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Seasonal Activity Of Sucking Pest Complex On Transgenic Cotton

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ABSTRACT

The seasonal activity of major sucking pest complex on transgenic cotton along with their correlation with weather parameters were studied during kharif 2015-2016 and 2016-2017, at the Experimental Farm, Department of Agricultural Entomology, Marathwada Agricultural University, Parbhani. During kharif 2015-2016 the incidence of aphids was highest (36.40/aphids/3 leaves) during 40th MW. Jassids highest population (32.12/3 leaves) was observed during 34th MW and thrips reached highest incidence (41.20 thrips/3 leaves) in 39thMW while highest incidence of whitefly (21.60/3 leaves) was noticed during 42ndMW. During kharif 2016-2017the peak incidence of aphids (28.40 /3 leaves) was observed in 42nd MW while Jassids peak (26.60) was recorded in 34th MW. The peak incidence of thrips (37.20/3 leaves) was recorded in 41thMW and whitefly (18.50whiteflies/3 leaves) in 43rd MW. Simple correlation studies revealed that weather parameters viz., rainfall, morning RH and evening RH showed significant and negative correlation with aphids and whitefly population while maximum temperature showed significant positive correlation with jassids and thrips populations.

Key words: *Transgenic cotton, sucking pest complex, seasonal activity, weather parameters, correlation*

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INTRODUCTION

Cotton is a commercial cash crop of India and is grown in three agro-climatic zones. Cotton (*Gossypium* Spp.), in a way is a gift of the Indian subcontinent to human civilization. By far, cotton is the most important natural fibre or vegetable wool has been in the cultivation commercially for domestic consumption and export needs in about 111 countries worldwide and hence called "King of fibres". *Bt* cotton is specially developed for the bollworms but sucking pests are emerging as prime insect pests causing severe losses in yield. In cotton population build up of various pests has been found to be influenced by different parameters of climate. The insect being the member of biotic community interacts with other non living (abiotic) components of the environment. The outcome of these interactions is population dynamics, the positive and negative growth of the population. Hence, the life system and abundance of insect can be understood by study of interaction between insect and abiotic factors. Hence, studies on population dynamics are essential serving as base for pest management.

MATERIALS AND METHODS

Field experiments were conducted during *kharif* 2015-2016 and 2016-17, in unprotected plots which wasnon-replicated and the plot was divided in four quadrantsat the Experimental Farm, Department of Entomology,Marathwada Agricultural University, Parbhani. Theplot size was 10 m x 10 m with a spacing of 90 cm x60 cm. The sowing was done by hand dibbling usingseed of RCH-II BGIIpurchased from Parbhani Retail Market placing 2 seeds per hill on 21 June 2015 and 26 June 2016after the receiving optimum rains. Gap filling was done within 5-7 days after emergence and thinning was done at 15 days after emergence, keeping one healthy plant per hill. The observations on populations of aphids, jassids, thrips and whiteflies were recorded at weekly intervals from three leaves (each from top, middle and bottom canopy) on ten randomly selected plants from each quadrant.

The data pertaining to seasonal activity of major sucking pest complex of transgenic cotton were compared with various environmental factors. The relation between weather parameters and major sucking pests was studied and simple correlation was worked out.

RESULTS AND DISCUSSION

The data on incidence of sucking pests of *Bt* cotton during *kharif* 2007-2008 and 2008-2009 are presented in Table 1 and depicted in Fig 1and 2.

The seasonal activity of aphid *A. gossypii* during *Kharif* 2015 in transgenic cotton ranged between 3.20 to 36.4 aphids/ three leaves. The incidence of aphids started from 30th MW (3.20 aphids/ three leaves) with its first peak (15.60 aphids/ three leaves) in 34th MW. Thereafter second peak incidence was noted in 38th MW (8.80 aphids/ three leaves). The third peak was observed in 44th MW (9.2 aphids/ three leaves). The highest incidence in this was recorded in 40th MW (36.40 aphids/ three leaves).The seasonal activity fluctuations of aphids *A. gossypii* during *Kharif* 2016 the aphid population in transgenic cotton ranged between 2.30 to 28.40 aphids/ three leaves. The incidence of aphids started from 31st MW (2.30 aphids/ three leaves). First peak of aphid was observed 32st MW (5.40 aphids/ three leaves). Second peak was noted in 36th MW (10.60 aphids/ three leaves). The highest incidence of aphid was recorded in 42nd MW (28.40 aphids/ three leaves).

The trends of aphid infestation were more or less similar to those reported by other research workers like Purohit *et al.* (2006) reported the aphid population reached the peaks in 4th week of August and during 1st week of December and 4th week of November. More *et al.* (2009) observed the peak incidence of aphids of 52.20/three leaves during first week of September while second peak was observed during last week of October (51.80 aphids/three leaves).Soujanya *et al.* (2010) who reported major sucking pest aphids *A. gossypii* infested crop initial incidence of aphids was recorded 34th standard week (4th week of August) and peak incidence was observed from 39th standard week (4th week of September) to 46th standard week (3rd week of November). Mohapatra (2008) who reported major sucking pest aphids, *A. gossypii* infested crop from 30th standard week to 50th standard week.

The seasonal activity of jassid *A. biguttula biguttula* during *Kharif* 2015 that jassids population ranges between (0.75 to 32.12 jassids/3 leaves). The incidence of jassids started from 30th MW. The peak incidence of jassids was recorded in 34th MW to 44th MW. Maximum population of jassids recorded (32.12 jassids/3 leaves) during 34th MW (15 – 21 October). After 44th MW the population decreased and reached up to (1.80 jassids/3 leaves) in 49th MW (10 – 16th December). During *Kharif* 2016 in transgenic cotton the jassid population ranged between 2.6 to 26.60 jassids/ three leaves. The incidence of jassids started from 30th MW. The peak incidence of jassids was recorded in 34th MW to 44th MW. Maximum population of jassids recorded (26.60 jassids/3 leaves) during 34th MW (15 – 21 October).

The present findings are in agreement with those of earlier researchers like Mohapatra (2008) reported the leaf hopper infested cotton crop from 30th standerd week to 50th standerd week with peak population attained during 41st standerd week (October 8-14). Also, Prasad *et al.* (2008) observed the peak incidence of leafhopper on cotton from 37th to 47th standard week (mid September to November). Rajput *et al.* (2010) reported the peak of jassidson cotton in 3rd - 9th September to 17th - 23rd September with maximum population in 37th standard week. Saujanya *et al*. (2010) recorded the leaf hoppers incidence showed increasing trend from 39th standard week (2nd week of October to 3rd week of November. More or less similar observations were also recorded by Desai *et al.* (2009), Kalkal *et al.* (2009), More *et al.* (2009) and Shitole and Patel (2009).

The seasonal activity of thrips in transgenic cotton during *Kharif* 2015 ranged between 1.80 to 41.20 thrips/ three leaves. The incidence of thrips started from 30th MW (1.80 thrips/ three leaves) and rose to its first peak 16.40 thrips/ three leaves in 34th MW. The population of thrips was increased from 36th to 43th MW with highest population (41.2 thrips/ three leaves) in 39th week. The population declined thereafter till 49th MW and become nil upto 50th MW. The population of thrips, *T. tabaci* during *Kharif* 2016 ranged from 1.05 to 42.60 thrips/ three leaves. The incidence of thrips started from 31th MW and reached to its first peak (37.2 thrips/ three leaves) in 41th MW. Thereafter population declined up to 8.30 thrips/ three leaves in 30th MW. The highest population during the season was 37.20 thrips/ three leaves in 41th MW.

The present findings of peak incidence of thrips is more or less similar as sowing period may vary confirming with those of Patel (1992) who reported that the population of thrips first appeared in 34th standard week to 40th standard week with highest population was observed in 37th standard week (2nd week of September).Gupta *et al.* (1997) noticed that the peak population of thrips was recorded during the second fortnight of August to the first fortnight of October. Gosalwad *et al*. (2009) studied population dynamics of major insect pest of cotton and showed that thrips attained its peak in August and November in 2004-05. Kudale (2000) observed the maximum population of thrips (14.70 thrips/plant) in fourth week of September i.e. in 39th MW when temperature and relative humidity were 31°C and 83 per cent respectively. Bhede (2003) reported that thrips *S. dorsalis* commenced in last week of August and reached peak during first week of October. Pawar *et al.* (2008) recorded the highest thrips population (92.65/leaf) during 35th MW and second peak (65.70/leaf) was recorded in next week. Prasad *et al.* (2008) observed the peak incidence of thrips was observed from 35th to 39th standard week (September). Parsai and

Shashtry (2009) observed thrips from 39th to 46th SMW with its peak (12.5- 23.5/ three leaves) during 42nd SMW. The present findings are also supported by those of. Daware *et al.* (2003),More *et al.* (2009), Shitole and Patel (2009) and Rajput *et al.* (2010).

The seasonal activity fluctuations of whitefly, *B. tabaci* in transgenic cotton during *Kharif* 2015 ranged between 1.75 to 21.60 whiteflies/ three leaves. The incidence of whiteflies started from 30st MW (1.75 whiteflies/ three leaves). The activity of whiteflies was more from 41rd to 47th MW with highest population (21.60 whiteflies/ three leaves) in 42nd week of Octomber. Thereafter population declined till 49th MW. While, during 2016 data on whiteflies *B. tabaci* revealed that in transgenic cotton population ranged from 3.60 to 18.50 whiteflies/three leaves. The incidence of whiteflies started from 31th MW (3.60 whiteflies/three leaves) and reached to the 1st peak of whitefly incidence in 35th MW (2.80 whiteflies/three leaves). second peak was observed in 41th MW (10.6 whiteflies/three leaves). The incidence of whitefly was severe from 41th to 46th MW and declined upto 50nd MW. The highest population (18.50 whiteflies/ three leaves) during the season was observed in 43th MW.

The present findings are similar with the findings of research workers like Patel (1992) who reported that *B. tabaci* was at peak during 2nd week of October through 3rdweek of November.Daware *et al.* (2003) reported first appearance of whiteflies from first week of August (31st MW) and peaked in first week of October to second week of November (40th -46th MW). Mohapatra (2008) observed that *B. tabaci* infested the *hirsutum* cotton crop from 30th standard week to 50th standard week and peak population of *B. tabaci* attained during 44th standard week (October 29-November 4). Prasad *et al.* (2008) observed that the peak incidence of whiteflies was started from 44th to 48th standard week (November). Pawar *et al*. (2008) observed that population of whitefly started to increase significantly and attained its peak/leaf (10.46 whitefly/3 leaves) during third week of October. Gosalwad *et al.* (2009) reported the peak population of *B. tabaci* attained in second week of November during 2005. Parsai and Shastry (2009) observed the incidence of whitefly from 33rd - 48th SMW with its maximum (21.1-31.1 per three leaves) incidence during 41st SMW. Rajput *et al.* (2010) observed the highest population whiteflies in 41st standard week i.e. 8th – 14th October during 2001-02 and during 2002-03 it was maximum in 42nd and 43rd standard week (15th to 28th October). The findings are also supported with Soujanya *et al*. (2010).

Correlation between weather parameters and major sucking pests presented in Table 2 reveal the following.

During *Kharif* 2015-16 the aphid population was negatively non-significant with the maximum temperature (r = -0.018), rainfall (r = -0.068), min. temperature (r = -0.099) and morning RH (r = -0.074). The aphid population showed positively significant effect with evening RH (r = 0.023) and evaporation (r = 0.314).

While, during *Kharif* 2016-17 the aphid population was positively significant with the maximum temperature (r = 0.412* respectively) and evaporation (r = 0.561*). The aphid population showed negatively significant correlation with morning RH (r = -0.477*), evening RH (r = -0.585*) and rainfall (r = -0.458) and minimum temperature (r = -0.411*).

The above findings are in consonance with those of earlier research workers like Rathod and Bapodra (2004) who reported that the maximum temperature, relative humidity and sunshine hours showed the positive correlation, whereas minimum relative humidity showed the negative correlation with the aphid population in cotton. Prasad *et al.* (2008) reported that the incidence of aphids had significant negative association with maximum temperature, minimum temperature, evening relative humidity and rainfall and positive association with morning relative humidity, while Mohapatra (2008) reported that among the weather parameters, temperature showed a positive correlation with *A. gossypii* and effect of rainfall was adverse.Shitole and Patel (2009) reported that aphid population exhibited significant positive correlation with average temperature, relative humidity (maximum, minimum and average), rainfall, rainy days and wind velocity. More or less similar observations were also recorded by Soujanya *et al*. (2010) and Shivanna *et al*. (2011) that also confirming the results obtained during present investigations.

The population of jassid in relation to rainfall (r= 0.328**), morning RH (r= 0.338*) and evaporation (r= 0.365**) were positively significant and maximum temperature (r= -0.338**) negatively significant during *Kharif* 2015.While, during *Kharif* 2016 population of jassid correlated positively significant with maximum temperature (r= 0.469*) and evaporation (r= 0.408*).

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The data on correlation between weather parameters and jassid population during *Kharif* 2015 and *Kharif* 2016 are presented in Table 2.

The population of jassid in relation to rainfall (r= 0.328**), morning RH (r= 0.338*) and evaporation (r= 0.365**) were positively significant and maximum temperature (r= -0.338**) negatively significant during *Kharif* 2015.

While, during *Kharif* 2016 population of jassid correlated positively significant with maximum temperature (r= 0.469*) and evaporation (r= 0.408*).

The present findings are more or less similar with the findings of Patel (1992) and Mohapatra (2008), who also reported a positive significant correlation of maximum temperature with the density count of the jassids. Also, Purohit *et al.* (2006) observed showed positive correlation of all abiotic factors with jassid population. Whereas, Dhawan *et al.* (2009) reported positive correlation of jassids with the maximum, minimum and mean temperature and negatively correlated with the morning RH, evening RH and mean RH. Gosalwad *et al.* (2009) reported significant negative correlation of jassid population with relative humidity. Kalkal *et al.* (2009) reported that temperature and mean RH showed a positive correlation with leafhopper. Shitole and Patel (2009) observed that jassid population exhibited significant positive correlation with average temperature, relative humidity (maximum, minimum and average), rainfall, rainy days and wind velocity. Shivanna *et al.* (2011) reported that the maximum temperature correlated significantly and positively with leaf hopper population. The rainfall correlated negatively whereas minimum temperature and relative humidity showed non-significant effect. Shera *et al*. (2013) observed the population of the jassid significant positive correlation with minimum temperature, mean temperature, evening relative humidity and rainfall. The multiple regression analysis revealed that all the weather parameter collectively accounted for variability in the (*A.biguttula)* population with R^2 values ranging from 0.67-0.80 during different years confirming the results obtained during present investigations.

The population of thrips in relation to rainfall (r= 0.337**) were positively significant during *Kharif* 2015. While, during *Kharif* 2016 population of thrips was positively significant maximum temperature (r= 0.326**).

The above findings are parallel with those of earlier research workers like Al-Faisal and Kadari (1986) who reported that temperature above 35^{o}C and high RH helps in rapid multiplication of the thrips on cotton young plants.Thrips incidence had significantly positive correlation with maximum temperature and morning relative humidity (Patel, 1992 and Kudale, 2000) and negatively significant with evening relative humidity and rainfall (Bhede, 2003). Prasad *et al.* (2008) reported that the total influence of all the weather parameters was low and non-significant on thrips population. Desai *et al.* (2009) reported that thrip population showed positive and significant correlation with maximum temperature minimum temperature, relative humidity. Shitole and Patel (2009) found the significant positive correlation with average temperature, relative humidity (maximum, minimum and average), rainfall, rainy days and wind velocity with cotton thrips. The references are more or less justifying the results of present investigation indicating the positive correlation of thrips with maximum temperature.

The data regarding the correlation between whitefly population with weather parameters in transgenic cotton showed that minimum temperature (r= -0.631*), morning RH (r= -0. 405*), evening RH (r= -0. 530*) were negatively significant during *Kharif* 2015. While, during *Kharif* 2016 minimum temperature (r= -0.617*), morning RH (r= -0. 625*), evening RH (r= -0. 716*) and evaporation (r = -0.448*). Were negatively significant.

The above findings are in confirmation with those of Gupta *et al.* (1997) reported that a significant negative linear relation exists between the whitefly population and the minimum temperature and evening relative humidity. Prasad *et al.* (2008) reported that both maximum and minimum temperature and rainfall were found to exert significant negative influence on whiteflies population. Desai *et al.* (2009) observed negative and significant correlation of whitefly with evening and average relative humidity while positive and significant correlation with maximum temperature, irrespective of *Bt* and non-*Bt* hybrid.

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Table 1- Seasonal activity of major sucking pest complex in transgenic cotton

MW	Duration	No. of sucking pests/ three leaves							
		Aphids		Jassids		Thrips		Whiteflies	
		2015	2016	2015	2016	2015	2016	2015	2016
25	18-24 June	0.0	-	0.0	-	0.0	-	0.0	-
26	25-01 July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	02-08 July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	09-15 July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	16-22 July	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	23-29 July	3.2	0.0	0.75	0.0	1.8	0.0	1.75	0.0
31	30-05 Aug	6.8	2.3	4.2	2.6	6.2	2.4	2.25	3.6
32	06-12 Aug	7.4	5.4	6.4	6.4	6.8	5.4	3.2	2.1
33	13-19 Aug	8.2	1.9	12.2	12.8	7.2	6.6	4.2	1.6
34	20-26 Aug	15.6	9.8	32.12	26.6	16.4	16.4	3.5	2.4
35	27-02 Sept	13.8	4.5	24.4	11.6	15.6	12.4	3.7	2.8
36	03-09 Sept	8.2	10.6	20.6	7.8	22.6	5.8	4.8	1.1

37	10-16 Sept	7.9	1.4	14.2	1.2	10.4	7.2	3.6	0.9
38	17-23 Sept	8.8	2.8	13.2	3.2	34.6	7.9	4.8	0.6
39	24-30 Sept	22.14	3.2	12.4	4.2	41.2	8.4	7.6	0.4
40	01-07 Oct.	36.4	9.2	9.8	9.2	23.8	18.8	8.9	1.2
41	08-14 Oct.	12.8	18.6	9.2	14.8	13.2	37.2	13.8	10.6
42	15-21 Oct.	16.4	28.4	6.2	8.9	12.8	19.2	21.6	12.2
43	22-28 Oct.	8.5	16.8	10.6	10.2	8.2	17.4	15.4	18.5
44	29-04 Nov.	9.2	14.8	8.2	8.2	6.4	7.8	9.4	16.2
45	05-11 Nov.	8.4	12.2	6.8	5.2	7.8	8.6	8.2	14.4
46	12-18 Nov.	3.2	4.2	5.2	2.1	3.4	9.2	9.8	12.5
47	19-25 Nov.	2.9	10.2	4.6	1.8	3.2	7.8	13.0	9.7
48	26-02 Dec.	3.4	9.8	2.2	1.6	2.2	5.4	7.1	5.7
49	03-09 Dec.	2.8	5.8	1.8	0.2	1.8	1.2	4.2	2.4
50	10-16 Dec.	0.0	3.2	0.00	0	0.0	1	0.0	1.2

Table 2. Correlation between weather parameters and sucking pests in transgenic cotton

Pests	Year	Correlation coefficient (r)					
		Rainfall	Max. temp	Min. temp	Mor. RH	Eve. RH	EVP
Aphids	2015	-0.068	-0.018	-0.099	-0.074	0.023	0.314
	2016	0.458*	0.412*	-0.411*	-0.477*	-0.585*	0.561*
Jassids	2015	0.328**	-0.338**	0.085	0.338**	0.296	0.365**
	2016	-0.200	0.469*	0.143	0.053	-0.085	0.408*
Thrips	2015	0.337**	-0.195	0.007	0.110	0.230	0.152
	2016	-0.065	0.326**	-0.027	0.000	-0.174	0.259
Whitefly	2015	-0.268	0.177	-0.631*	-0.405*	-0.530*	0.246
	2016	-0.505*	0.286	-0.617*	-0.625*	-0.716*	0.448*

*Significant at 5 % level **Significant at 1 % level

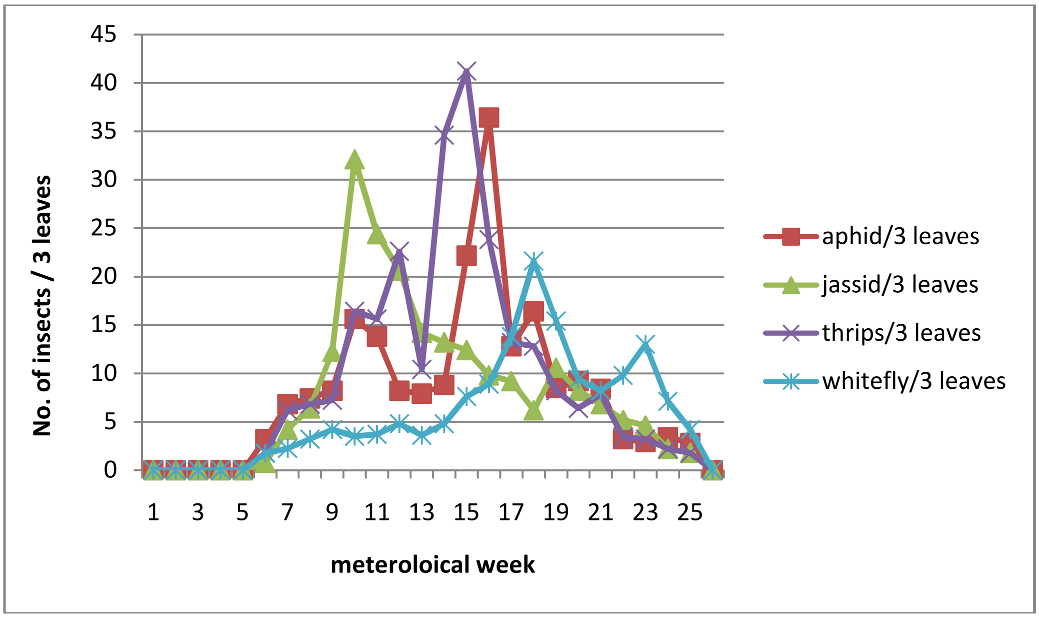

Fig. 1- Seasonal activity of sucking pests in 2015

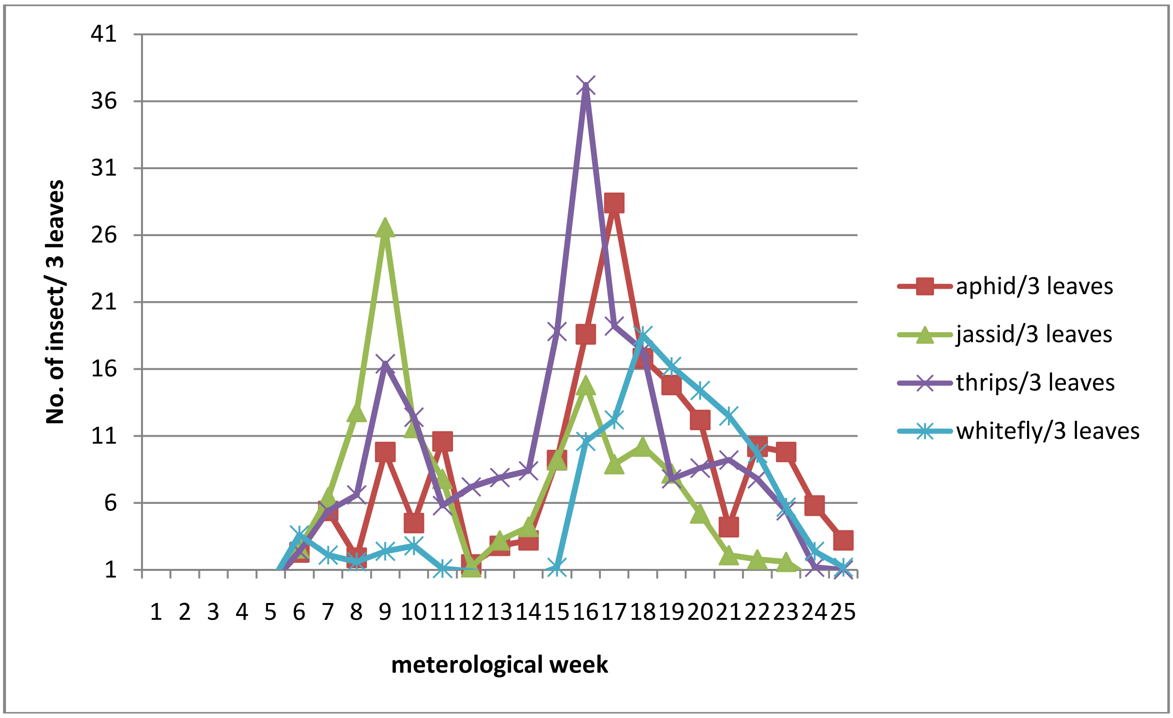

Fig. 2 - Seasonal activity of sucking pests in 2016

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