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Seasonal Incidence of Mealybug, *Maconellicoccus hirsutus* (Green) on Grape

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A B S T R A C T

A field experiment to study the seasonal incidence of mealybug on grapevine was conducted at Grape Research Station, Rajendranagar, Hyderabad from July, 2014 to March, 2015. Studies on seasonal incidence of mealybug of grapevine in relation to abiotic factors were carried out during 2014-15 (July to March). The incidence of mealybug on grapevine started increasing from the first standard week of January 2015 and continued to increase thereafter till the end of the season up to harvesting of bunches. Higher incidence of mealybug colonies coincided with the fruiting stage and mealybugs were observed on the bark also. Correlation studies of mealybug population with weather parameters indicated that weather had a substantial influence on its incidence. Among the various weather parameters, morning relative humidity (r = -0.6500***) and evening relative humidity (r = -0.5429***) had maximum impact (significant and negative, $p < 0.001$) on mealybug incidence. Maximum temperature (r = +0.4074*) and sunshine hours (r = +0.3445*) had significant ($p < 0.05$) positive influence on the pest. The other factors did not influence pest incidence significantly. This explains the higher incidence levels in summer months when relative humidity is very low, maximum temperature and sunshine hours are higher. However mealybug incidence correlated negatively and non-significantly with minimum temperature (r = -0.0485), rainfall(r = -0.1130) and wind speed(r = -0.2256).

Introduction

Grape (*Vitis vinifera*) is grown under a variety of soil and climatic conditions in three distinct agro-climatic zones, namely, sub-tropical, hot tropical and mild tropical climatic regions in India. Grapes are a non-climacteric type of fruit, which can be eaten raw or they can be used for making wine, jam, juice, jelly, grape seed extract, raisins, vinegar and grape seed oil. Insect pests are the important production constraints in grape cultivation apart from diseases. In grape, 94 insect pests have been reported by Tandon and Verghese (1994). Among them, thrips, mites and mealybugs are important sucking pests causing serious damage to the vineyards. Mani *et al* (2008) reported that among the mealybug species infesting grapes in India, the pink mealybug *Maconellicoccus hirsutus*, citrus mealybug *Planococcus citri*, spherical mealybug *Nipaecoccus viridis* and striped mealybug *Ferrisia virigata* cause severe losses in many grape growing areas of Maharashtra,

Karnataka, Andhra Pradesh and Tamil Nadu. First occurrence of *M. hirsutus* on grapevine has been reported by Fletcher (1919). Severe outbreak of mealybugs was reported during 1974 in Andhra Pradesh by Tejkumar *et al* (1977) and subsequently in several other places. Mani (1989) also reported that the population of the mealybug was found to be high from January to May and low from June to December in vineyards of South India. Babu and Azam (1989) reported that the grapevine mealybug, *M. hirsutus* is a serious vineyard pest in India. The infestation is becoming more severe every year. Heavily infested clusters shrivel and drop or become sticky and unfit for consumption. In case of severe attack in the main field upto 90 per cent clusters are damaged. After pruning the mealybug attacks tender developing sprouts causing stunted growth. Malformation of growing shoots and leaves occurs due to its feeding and sticky honeydew excreted by mealybug predisposes mould growth (*Capnodium sp*.). According to Murthy and Babu (1996), highest population was found on grapes during the first half of July (vegetative phase) and during the second half of March (reproductive phase) in Andhra Pradesh. Although occurrence of grape mealybug has been reported from Andhra Pradesh, comprehensive information regarding seasonal incidence of grape mealy bug and its interaction with weather parameters will help to adopt control measures in time and suppress before it cause economic damage. Hence, a study was conducted to know the seasonal incidence of grape mealy bug and influence of weather parameters on the incidence of mealy bugs.

Materials and Methods

Studies on seasonal incidence and management of grapevine mealybug *Maconellicoccus hirsutus* (Green) were carried out in the experimental plot at Grape Research Station, Rajendranagar, Hyderabad, Telangana during 2014-15. Ten year old grape vineyard (Variety: Thompson seedless) was selected for studying the seasonal incidence and population dynamics of *M. hirsutus*. The crop was pruned in April (forward pruning) and October (backward pruning) and all other recommended package of practices was followed. The crop was kept free from insecticidal applications during the period of study. Fifteen vines were selected randomly and tagged. Observations on numbers of colonies were taken on various parts like stems, barks, leaves and fruits in each vine were counted and the average was worked out at weekly intervals. Seasonal incidence and peak periods of infestation were documented by collecting the absolute counts of the mealybug colonies at weekly intervals from July to March. Mealybug populations were correlated with weather parameters *viz*., maximum temperature, minimum temperature, morning and evening relative humidity, rainfall, sunshine and wind velocity to quantify the impact of abiotic factors on their incidence levels.

Results and Discussion

The data of the pest incidence and weekly averages of meteorological parameters are presented in table 1. Mealybug colonies were recorded at weekly intervals commencing from July, 2014 to March, 2015. Results pertaining to the studies on the seasonal incidence of grape mealybug observed during different standard weeks (Table 1 and Figure 1) indicated that the population of mealybug on grapevine started increasing from the first standard week (January 2015) and a continuous increasing trend was observed till the thirteenth standard week (March 2015) with a population of 48.33 colonies per vine. Thereafter, the population increased till the harvest of berries. Lowest population was recorded during the twenty ninth standard

weeks (July 2014) with about 0.8 colonies per vine. Results of the present investigation indicated that the population of mealybug, *M. hirsutus* on grapevine was less from July to January second week. These findings are in accordance with those of Mani and Thontadarya (1987) who reported that the population of the mealybug, *M. hirsutus* was found to be high from January to May and low from June to December in vineyards in South India. In the present study rainfall was found to have a negative impact on the pest which was in partial agreement with Garcia-Álvarez *et al.,* (2014) who recorded that populations of pink hibiscus mealybug, *M. hirsutus* (Green) were lower during the rainfall months from August to October and population was moderate during periods of low temperatures from November to February.

The population of mealybug on grapevine started increasing from third standard week of January 2015 and peak incidence was recorded from ninth standard week of February 2015 to thirteenth standard week of March 2015. This outcome is in close agreement with the findings of Balikai (1999) who recorded that mealybug population started to increase from January and peak infestation was observed during February-March before harvesting. After harvest, the population remained low from May to December which was in conformity with Manjunath (1985) who reported that peak infestation was observed during February-March and to a lesser extent during October-November.

Higher incidence of mealybug was recorded from ninth standard week of February 2015 (31.8 colonies per vine) to thirteenth standard week of March 2015 (48.33 colonies per vine). The findings are in close agreement with Maheshkumar *et al.,* (2009) who reported that peak populations of 32.4 colonies per vine were observed during 10th standard week in the fruiting season respectively. Similar results were also found by Kulkarni *et al.,* (2008) who reported that mealybug population was distributed sporadically and the highest population during the last week of February to the last week of March coincided with the fruiting and harvesting season correlation co-efficient of maximum and minimum temperature, morning and evening relative humidity, sunshine hour, evaporation and rainfall against mean population of mealy bug were worked out and presented in table 2. The correlation between mealybug colonies and different weather parameters is given in the figure 2.

Results revealed that mealybugs were profoundly affected by weather factors. It was found that out of all weather factors, relative humidity (morning and evening) had substantial negative effect on its incidence (morning relative humidity r = -0.6500*** and evening relative humidity r = -0.5429***) ($p<0.001$). Mealybug incidence had a significant and positive correlation with maximum temperature (r = 0.4074*) and sunshine (r = 0.3445*) ($p<0.05$). It had nonsignificant negative correlation with minimum temperature (r = -0.0485), rainfall (r = -0.1130) and wind speed (r = -0.2256).

Correlation studies for relative humidity indicated that the evening and morning relative humidity showed significant negative correlation with population of mealybug. Similar findings were also registered by Koli (2003) who reported that mealybugs on grapes showed highly significant negative correlation with morning and evening relative humidity. The findings are also in agreement with Mani and Thontadarya (1987) who reported that relative humidity showed a significant negative correlation with mealybug population.

Table.1 Seasonal incidence of grapevine mealybug, *Maconellicoccus hirsutus* with weather parameters (2014 - 2015)

Standard week	Month and Date	Average no. of mealybug colonies per vine	Maximum Temperature (°C)	Minimum Temperature (°C)	Relative humidity I (%)	Relative Humidity II (%)	Rainfall (mm)	Sunshine (hrs)	Wind speed (Kmph)
29	Jul 16-22	0.80	29.70	23.70	68.70	68.70	11.30	1.0	14.4
30	Jul 23-29	5.74	30.70	23.20	65.60	64.90	17.10	3.8	12.5
31	Aug 30-05	6.50	30.40	22.20	84.90	63.70	3.00	2.7	12.5
32	Aug 06-12	6.73	32.00	22.70	83.10	61.00	8.60	7.0	11.6
33	Aug 13-19	5.40	33.30	24.50	81.40	53.00	25.50	6.4	6.6
34	Aug 20-26	7.26	34.00	24.00	88.60	58.60	12.20	6.8	1.9
35	Sep 27-02	3.93	28.10	22.10	92.60	80.70	160.60	1.5	6.0
36	Sep 03-09	2.26	27.50	22.60	86.00	66.40	12.20	5.1	8.2
37	Sep 10-16	4.20	31.00	22.80	87.00	62.00	12.60	5.8	5.4
38	Sep 17-23	2.80	31.10	22.20	90.00	63.00	9.40	4.2	3.8
39	Sep 24-30	2.13	32.30	22.10	86.00	51.00	15.00	6.4	2.0
40	Oct 01-07	1.60	34.10	21.90	80.00	45.00	40.20	7.6	1.3
41	Oct 08-14	2.52	32.40	20.30	78.00	49.00	0.80	4.3	3.9
42	Oct 15-21	3.00	32.80	19.20	85.00	47.00	6.20	8.2	2.5
43	Oct 22-28	2.20	28.30	19.00	89.00	68.00	22.00	4.0	2.0
44	Nov 29-04	2.60	30.40	18.40	80.00	24.00	0.00	8.3	2.3
45	Nov 05-11	2.80	30.90	16.40	76.00	42.00	0.00	6.8	2.3
46	Nov 12-18	2.67	30.00	19.70	81.00	61.00	10.60	5.5	1.8
47	Nov 19-25	1.86	30.60	16.40	87.00	42.00	0.00	7.6	1.2
48	Dec 26-02	2.40	30.60	12.10	73.00	3000	0.00	8.5	1.7
49	Dec 03-09	1.53	30.50	12.00	81.00	42.00	0.00	8.8	1.6
50	Dec 10-16	2.46	28.20	15.90	89.00	68.00	0.00	3.4	1.5
51	Dec 17-23	3.06	27.10	9.30	71.00	41.00	0.00	7.7	1.8
52	Dec 24-31	4.46	27.1	11.40	69.00	47.00	0.00	8.1	1.5
1	Jan 01-06	3.26	29.20	17.90	78.50	48.80	0.00	5.7	1.6
2	Jan 07-14	4.86	27.10	5.40	66.00	23.00	0.00	9.8	1.3
3	Jan 15-21	12.66	28.20	9.10	75.00	32.00	0.00	9.2	1.6
4	Jan 22-28	16.40	29.40	10.60	79.00	30.00	0.00	9.1	2.5
5	Jan 29-04 Feb	17.20	28.80	13.30	86.00	36.00	0.00	9.3	2.3
6	Feb 05-11	17.93	30.70	13.40	74.00	26.00	0.00	9.9	3.2
7	Feb 12-18	20.20	33.10	15.00	66.000	18.00	0.00	10.2	1.2
8	Feb 19-25	26.60	33.30	16.90	63.00	21.00	0.00	9.8	2.0
9	Feb 26-04 Mar	31.80	32.70	17.70	73.00	32.00	8.00	7.8	2.4
10	Mar 05-11	37.73	31.10	19.20	73.00	48.00	21.60	5.5	1.7
11	Mar 12-18	43.80	34.00	18.60	64.00	22.00	0.00	9.5	2.7
12	Mar 19-25	45.46	36.60	20.20	55.00	26.00	0.00	8.3	1.8
13	Mar 26-01 Apr	48.33	30.00	18.70	57.00	29.00	12.00	6.6	1.3

Table.2 Correlation between incidence of grapevine mealybug, Maconellicoccu hirsutus and weather parameters

Weather parameters	Correlation coefficient (r)
Maximum temperature (T max)	+0.4074*****
Minimum temperature (T min)	-0.0485 NS
Relative humidity morning (RH I)	-0.6500***
Relative humidity evening (RH II)	-0.5429***
Rainfall	-0.1130 NS
Sunshine	+0.3445*
Wind speed	-0.2256 NS

*** = Significant at 0.1 %; * = Significant at 5 %; NS = Non significant

Fig.1 Seasonal incidence of mealybug, *Maconellicoccus hirsutus* on grapevine (July 2014 to March 2015)

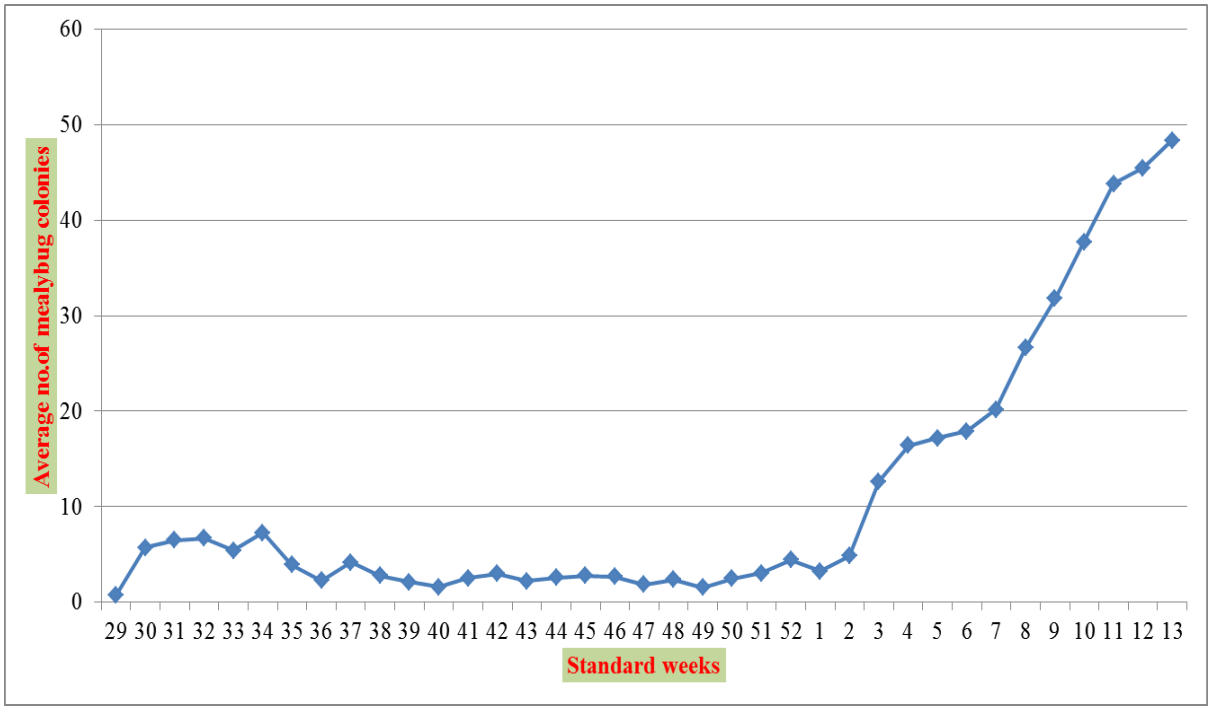
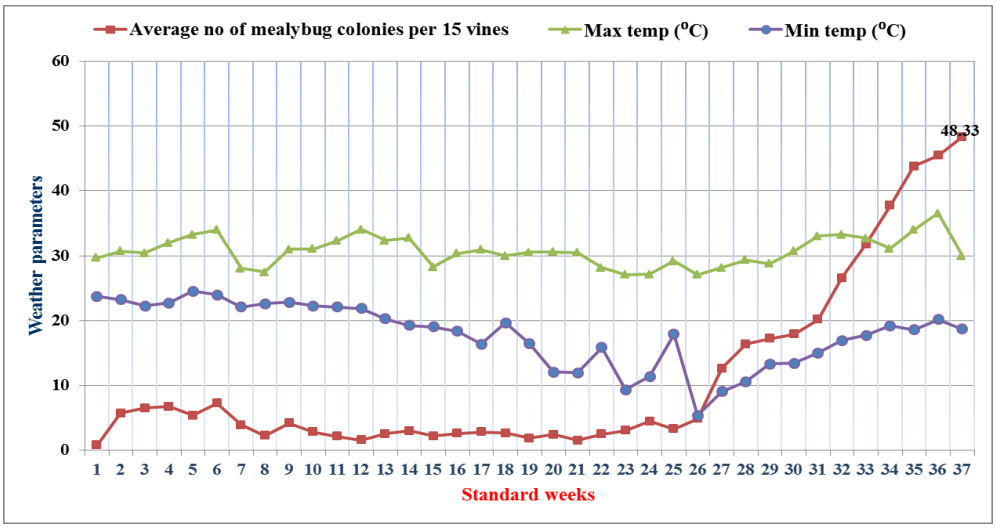
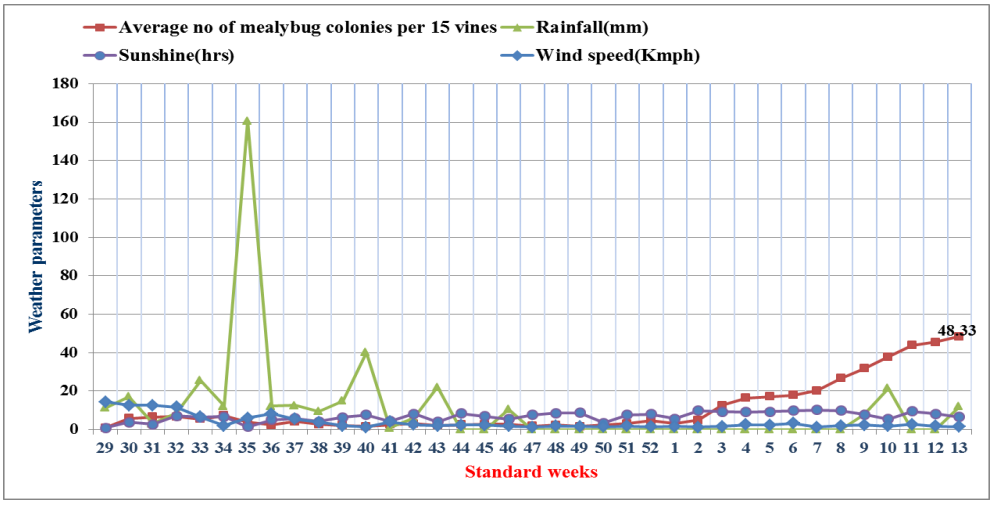
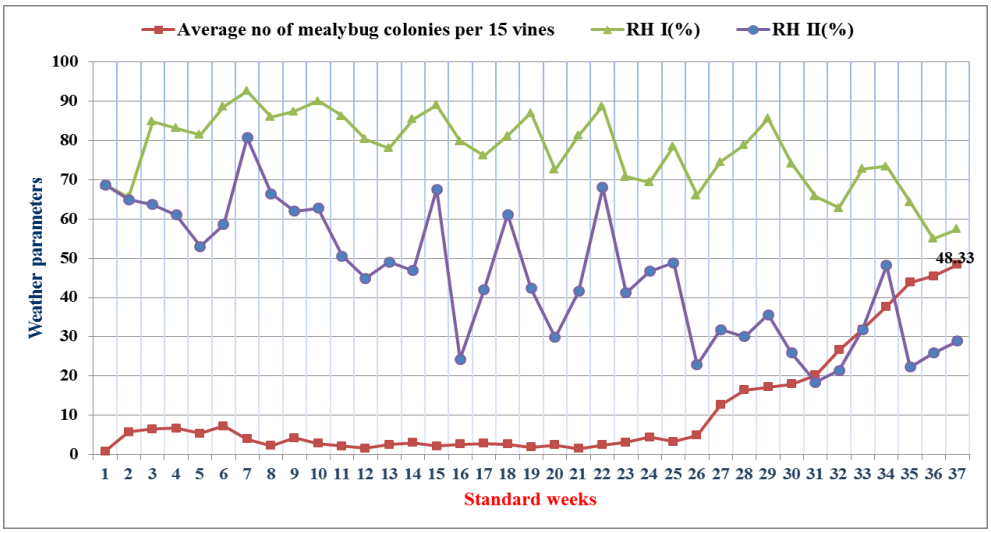


Fig.2 Correlation of incidence of grapevine mealybug, *Maconellicoccus hirsutus* with different weather parameters







Significant positive correlation was observed between population of mealybug and maximum temperature and sunshine hours in the present study. These findings are in conformity with those of Mani and Thontadarya (1987) who reported that maximum temperature showed a positive and significant correlation with the mealybug population. Further, the findings are also in partial agreement with Koli (2003) who opined that mealybugs on grapes showed highly significant and positive correlation with maximum and minimum temperature. Mealybug population had nonsignificant negative correlation with rainfall. This was well demonstrated by Koli (2003) who reported that mealybugs on grapes showed non significant negative correlation with rainfall.

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