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Seasonal incidence and varietal preference of leafhopper species infesting Mango in Karnataka

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Abstract

Studies on survey and seasonal incidence of mango leafhopper was conducted at Daddikamalapur and MARS, Dharwad during first fortnight of 2013 to second fortnight of 2015. In mango orchard revealed the occurrence of all the three species of leafhoppers namely *I. nitidulus*, *I. clypealis* and *A. atkinsoni* and their dominance was *I. nitidulus* > *A. atkinsoni* > *I. nagpurensis*. Peak incidence was noticed during first fortnight of January 2014 (56.70 leafhoppers/yellow sticky trap) to second fortnight of May 2014 (80.60 leafhoppers/trap) and another peak was during second fortnight of December 2014 (85.40 leafhoppers/trap) to second fortnight of January 2015 (47.40 leafhoppers/trap). Seasonal incidence of leafhoppers at UAS campus, Dharwad revealed that the incidence of leafhoppers was registered from first fortnight of July 2013 to second fortnight of October 2014. Whereas, first peak of leafhoppers was during second fortnight of February 2014 (36.35 leafhoppers) and second peak was in second fortnight of June 2014 (38.38 leafhoppers) in Alphonso. Similar trend was observed in remaining varieties. The incidence of mango leafhoppers was noticed on alternate host Sapota from first fortnight of April 2014 (56.02 leafhoppers/5 sweeps) to second fortnight of September 2014 (8.04 leafhoppers/5 sweeps). Peak incidence was registered during first fortnight of April 2014 to second fortnight of April 2014 (25.62 leafhoppers/ 5 sweeps). Feeding damage was not noticed on Sapota plants.

Keywords: Leafhopper, mango, survey

1. Introduction

Mango is the most ancient among the tropical fruits and is believed to have originated in the Indo-Burma region. It is the third-largest tropical fruit after banana and citrus in terms of area and production in the world. It is the most popular, choicest fruits of India and occupies a prominent place among the best fruits in the world. It is a good source of sugar, vitamin A and C, calcium and phosphorus. It occupies an area of 2.52 million hectares with a production of 18.43 million metric tonnes and productivity of 7.30 MT/ha (Anon. 2014) [2]. Over 492 species of insects have been reported to infest mango crop (Tandon and Verghese, 1985) [14]. Among the pests of mango, leafhoppers are economically important (Gangolly *et al.*, 1957) [4]. A total of 37 species of Auchenorrhyncha in seven families are associated with mango all over the world. These groups form major pest taxa of mango in India.

The nymphs and adults cluster on the lower side of tender leaves, on inflorescence and suck the sap, resulting in drying of the entire inflorescence, small fruits, ultimately resulting in the yield loss. Nymphs cause more damage than adults. Besides the direct damage, leafhoppers excrete honeydew, which supports the growth of black sooty mold which adversely affects the photosynthetic activity of the plant. 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 [7] and Rahman and Kuldeep, 2007) [12]. In India, the area under mango is rapidly increasing, thus developing into perennial stretches of monocropping system. Consequently, this has led to increased leafhopper incidence. To develop suitable management techniques, it is essential to do a survey to understand the seasonal abundance and damage potential of different leafhopper species on mango varieties.

2. Material and methods

2.1 Seasonal incidence of leafhoppers in mango orchard

To survey mango leafhoppers on mango orchard was selected in Daddikamalapura of Dharwad district and studies were made from the first fortnight of December 2013 to second fortnight of

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February 2015. To monitor the leafhoppers yellow sticky traps were used.

2.1.1 Preparation of sticky trap

Before applying gum, threads were tied at four edges; later the gum was uniformly applied on both the sides of the sheet. Such 10 sticky traps were hung in 10 mango trees firmly tied with thread @ one trap/tree. After every three months, the gum was removed with the help of kerosene and fresh gum was applied for reuse of the trap. Same traps were reused for two years.

2.1.2 Leafhopper counting

Observations on the leafhoppers trapped were taken at fortnightly intervals. Each species of leafhopper was counted and recorded separately. The total count of leafhoppers made species-wise was deducted from the total leafhoppers counted in the previous fortnight to arrive at the number of leafhoppers trapped at a subsequent interval of observations.

2.2 Seasonal incidence of leafhoppers on different varieties at UAS campus Dharwad

To study the seasonal incidence of different species of leafhoppers at the UAS campus Dharwad total of 10 varieties were selected. In each genotype, three trees were selected and marked. Each tree was considered as one replication and thus there were 30 trees. Observations were made on the incidence of different species of leafhopper on these trees at fortnight intervals from the first fortnight of July 2013 to the second fortnight of March 2015. The following methods were employed for sampling during flowering and off season.

2.2.1 Survey and Sampling during the flowering season (January- February)

During the flowering period, five 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.

2.2.2 Survey and Sampling during the off-season (July-August)

During the off-season, five sweeps in each direction on the foliage were taken with a standard 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.

3. Results and discussion

3.1 Seasonal incidence of leafhoppers in mango orchard at Daddikamalapura

Results of the studies conducted to know the seasonal incidence of different species of mango leafhoppers in Alphonso variety by using yellow sticky traps in an mango orchard in Daddikamalapura village of Dharwad district from first fortnight of December 2013 to second fortnight of February 2015 are presented in Table 1 and Fig.1.

Findings revealed that, *I. nitidulus* was trapped throughout the study period, whereas, highest number of leafhoppers was trapped during first fortnight of May 2014 (190.00

leafhoppers/10 traps) followed by second fortnight of January 2014 (148.00 leafhoppers). More number of *I. nagpurensis* was trapped during second fortnight of January 2014 (3.90 leafhoppers) followed by second fortnight of January 2015 (3.50 leafhoppers). Whereas, highest number of *A. atkinsoni* was trapped during first fortnight of January 2014 (10.70 leafhoppers) followed by second fortnight of September 2014 (6.70 leafhoppers).

Total number of leafhoppers trapped during first fortnight of May 2014 was highest (190.30 leafhoppers) followed by second fortnight of January 2014 (158.20 leafhoppers). Lowest leafhopper was trapped during second fortnight of August 2014 (3.90 leafhoppers).

3.2 Seasonal incidence of mango leafhoppers on different mango varieties at UAS campus, Dharwad

In Alphonso, at the initiation of the study, the population was 4.27 leafhoppers/ 5 sweeps during first fortnight of July 2013. More or less the same level of population was recorded till second fortnight of August (4.77 leafhoppers). But thereafter the population declined to the level of 0.26 leafhoppers by first fortnight of November 2013. From second fortnight of November 2013 the population rapidly increased reaching the first and smaller peak of 36.35 leafhoppers during second fortnight of February 2014. Thereafter, the population declined to 6.78 leafhoppers by second fortnight of April 2014 and more or less the same level was maintained till first fortnight of June 2014. However, the population suddenly shot up to the highest peak level of 68.38 leafhoppers during second fortnight of June 2014. From second fortnight of June the population rapidly declined to the level of 4.49 leafhoppers by first fortnight of October 2014. From second fortnight of October to second fortnight of March 2015, the leafhopper population was at the lowest level varying from 0.00 to 0.66. Similar trend was noticed in Pairi, Totapuri, Mulgoa, Neelum, Mallika, Neelgoa, Neeleshan, Ratna and Swarna Jahangir varieties (Table 2 and Fig. 2).

In Pairi the first peak occurred in the first fortnight of February 2014 (28.30 leafhoppers) while highest peak of 227.33 leafhoppers was noticed during second fortnight of June, 2014. In Totapuri the first peak occurred in second fortnight of February 2014 (11.84 leafhoppers) while highest peak of 19.29 leafhoppers was noticed during second fortnight of June, 2014. In Mulgoa the first peak occurred in second fortnight of February 2014 (15.63 leafhoppers) while highest peak of 32.60 leafhoppers was noticed during second fortnight of June, 2014.

In Neelum the first peak occurred in second fortnight of February 2014 (27.77 leafhoppers) while highest peak of 55.97 leafhoppers was noticed during first fortnight of July, 2014. However, in Mallika the first peak occurred in second fortnight of February 2014 (7.35 leafhoppers) while highest peak of 11.82 leafhoppers was noticed during second fortnight of June, 2014. In Neelgoa the first peak occurred in second fortnight of February 2014 (8.64 leafhoppers) while highest peak of 15.12 leafhoppers was noticed during second fortnight of July, 2014. In Neeleshan the first peak occurred in first fortnight of April 2014 (17.70 leafhoppers) while highest peak of 21.27 leafhoppers was noticed during first fortnight of July, 2014. In Ratna the first peak occurred in second fortnight of February 2014 (18.58 leafhoppers) while highest peak of 19.54 leafhoppers was noticed during second fortnight of June, 2014. Similarly, in Swarna Jahangir the first peak occurred in second fortnight of February 2014 (12.38

leafhoppers) while highest peak of 16.57 leafhoppers was noticed during second fortnight of June, 2014.

Mango leafhoppers are major threat in reducing the yield in major mango growing areas. Nymphs and adults of the mango leafhoppers suck sap from tender foliage and floral parts, floral shoots and adults lay eggs into the underside of the midribs of tender leaves, tender rachis of florets, flowers, fruitlets and stem bark crevices. Damaged shoots grow slowly with down curved and puckered the leaves. In severe cases, the damaged shoots stop growing and finally forms die back, as a result 20–100 per cent loss of inflorescence occurred (Sohi and Sohi, 1990) [13]. Studies on seasonal incidence of different species of mango leafhoppers at MARS, Dharwad revealed that, three species of Idiocerinae namely, *I. Nitidulus*, *I. nagpurensis* and *A. atkinsoni* occurred during the study period from July 2013 to March 2015. *I. nitidulus* was found to be the dominant species of leafhopper infesting the mango crop. There were two peaks noticed during the study period. First minor peak was observed from first fortnight of January 2014 to first fortnight of April 2014 and the second major peak was from first fortnight of June 2014 to second fortnight of August 2014. Later, the population gradually decreased and from first fortnight of November 2014 till March 2015 leafhopper population was negligible in Alphonso and similar situation was observed in the remaining varieties (Fig. 02). These observations are in line with results of Glass *et al.* (1966) [6] who recorded maximum activity of *I. nitidulus* and *I. clypealis* only during flowering period. Hiremath (1978) [8] reported occurrence of the adults of all the above three species throughout the year. This is also supported by the results of Jilani *et al.* (1991) [9] and Abbas and Sharma (1995) [1] who observed the abundance of all three species on mango from June to late September. However, Dalvi *et al.* (1992) [3] recorded as many as 20 species of leafhoppers on mango in Konkan region of Maharashtra. Among them, *I. nitidulus*, *A. atkinsoni* and *I. nagpurensis* were found to be major ones. Viraktamath *et al.* (1996) [15] recorded *A. atkinsoni*, *I. nitidulus* and *I. nagpurensis* as major leafhoppers on mango at Raichur. Kudagamage *et al.* (2001) [11] also reported the population of *I. nitidulus* and *A. brevistylus* increased in February with a peak in March – April. 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) [15]. In contrary, Abbas and Sharma (1995) [1] reported a moderate to high population of *I. clypealis* and a low (0.5%) to moderate population of *I. nitidulus* on the inflorescence and leaves during February and March. The population of *A.*

atkinsoni was nil during these months. Joshi and Kumar (2012) [10] observed low occurrence of *I. nitidulus* during winter and the population started appearing with the panicle emergence. Peak leafhopper population (5.57 leafhoppers) was recorded in May at maximum temperature of 37.10°C and low relative humidity of 48%. During the present study three predators (*Mallada desjardinsi*, *Cheilomenes sexmaculata* and *Endochus inornatus*) were recorded. Verghese (1985) has also reported *Mallada* spp, coccinellids and reduviids were observed as predators of mango leafhoppers. Besides these, a fungus, *L. lecanii* was also noticed infecting and causing mortality of *I. nitidulus* from August to November 2014. This was attributed to the prevalence of high humidity in this period. The present results are in conformity with the findings of Viraktamath *et al.* (1994) [15] and Girish kumar (2000) [5].

In the present study on seasonal incidence, three sampling techniques were adopted namely usage of yellow sticky trap, sweep netting during offseason and absolute counting of leafhoppers on the inflorescence. In all these sampling techniques, *I. nitidulus* was found to be the most dominant species irrespective of places and varieties. *A. atkinsoni* adults were confined to the stem and nymphs were found only on the new flush in November 2014. Adults of *I. nagpurensis* were observed only on the leaves at Shivamogga and no nymphs were found either on leaves or inflorescence throughout the study period. These findings clearly showed that, the damage to the mango mainly caused by *I. nitidulus*. During flowering period of 2014-15, the incidence of leafhoppers was negligible. This was an unusual situation prevailed during the period which was attributed to the non flowering of more than 90 per cent of the mango trees in the experimental orchards. The flowering was highly irregular and inadequate in other mango trees. This might have interfered in normal breeding pattern of mango leafhoppers.

4. Conclusion

The leaf hopper incidence in orchard revealed the occurrence of all the three species of leafhoppers namely *I. nitidulus*, *I. clypealis* and *A. atkinsoni*. Peak incidence was noticed during first fortnight of January 2014 (56.70 leafhoppers/yellow sticky trap) to second fortnight of May 2014 (80.60 leafhoppers/trap) and another peak was during second fortnight of December 2014 (85.40 leafhoppers/trap) to second fortnight of January 2015 (47.40 leafhoppers/trap). Whereas in UAS campus, Dharwad the incidence of leafhoppers was registered from first fortnight of July 2013 to second fortnight of October 2014. from the present study it can be inferred that the leafhopper incidence was observed throughout the year but peak incidence was noticed during summer months especially from January to May. Hence, it is necessary to takeup control measures during these months for the better mango fruit yield.

Table 1: Seasonal incidence of mango leafhoppers in an mango orchard at Daddikamalapura, Dharwad district

Period	Mean leafhoppers / yellow sticky trap			
	<i>Idioscopus nitidulus</i>	<i>I. nagpurensis</i>	<i>Amritodus atkinsoni</i>	Total leafhoppers
I FN December 2013	13.90	1.30	2.90	18.10
II FN December 2013	20.20	2.30	5.70	28.20
I FN January 2014	45.80	0.20	10.70	56.70
II FN January 2014	148.00	3.90	6.30	158.20
I FN February 2014	47.80	0.20	0.30	48.30
II FN February 2014	38.50	0.00	0.40	38.90
I FN March 2014	39.70	0.00	0.20	39.90
II FN March 2014	23.60	0.00	0.30	23.90

I FN April 2014	15.30	0.00	0.50	15.80
II FN April 2014	23.70	0.00	0.50	24.20
I FN May 2014	190.00	0.00	0.30	190.30
II FN May 2014	80.50	0.00	0.10	80.60
I FN June 2014	37.70	0.00	0.00	37.70
II FN June 2014	31.70	0.20	0.50	32.40
I FN July 2014	38.00	0.10	0.00	38.10
II FN July 2014	12.90	0.00	0.10	13.00
I FN August 2014	6.20	0.00	0.00	6.20
II FN August 2014	3.90	0.00	0.00	3.90
I FN September 2014	6.70	0.00	0.00	6.70
II FN September 2014	41.20	0.40	6.70	48.30
I FN October 2014	22.40	0.00	1.80	24.20
II FN October 2014	9.20	0.00	1.50	10.70
I FN November 2014	20.30	0.50	1.30	22.10
II FN November 2014	5.20	0.00	1.40	6.60
I FN December 2014	6.80	0.40	0.20	7.40
II FN December 2014	80.30	2.80	2.30	85.40
I FN January 2015	113.00	2.60	3.10	118.70
II FN January 2015	42.00	3.50	1.90	47.40
I FN February 2015	16.90	1.60	0.80	19.30
II FN February 2015	17.40	0.90	0.40	18.70
Grand mean	39.96	0.70	1.67	42.35

FN- fortnight

Table 2: Seasonal incidence of mango leafhoppers in different varieties at Dharwad

Dates	Mean leafhoppers* /inflorescence or five sweeps									
	Alphonso	Pairi	Totapuri	Mulgoa	Neelum	Mallika	Neelgoa	Neeleshan	Ratna	Swarna Jahangir
I FN Jul 2013	4.27	2.78	1.13	3.98	2.10	1.15	2.62	2.13	1.22	7.66
II FN Jul 2013	4.51	3.02	1.18	4.22	2.13	1.25	2.65	2.28	1.30	7.85
I FN Aug 2013	4.36	2.93	1.08	4.11	1.94	1.15	2.46	2.13	1.07	7.72
II FN Aug 2013	4.77	3.46	1.11	4.34	2.11	1.62	2.96	2.53	1.20	8.48
I FN Sept 2013	0.94	0.96	1.04	1.18	0.86	0.19	1.65	1.00	1.05	2.12
II FN Sept 2013	0.75	1.49	0.36	0.83	0.56	0.28	0.70	0.98	0.53	0.91
I FN Oct 2013	0.85	0.60	0.24	0.46	2.04	0.49	0.53	1.01	0.29	0.63
II FN Oct 2013	0.30	0.78	0.11	0.59	0.67	0.13	0.37	0.94	0.22	0.35
I FN Nov 2013	0.26	0.78	0.13	0.27	0.45	0.00	0.22	0.38	0.22	0.18
II FN Nov 2013	1.21	0.51	0.17	1.70	0.65	0.44	1.07	0.94	0.35	0.43
I FN Dec 2013	1.03	0.18	0.22	2.45	0.48	0.89	0.62	0.25	0.15	0.39
II FN Dec 2013	1.15	0.64	0.44	1.01	0.44	0.54	0.62	0.43	0.36	0.22
I FN Jan 2014	3.72	1.43	0.26	2.79	1.72	0.79	1.58	0.42	0.40	1.71
II FN Jan 2014	25.71	18.28	5.99	7.88	23.90	1.92	9.15	3.20	8.61	4.80
I FN Feb 2014	32.48	28.30	9.97	12.30	27.24	6.17	16.79	7.33	15.20	11.39
II FN Feb 2014	36.35	27.42	11.84	15.63	27.77	7.35	18.64	8.97	18.58	12.38
I FN March 2014	26.78	21.37	7.08	12.05	16.42	4.09	10.67	2.72	7.60	4.39
II FN March 2014	14.53	10.22	9.08	7.01	9.73	1.45	2.76	2.96	2.75	3.30
I FN Apr 2014	25.00	16.07	15.97	18.81	13.51	4.13	6.92	17.70	8.34	6.22
II FN Apr 2014	6.78	19.36	8.09	11.37	11.83	1.76	6.27	8.67	5.00	3.92
I FN May 2014	5.78	13.41	6.54	12.39	10.11	1.13	3.93	6.28	2.52	3.11
II FN May 2014	7.36	14.03	4.87	6.10	7.05	3.72	4.77	6.34	5.51	4.53
I FN June 2014	8.71	18.44	5.15	7.87	5.14	3.36	3.89	5.20	3.86	5.91
II FN June 2014	68.38	227.33	19.29	32.60	49.81	11.82	10.81	8.68	19.54	16.57
I FN Jul 2014	67.41	211.27	16.14	26.91	55.97	10.70	11.30	21.27	13.21	15.14
II FN Jul 2014	38.03	38.02	7.06	11.56	45.72	10.72	15.12	11.56	15.08	13.61
I FN Aug 2014	30.22	36.83	3.76	11.54	47.29	6.29	14.03	13.07	10.03	7.77
II FN Aug 2014	31.14	32.95	2.63	10.13	40.84	5.02	10.98	11.83	8.18	5.55
I FN Sept 2014	16.62	27.32	2.19	8.60	26.80	3.76	6.96	9.77	4.13	2.53
II FN Sept 2014	8.48	14.24	0.83	5.66	10.68	1.21	5.11	7.59	0.71	0.64
I FN Oct 2014	4.49	7.56	0.41	3.22	4.36	0.65	2.75	3.72	0.41	0.42
II FN Oct 2014	0.66	0.96	0.32	0.49	0.81	0.36	0.58	0.62	0.32	0.30
I FN Nov 2014	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
II FN Nov 2014	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I FN Dec 2014	0.00	0.13	0.05	0.00	0.00	0.09	0.00	0.00	0.27	0.00
II FN Dec 2014	0.66	0.13	0.05	0.13	0.24	0.09	0.05	0.00	0.13	0.15
I FN Jan 2015	0.66	0.13	0.05	0.13	0.24	0.09	0.05	0.00	0.13	0.15
II FN Jan 2015	0.00	0.00	0.00	0.00	0.00	0.09	0.05	0.00	0.00	0.09
I FN Feb 2015	0.13	0.00	0.00	0.00	0.05	0.05	0.05	0.00	0.22	0.08

II FN Feb 2015	0.28	0.00	0.00	0.00	0.28	0.00	0.00	0.18	0.22	0.18
I FN March 2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
II FN March 2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grand mean	11.54	19.13	3.45	5.96	10.76	2.26	4.28	4.12	3.78	3.85

FN- fortnight * Mean leafhoppers (Idioscopus nitidulus + I. naggurensis + Amritodus atkinsoni)

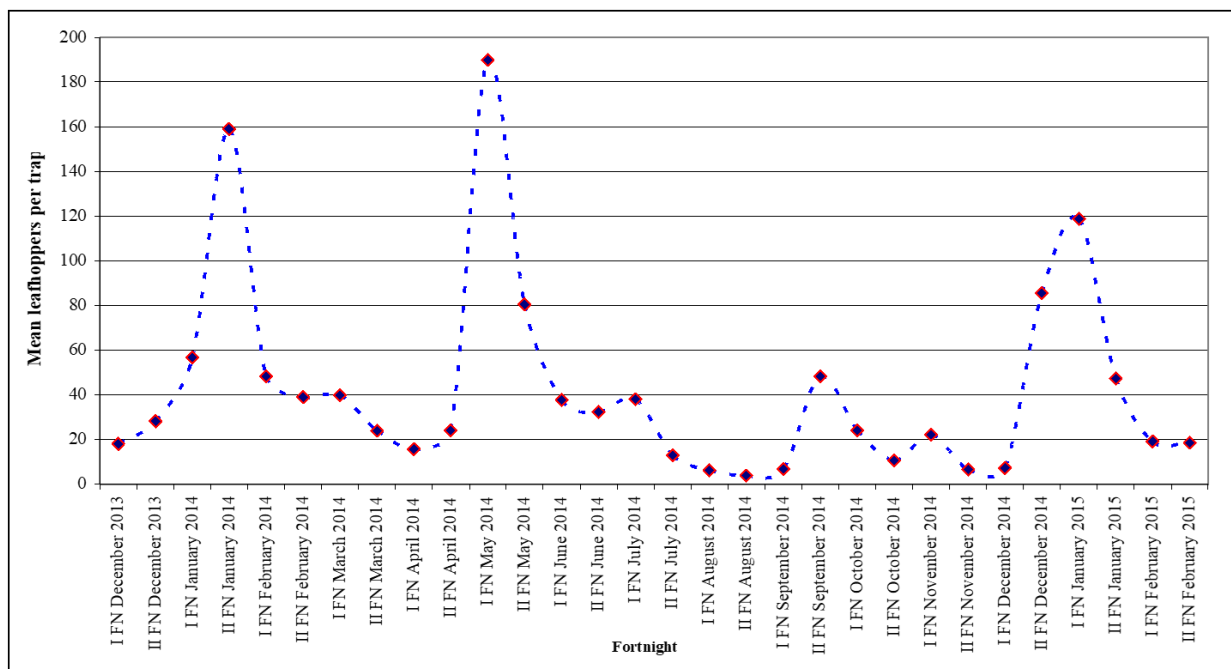


Fig 1: Seasonal incidence of mango leafhoppers in mango orchid at Dharwad

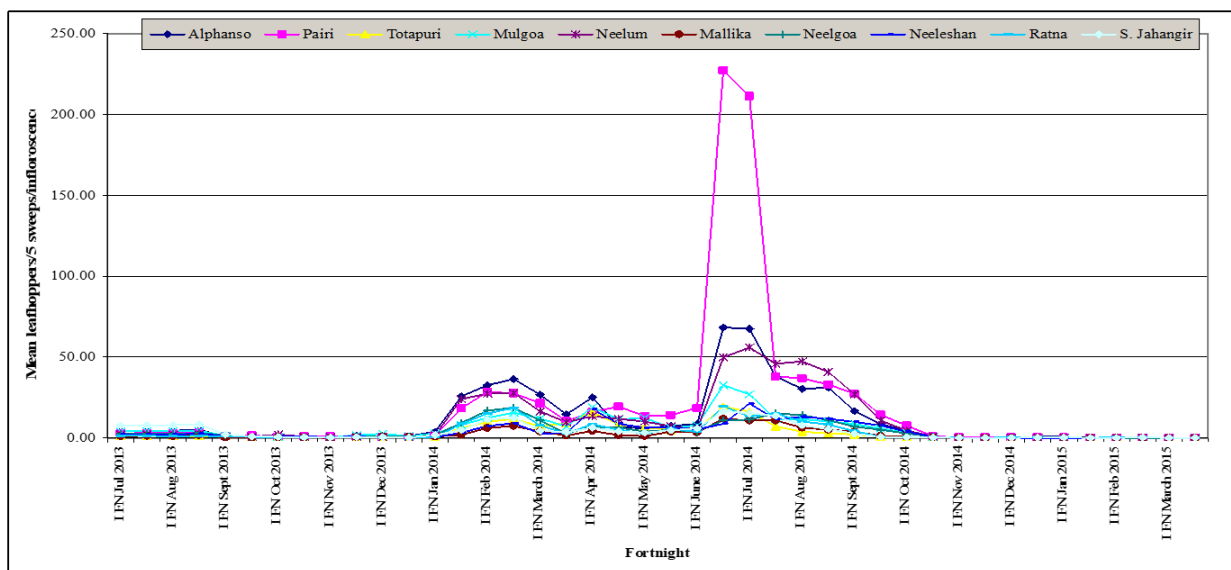


Fig 2: Seasonal incidence of mango leafhoppers on different mango varieties at UAS campus, Dharwad

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