkinsoni* Leth. was found during second fortnight of February 2017 (2.55 leafhopper) followed by first fortnight of February 2017 (2.48 leafhopper) (Table 1). Dominance of different mango leafhoppers species were worked out and the results revealed that during offseason of 2016-17, *I. nagpurensis* has the higher per cent dominance (68.77 %) (Table 2) followed by *I. nitidulus* (23.72 %) and *A. atkinsoni* (7.50 %). During the flowering season, *I. nitidulus* has the higher per cent dominance (80.08 %) followed by *I. nagpurensis* (12.96 %) and *A. atkinsoni* (6.96 %). Over all per cent dominance irrespective of seasons per cent dominance was highest in *I. nitidulus* (72.68 %) followed by *I. nagpurensis* (20.25 %) and *A. atkinsoni* (7.06 %).

At Doddabbigere, a total number of leafhoppers found during first fortnight of February 2017 was highest (35.47 leafhoppers) followed by first fortnight of January 2017 (34.49 leafhoppers). Lowest leafhopper was found during first fortnight of September 2016 (2.05 leafhoppers). *I. nitidulus* was found throughout the study period, whereas, highest number of leafhoppers *I. nitidulus* were found during first fortnight of February 2017 (30.24 leafhoppers) followed by second fortnight of January 2017 (28.96 leafhoppers). More number of *I. nagpurensis* was found during first fortnight of December 2016 (11.82 leafhoppers) followed by second fortnight of November 2016 (11.27 leafhoppers). Whereas, highest number of *A. atkinsoni* was found during first fortnight of November 2016 (2.25 leafhoppers) followed by second fortnight of November 2016 (1.99 leafhoppers) (Table 3). During offseason of 2016-17, *I. nagpurensis* has the higher per cent dominance (54.88 %) followed by *I. nitidulus* (36.23 %) and *A. atkinsoni* (8.89 %). During flowering season, *I. nitidulus* has the higher per cent dominance (77.72 %) followed by *I. nagpurensis* (17.14

%) and *A. atkinsoni* (5.14 %) (Table 4). Irrespective of seasons per cent dominance was highest in *I. nitidulus* (66.03 %) followed by *I. nagpurensis* (27.80 %) and *A. atkinsoni* (6.17 %).

These results are in line with results of Glass *et al.* (1966) who recorded maximum activity of *I. nitidulus* and *I. clypealis* during flowering period. Hiremath (1978) also reported occurrence of the adults of all the above three species throughout the year. These results are also supported by the Viraktamath *et al.* (1996) who reported that *A. atkinsoni*, *I. nitidulus* and *I. nagpurensis* as major leafhoppers on mango at Raichur. Another study on the species composition and incidence of mango leafhoppers revealed that the occurrence of *I. nagpurensis*, *I. nitidulus* and *A. atkinsoni* in Dharwad was observed. Amongst these, *I. nitidulus* was the dominant species recorded the population as high as 225 and 104 leafhoppers per inflorescence during February–April in 1990 and 1991, respectively (Viraktamath *et al.*, 1994).

Correlation coefficient with various weather parameters with the incidence of leafhoppers at mango orchard of Agriculture College Shivamogga revealed that, maximum temperature ($r = 0.847^*$), minimum temperature ($r = 0.473^*$) and sunshine hours ($r = 0.630^*$) showed significant positive, whereas morning relative humidity ($r = -0.571^*$) and afternoon relative humidity ($r = -0.728^*$) had significant negative correlation with the incidence of hoppers (Table 5). However rainfall ($r = -0.380$) and wind speed ($r = -0.129$) showed non-significant correlation on the incidence of leafhoppers. The multiple linear regression between incidence and weather parameters showed a R^2 value of 0.896 indicating 89.60 per cent influence of weather parameters on the incidence. The multiple regression equation was

$$Y = -74.586 + (0.024) \times X_1 + (0.436) \times X_2 + (2.679) \times X_3 + (0.386) \times X_4 + (-0.486) \times X_5 + (0.929) \times X_6 + (1.432) \times X_7$$

Similarly correlation coefficient of weather parameters with the incidence of leafhoppers at mango orchard of Doddabbigere, maximum temperature ($r = 0.482^*$), minimum temperature ($r = 0.505^*$) showed significant positive, whereas morning relative humidity ($r = -0.488^*$) had significant negative correlation with the incidence of hoppers. However, rainfall showed non-significant correlation on the incidence of leafhoppers ($r = -0.369$) (Table 6). The multiple linear regression between incidence and weather parameters showed a R^2 value of 0.372 indicating 37.20 per cent influence of weather parameters on the incidence. The multiple regression equation was

$$Y = -17.807 + (-0.113) \times X_1 + (0.058) \times X_2 + (1.539) \times X_3 + (0.036) \times X_4$$

Table 2. Dominance of different mango leafhoppers species at College of Agriculture, Shivamogga

Mango leafhopper species	Alphonso					
	Mean no. of leafhoppers			Per cent dominance		
	Off season	Flowering season	mean	Off season	Flowering season	mean
<i>I. nitidulus</i>	0.79	17.73	9.26	23.72	80.08	72.68
<i>I. nagpurensis</i>	2.29	2.87	2.58	68.77	12.96	20.25
<i>A. atkinsoni</i>	0.25	1.54	0.90	7.50	6.96	7.06
Total	3.33	22.14	12.74	100	100	100

- ❖ Off season- June-November, Flowering season- December-May
- ❖ During off season- Mean no. of leafhoppers / five sweeps in each direction
- ❖ During Flowering season- Mean no. of leafhoppers / inflorescence

Table 3. Population dynamics of mango leafhoppers at Doddabbigere, Channagiri. (Variety: Alphonso)

Date of observation	Mean no. of leafhoppers /inflorescence or five sweeps in each direction			
	<i>Idioscopus nitidulus</i>	<i>Idioscopus nagpurensis</i>	<i>Amritodus atkinsoni</i>	Total
I FN May 2016 **	8.27	1.92	1.35	11.54
II FN May 2016	6.84	1.67	1.67	10.18
I FN June 2016	3.12	3.24	1.24	7.60
II FN June 2016	0.74	3.56	0.10	4.40
I FN Jul 2016	0.10	4.10	0.05	4.25
II FN Jul 2016	0.14	4.28	0.08	4.50
I FN Aug 2016	0.12	4.17	0.06	4.35
II FN Aug 2016	0.20	4.35	0.20	4.75
I FN Sept 2016	0.50	1.50	0.05	2.05
II FN Sept 2016	3.41	5.12	1.45	9.98
I FN Oct 2016	5.12	6.74	1.64	13.50
II FN Oct 2016	7.15	7.92	1.73	16.80
I FN Nov 2016	11.12	10.43	2.25	23.80
II FN Nov 2016	12.34	11.27	1.99	25.60
I FN Dec 2016 ***	14.86	11.82	1.72	28.40
II FN Dec 2016	18.98	10.43	1.85	31.26
I FN Jan 2017	28.48	4.12	1.89	34.49
II FN Jan 2017	28.96	3.06	1.14	33.16
I FN Feb 2017	30.24	4.25	0.98	35.47

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II FN Feb 2017	27.41	3.72	0.97	32.10
I FN March 2017	26.24	3.46	0.44	30.14
II FN March 2017	21.23	3.28	1.21	25.72
I FN Apr 2017	17.64	2.94	0.85	21.43
II FN Apr 2017	11.92	2.53	1.93	16.38
Mean ± SD	11.88 ± 10.39	5.00 ± 3.02	1.12 ± 0.72	17.99 ± 11.31

*FN- Fortnight (15 days interval), ** - Off season observations started, *** - On season observations started , During off season- Mean no. of leafhoppers / five sweeps in each direction, During flowering season- Mean no. of leafhoppers / inflorescence

Table 5. Correlation and regression studies between mango leafhoppers# and weather parameters at College of Agriculture, Shivamogga

Variety	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	Regression equation	R ²
Alphonso	-0.380	0.847*	0.473*	-0.571*	-0.728*	0.630*	-0.129	Y= - 74.586 + (0.024) x X ₁ + (0.436) x X ₂ + (2.679) x X ₃ + (0.386) x X ₄ + (-0.486) x X ₅ + (0.929) x X ₆ + (1.432) x X ₇	0.896

Note: # Mango leafhoppers (*Idioscopus nitidulus* + *I. nagpurensis* + *Amritodus atkinsoni*). X₁- RF (mm), X₂- Max. Temp, X₃- Min. Temp, X₄- RH-I (Morning), X₅- RH-II (Afternoon), X₆- Sunshine hours and X₇-Wind speed.

*Significant at 5% level

Table 6. Correlation and regression studies between mango leafhoppers# and weather parameters at Doddabbigere, Channagiri

Variety	X ₁	X ₂	X ₃	X ₄	Regression equation	R ²
Alphonso	-0.369	0.482*	0.505*	-0.488*	Y= -17.807 + (-0.113) x X ₁ + (0.058) x X ₂ + (1.539) x X ₃ + (0.036) x X ₄	0.372

Note: # Mango leafhoppers (*Idioscopus nitidulus* + *I. nagpurensis* + *Amritodus atkinsoni*) X₁- RF (mm), X₂- Max. Temp, X₃- Min. Temp, X₄- RH-I (Morning) *Significant at 5% level

The correlation and regression results are in line with the findings of Varshneya and Rana (2008) who observed a positive correlation between the leafhopper population and maximum, minimum temperature. Similarly, positive significant correlation of mango hopper with temperature and negative non-significant correlation with relative humidity on Langra variety of mango in Pakistan reported by Talpur *et al.* (2002). As per the report of Rahman and Singh (2004), mango leafhopper population had significantly positive and negative relationship with temperature and relative humidity, respectively. Similar relationship was also noted by Pushpalatha *et al.* (2008) and Anithakumari *et al.* (2009). Thus, present findings confirmed with the earlier workers.

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REFERENCES

- Anithakumari, D., Lakshmi, B. K. M. Reddy, S. G. and Reddy, L. M. 2009. Influence of abiotic factors on the incidence of hopper and chemical control strategies in mango *of. Karnataka Journal Agricultural Sciences*, **22** (3): 601-602.
- Gangolly, S.R., Singh, R., Katyal, S. L. and Singh, D. 1957. Mango, ICAR, New Delhi, pp. 492.
- Glass, E. H., Reyes, S. L. and Calora, F. B. 1966. Note on the biology of three leafhoppers on mango. *Philippines Agricultural Scientist*, **50**: 739-743.
- Haseeb, M. 2006. Occurrence of fruit sucking bug on mango. *Annals of Plant Protection Sciences* **14**: 218-219.
- Hiremath, S. C. 1978. Studies on the bionomics of the mango hoppers (Cicadellidae : Hemiptera) and their control by different methods of application of insecticides. *M.Sc. (Agri.) Thesis*, University of Agricultural Sciences Bangalore, Karnataka (India).
- Pushpalatha, S., Kathirvelu, C. and Nachiappan, R. M. 2008. Correlation of seasonal incidence of mango hopper, *Amritodus atkinsoni* and weather parameters on certain varieties of mango. *Indian Journal of Tropical Biodiversity*, **1** : 81-83.
- Rahman, S. K. M. D. A. and Singh, G. 2004. Population dynamics of mango hopper (*Amritodus atkinsoni*) on 'Langra' mango (*Mangifera indica*) and its relationship with abiotic factors. *Indian Journal of Agricultural Sciences*, **74** (10): 566-569.
- Rahman, S. M. A. and Kuldeep, 2007. Mango hopper : Bio-ecology and management- A review. *Agricultural Reviews* **28**: 49-55.
- Talpur, M. A. and Khuhro, R. D. 2002. Relative population of mango hopper species on different mango varieties. *Journal of Asia-Pacific Entomology*, **6** (2): 183-186.
- Tandon, P. L. and Verghese, A. 1985. World list of insects, mite and other pests of mango. Tech. Bull., Indian Institute of Horticulture Research, No. 5, pp. 22-26.
- Varshneya, A. and Rana, K. S. 2008. Effect of some abiotic factors on population buildup of *Idioscopus clypealis* (Lethierry) in Western Uttar Pradesh. *Journal of Environmental Biology*, **29** (5): 811-812.
- Viraktamath, S., Hiremath, S. C. and Viraktamath, C. A. 1996. Varietal influence on the seasonal incidence of mango leafhoppers in Raichur. *Karnataka Journal of Agricultural Sciences*, **9** : 40-46.
- Viraktamath, S., Vastrad, A. S. and Lingappa, S. 1994. Incidence of the fungus *Verticillium lecanii* (Zimm.) on mango leafhoppers. *Karnataka Journal of Agricultural Sciences*, **7** (2): 242-243.

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