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Seasonal incidence of sucking pest complex of guava CV. Taiwan white in Andhra Pradesh

Giddi Thirumala Devi, Dr. N Emmanuel and Dr. V Sekhar

Abstract
The present investigation was done on seasonal incidence of sucking pests of guava cv. Taiwan white during 2019 – 2020 in Dr. Y.S.R. Horticultural University of Andhra Pradesh which recorded the peak population of *Ferisia virgata*, *Aleurodicus rugioperculatus* during 9th standard meteorological week (25.5 adults/branch and 27.38 adults/branch) in first season and 35th (16.80 per cent) and 39th week (26.48 per cent) in second season. The peak bud infestation (37.57 per cent) and fruit infestation (39.99 per cent) by *Helopeltis antonii* was observed during 9th standard meteorological week first season and bud infestation was high during 38th week (25.38 per cent) and fruit infestation was reaching peak at 39th week (24.90 per cent). The correlation studies revealed that the maximum, minimum temperature and rainfall was negatively correlated with the infestation of all the sucking pests whereas, in the second season there is significant positive correlation with rainfall and highly significant positive correlation with maximum and minimum relative humidity with infestation of sucking pests.

Keywords: Taiwan guava, seasonal incidence, mealy bug, whitefly, tea mosquito bug

1. Introduction
Guava fruit is a rich source of vitamin-C, pectin, dietary fiber, iron, manganese, calcium, folic acid, potassium and phosphorus with high antioxidant properties, nutritive and medicinal values. The fruit is used for the preparation of processed products like jams, jellies, juice, cakes, puddings, sauces, ice-cream, wine and nectar. Taiwan guava is fetching popular every year amongst the guava growers for its consistent fruiting size and sweetness with two harvest seasons every year one from March to April and another from July to August. The major sucking pest complex of guava *viz.,* mealy bug. *Ferisia virgata* (Cockerell), rugose spiralling whitefly, *Aleurodicus rugioperculatus* (Martin) and tea mosquito bug, *Helopeltis antonii* (Signoret) are also the primary reason for the hindrance of guava cultivation which suck sap from twigs, leaves and flowers and the infested fruits will turn into uneven shapes with poor yield and quality (Amin *et al.* 2019) [2]. Weather parameters play a major role in multiplication, growth, development and distribution of insects and influence on their seasonal abundance. The incidence of tea mosquito bug, *H. antonii* in guava on young leaves was maximum (18.47 per cent) during first fortnight of October (Kumar, 2000) [3]. Keeping this in view, the present investigation was carried out to study the seasonal incidence of sucking pests of guava cv. Taiwan white.

2. Materials and Methods
Experiment was carried out during November of 2019 to September of 2020 in existing guava orchards at College of Horticulture and Farmer's orchard in Venkataramannagudem, West Godavari District of Andhra Pradesh with cultivar of Taiwan white. The observations on incidence of the sucking pests was studied during two seasons (November to February and June to September) on five guava trees of the same age and size were randomly selected in each garden which do not receive insecticidal spray throughout the experimental period.

2.1 Guava mealy bug, *Ferrisia virgata*
From each tree of all five tress, four fruit bearing branches of 30 cm in length was selected and tagged in all four directions. Average count of mealy bugs on five trees was calculated on leaves of branches with respect to their direction. The data of mean number of mealy bugs from the two gardens was calculated at weekly intervals. Correlation with weather parameters was worked out to know the relationship of the mealy bug with weather parameters.

2.2 Rugose spiralling whitefly, *Aleurodicus rugioperculatus*

The observations were taken on number of *A. rugioperculatus* adult population on four branches of five randomly selected plants. The data of mean number of rugose spiraling whitefly from the two gardens was calculated at weekly intervals. Correlation with weather parameters was done to know the relationship of the rugose spiralling whitefly with weather parameters.

2.3 Tea mosquito bug, *Helopeltis antonii*

The observations on tea mosquito bug, *H. antonii* was recorded from five guava trees which were randomly selected of four fruit bearing branches. The data was taken on total number of healthy and infested parts *viz*., flower buds and fruits of the five trees under observations in each garden at weekly intervals. Correlation with weather parameters was conducted to know the relationship of the tea mosquito bug with weather parameters.

2.3.1 Bud infestation (%)

Data on total number of buds and infested buds were recorded from five guava trees in two gardens at weekly intervals. The per cent infestation of bud was calculated by using the formula:

$$\% \text{ infestation of bud/plant} = \frac{\text{Number of infested buds/plant}}{\text{Total number of buds/plant}} \times 100$$

2.3.2 Fruit infestation (%)

Data on the number of healthy and infested fruits were recorded from five guava trees in each garden at weekly intervals. The per cent infestation of fruit was calculated by using the formula given by Abott (1925)

$$\% \text{ infestation of fruit/plant} = \frac{\text{Number of infested fruits/plant}}{\text{Total number of fruits/plant}} \times 100$$

3. Results and Discussions

3.1 Incidence of guava mealy bug, *Ferrisia virgata* in guava cv. Taiwan white and their correlation with weather parameters

It is apparent from the Table 1 and Fig. 1 that the incidence of *F. virgata* on guava cv. Taiwan white during first season was least (8.78 mealy bugs/branch) during 44th SMW of 2019 and the highest infestation (25.35 mealy bugs/branch) were recorded during 9th SMW of 2020. The data in table 2 noticed the peak incidence of mealy bug during 35th SMW (16.80 per cent) which is more than the first season incidence. The results of correlation in table 3 revealed that maximum and minimum temperature (-0.314 and -0.379) showed negative correlation in first season and significant negative correlation in second season with adult population of *F. virgata*, while maximum and minimum relative humidity (0.665** and 0.622**) showed positive and highly significant correlation in both the seasons and rainfall recorded negative (-0.118) correlation in first season and highly significant positive relation with *F. virgata*. These findings are supported by Khan (2018) who reported that the population of mealybug was also positively correlated with average relative humidity (r = 0.613) and negative correlation (r = -0.767) between population of guava mealy bug and average rainfall in guava. Amin *et al.* (2019) [2] stated that the daily mean relative humidity had significant positive correlation with mealy bug, *F. virgata*.

3.2 Incidence of rugose spiralling whitefly, *Aleurodicus rugioperculatus* in guava cv. Taiwan white and their correlation with weather parameters

The data presented in Table 1 and Fig. 1 specifies the incidence of rugose spiralling whitefly, *A. rugioperculatus* in guava cv. Taiwan white was observed from first week of November 2019 to last week of September 2020. The peak white fly adult population during first season was observed during 9th SMW of 2020 (27.38 adults per branch) whereas the lowest (2.93 adults per branch) was found during 44th SMW of 2019. During second season, the high activity was observed during 39th SMW (26.48 per cent) of 2020. The correlation data in Table 3 revealed that maximum and minimum temperature (-0.310 and -0.379) showed negative correlation during first season and significant negative correlation during further season with *Aleurodicus rugioperculatus*, while maximum and minimum relative humidity (0.622** and 0.678**) showed positive and highly significant correlation and rainfall recorded negative (-0.135) correlation during first season and highly significant positive correlation with *A. rugioperculatus*. The findings are in agreement with a statement of Wen *et al*. (1994) [8], who reported that the incidence of *A. disperses* found throughout the year and the peak activity was noticed during February to May and there existed a non-significant negative correlation of whitefly population with rainfall. Morde *et al.* (2017) [5] reported that outbreak of spiralling whitefly was noticed peak density from 9th SMW coinciding with first week of March and the correlation studies of spiralling whitefly with weather parameters show negative correlation with rainfall.

Table 1: Incidence of *Ferrisia virgata* and *Aleurodicus rugioperculatus* in guava cv. Taiwan white from November, 2019 to February, 2020 (winter season)

SMW	*F. virgata*			*A. rugioperculatus*			Weather parameters				
	No. of adults per branch		Mean	No. of adults per branch		Mean	Temperature (º C)		Relative humidity (%)		Rainfall (mm)
	G1	G2		G1	G2		Max.	Min.	Max.	Min.	
44	8.35	9.20	8.78	2.05	3.80	2.93	33.16	25.55	89.43	60.57	3.10
45	8.85	9.70	9.28	3.05	3.95	3.50	33.30	23.74	86.00	49.57	0.00
46	9.05	9.95	9.50	3.60	5.00	4.30	33.62	24.52	87.00	51.86	0.00
47	9.45	10.10	9.78	4.55	5.45	5.00	32.40	22.96	88.57	52.86	0.00
48	10.05	10.65	10.35	5.30	6.60	5.95	32.04	23.87	87.43	55.57	0.00
49	10.50	11.25	10.88	6.55	7.35	6.95	31.18	22.03	85.29	51.29	0.00
50	10.95	11.55	11.25	7.95	8.40	8.18	31.18	22.03	85.29	51.29	0.00
51	12.35	12.05	12.20	9.25	8.80	9.03	30.94	22.48	88.86	54.14	0.00
52	14.20	12.75	13.48	10.60	9.00	9.80	29.61	21.29	86.38	58.88	0.00
1	15.25	13.45	14.35	11.70	10.20	10.95	29.45	23.40	85.86	67.43	8.13
2	17.25	14.85	16.05	13.30	11.10	12.20	30.17	21.40	90.14	58.00	0.50

3	18.80	16.05	17.43	14.65	12.00	13.33	31.12	22.22	89.29	55.14	0.75
4	19.95	18.00	18.98	17.65	13.30	15.48	31.37	22.63	90.14	61.00	0.50
5	21.30	17.80	19.55	20.10	16.80	18.45	31.54	22.73	89.71	61.57	0.04
6	22.10	20.90	21.50	22.15	19.85	21.00	31.40	22.41	90.14	62.00	0.13
7	23.55	22.75	23.15	22.95	22.60	22.78	31.59	22.80	90.00	63.14	0.00
8	24.55	23.70	24.13	24.65	26.85	25.75	31.60	22.63	89.86	62.43	0.04
9	25.60	25.10	25.35	24.85	29.90	27.37	31.40	22.71	89.86	63.00	0.09

SMW: Standard meteorological week, G1: Garden 1 - COH, Venkataramannagudem and G2: Garden 2 - Venkataramannagudem village

Table 2: Incidence of *Ferrisia virgata* and *Aleurodicus rugioperculatus* in guava cv. Taiwan white from June, 2020 to September, 2020 (rainy season)

SMW	*F. virgata*			*A. rugioperculatus*			Weather parameters				
	No. of adults per branch		Mean	No. of adults per branch		Mean	Temperature (°C)		Relative humidity (%)		Rainfall (mm)
	G1	G2		G1	G2		Max.	Min.	Max.	Min.	
23	10.01	9.09	9.55	7.98	6.56	7.27	39.89	26.90	89.09	68.65	0.00
24	10.11	9.10	9.61	8.67	8.97	8.82	39.00	26.78	88.78	69.78	0.00
25	11.12	10.54	10.83	8.00	9.14	8.57	39.08	25.76	87.89	70.89	0.90
26	11.50	13.34	12.42	8.98	10.67	9.83	38.90	25.98	87.54	75.09	1.78
27	10.00	12.11	11.06	8.65	13.98	11.32	38.09	25.09	88.99	78.68	1.96
28	12.80	12.56	12.68	9.36	12.09	10.73	37.98	24.78	89.09	73.98	2.09
29	11.00	11.89	11.45	10.87	11.67	11.27	36.87	24.46	90.78	74.87	2.78
30	13.15	13.56	13.36	10.09	13.09	11.59	36.98	24.79	91.98	73.54	3.78
31	12.56	13.89	13.23	11.67	12.09	11.88	35.09	23.67	92.45	75.76	3.76
32	13.58	14.98	14.28	13.76	14.09	13.93	35.67	24.45	93.76	78.09	3.67
33	15.00	15.10	15.05	14.89	15.69	15.29	35.01	23.98	94.65	79.67	3.01
34	15.89	15.87	15.88	17.89	17.45	17.67	34.09	24.89	95.76	80.45	3.21
35	16.98	16.61	16.80	18.90	19.09	19.00	34.98	24.90	96.63	81.56	3.78
36	16.00	16.12	16.06	19.87	19.76	19.82	33.02	22.73	97.79	82.76	4.07
37	15.90	16.00	15.95	21.95	20.89	21.42	33.67	23.70	96.76	81.89	4.66
38	15.21	15.78	15.50	24.89	23.90	24.40	33.56	23.78	96.89	82.98	3.67
39	15.45	15.12	15.29	25.98	26.98	26.48	32.65	22.90	97.56	82.89	3.76
40	14.98	15.00	14.99	24.78	26.00	25.39	32.00	22.78	97.00	81.67	3.00

Table 3: Correlation coefficients of weather parameters and incidence of guava mealy bug, *Ferresia virgata* and rugose spiralling whitefly, *Aleurodicus rugioperculatus*in guava cv. Taiwan white

Weather parameter		*Winter season*		*Rainy season*	
		F. virgata	*A. rugioperculatus*	*F. virgata*	*A. rugioperculatus*
Temperature (°C)	Max.	-0.314	-0.310	-0.859**	-0.932**
	Min.	-0.379	-0.379	-0.766**	-0.801**
Relative humidity (%)	Max.	0.665**	0.622**	0.860**	0.917**
	Min.	0.694**	0.678**	0.915**	0.897**
Rainfall (mm)		-0.118	-0.135	0.908**	0.692**

SMW: Standard meteorological week, G1: Garden 1 - COH, Venkatramannagudem and G2: Garden 2 - Venkatramannagudem village

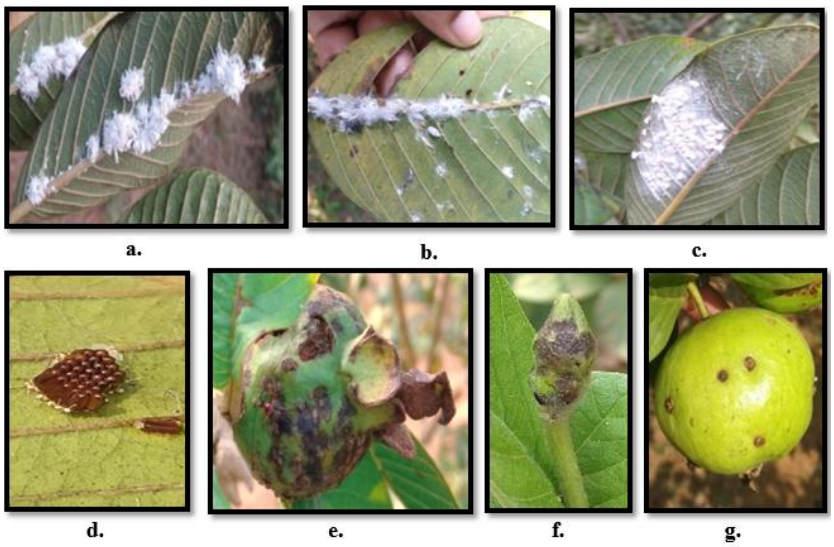

Fig 1: Sucking pest complex in guava cv. Taiwan white, a and b. leaf infested with *F. virgata, c.* Leaf infested with *A. rugioperculatus,* d. Eggs of *H. antonii* on guava leaf, e. *H. antonii* damaging guava fruit, f. Guava flower buds damaged *by H. antonii* ***g.*** Corky scab formation on guava

3.3 Incidence of tea mosquito bug, *Helopeltis antonii* in guava cv. Taiwan white and their correlation with weather parameters: The first season data given in Table 4 and Fig. 1 indicated that no incidence of bud infestation by *H. antonii* was observed on guava cv. Taiwan white till 50th SMW (2nd week of December 2019). However, the bud infestation and fruit infestation by *H. antonii* during first season begun from 51st SMW of 2019 and attained its peak during 9th SMW of February 2020 (37.57 and 39.99 per cent). Data of second season revealed the highest bud infestation during 38th SMW (25.38 per cent) and highest fruit infestation during 39th SMW (24.90 per cent) which is more than the previous season. The data on correlation between bud and fruit infestation in guava cv. Taiwan by *H. antonii* with weather parameters is depicted in Table 6. The data of the first season revealed that the maximum (-0.411 and -0.446), minimum temperature (-0.401 and -0.419) and rainfall (-0.023 and -0.001) was negatively correlated with the infestation of *H. antonii*, whereas in the second season, it is significant negative correlation with temperature and highly significant positive correlation with rainfall. However, maximum and minimum relative humidity shows highly significant positive correlation with infestation of *H. antonii* in the both seasons. The results of tea mosquito bug agree with the findings of Kumar and Naik (2002) [4] who identified the peak activity of *H. antonii* during December second fortnight (17.94%) on buds and during second fortnight of February (21.77%) on fruits and went on declining thereafter in guava. Later, Roy *et al.* (2009) [7] stated that relative humidity had a positive influence on the incidence of *H. theivora* in tea.

Table 4: Bud and fruit infestation (%) by *Helopeltis antonii* in guava cv. Taiwan white during November, 2019 to February, 2020 (winter season)

SMW	*H. antonii*						Weather parameters				
	Bud infestation (%)		Mean	Fruit infestation (%)		Mean	Temperature (º C)		Relative Humidity (%)		Rainfall (mm)
	G1	G2		G1	G2		Max.	Min.	Max.	Min.	
44	0.00	0.00	0.00	0.00	0.00	0.00	33.16	25.55	89.43	60.57	3.10
45	0.00	0.00	0.00	0.00	0.00	0.00	33.30	23.74	86.00	49.57	0.00
46	0.00	0.00	0.00	0.00	0.00	0.00	33.62	24.52	87.00	51.86	0.00
47	0.00	0.00	0.00	0.00	0.00	0.00	32.40	22.96	88.57	52.86	0.00
48	0.00	0.00	0.00	0.00	0.00	0.00	32.04	23.87	87.43	55.57	0.00
49	0.00	0.00	0.00	0.00	0.00	0.00	31.18	22.03	85.29	51.29	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	31.18	22.03	85.29	51.29	0.00
51	10.40	11.67	11.03	19.57	12.50	16.03	30.94	22.48	88.86	54.14	0.00
52	18.87	14.75	16.81	23.64	13.73	18.68	29.61	21.29	86.38	58.88	0.00
1	20.34	15.63	17.98	28.07	15.38	21.73	29.45	23.40	85.86	67.43	8.13
2	22.41	18.18	20.30	32.20	16.67	24.44	30.17	21.40	90.14	58.00	0.50
3	26.23	20.90	23.56	36.84	18.18	27.51	31.12	22.22	89.29	55.14	0.75
4	27.69	23.19	25.44	36.84	21.05	28.95	31.37	22.63	90.14	61.00	0.50
5	31.43	25.71	28.57	40.98	23.73	32.36	31.54	22.73	89.71	61.57	0.04
6	36.36	27.78	32.07	43.33	25.40	34.37	31.40	22.41	90.14	62.00	0.13
7	37.88	29.58	33.73	46.15	27.69	36.92	31.59	22.80	90.00	63.14	0.00
8	39.71	30.56	35.13	46.15	29.69	37.92	31.60	22.63	89.86	62.43	0.04
9	42.25	32.88	37.57	47.17	32.81	39.99	31.40	22.71	89.86	63.00	0.09

Table 5: Bud and fruit infestation (%) by *Helopeltis antonii* in guava cv. Taiwan white during June, 2020 to September, 2020 (rainy season)

SMW	Bud infestation %		Mean	Fruit infestation (%)		Mean	Weather parameters				
							Temperature (ºC)		Relative humidity (%)		Rainfall (mm)
	G1	G2		G1	G2		Max.	Min.	Max.	Min.	
23	0.00	0.00	0.00	0.00	0.00	0.00	39.89	26.90	89.09	68.65	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	39.00	26.78	88.78	69.78	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	39.08	25.76	87.89	70.89	0.90
26	0.00	0.00	0.00	0.00	0.00	0.00	38.90	25.98	87.54	75.09	1.78
27	0.00	0.00	0.00	0.00	0.00	0.00	38.09	25.09	88.99	78.68	1.96
28	0.00	3.89	3.89	0.00	6.23	6.23	37.98	24.78	89.09	73.98	2.09
29	6.09	7.65	6.87	4.00	7.98	5.99	36.87	24.46	90.78	74.87	2.78
30	10.98	11.09	11.04	7.34	9.56	8.45	36.98	24.79	91.98	73.54	3.78
31	13.00	12.76	12.88	9.12	11.45	10.29	35.09	23.67	92.45	75.76	3.76
32	14.56	14.65	14.61	12.78	13.76	13.27	35.67	24.45	93.76	78.09	3.67
33	15.87	16.70	16.29	14.86	14.89	14.88	35.01	23.98	94.65	79.67	3.01
34	17.90	17.56	17.73	15.90	16.67	16.29	34.09	24.89	95.76	80.45	3.21
35	20.67	19.54	20.11	17.38	18.60	17.99	34.98	24.90	96.63	81.56	3.78
36	23.00	20.90	21.95	19.67	20.43	20.05	33.02	22.73	97.79	82.76	4.07
37	25.76	24.76	25.26	21.59	23.87	22.73	33.67	23.70	96.76	81.89	4.66
38	24.89	25.87	25.38	23.40	24.90	24.15	33.56	23.78	96.89	82.98	3.67
39	24.00	24.90	24.45	24.80	25.00	24.90	32.65	22.90	97.56	82.89	3.76
40	23.45	22.30	22.88	23.10	24.30	23.70	32.00	22.78	97.00	81.67	3.00

Table 6: Correlation coefficients between weather parameters and incidence of *Helopeltis antonii* in guava cv. Taiwan white

Weather parameters		*Winter season*		*Rainy season*	
		Bud infestation (%)	**Fruit infestation (%)**	**Bud infestation (%)**	**Fruit infestation (%)**
Temperature (ºC)	Max.	-0.411	-0.446	-0.962**	-0.966**
	Min.	-0.401	-0.419	-0.829**	-0.840**
Relative humidity (%)	Max.	0.683**	0.687**	0.983**	0.974**
	Min.	0.757**	0.755**	0.874**	0.880**
Rainfall (mm)		-0.023	-0.001	0.843**	0.803**

SMW: Standard meteorological week, G1: Garden 1 - COH, Venkatramannagudem and G2: Garden 2 - Venkatramannagudem village

4. Conclusion

Based on the results obtained from this study, we can conclude that the lowest number of mealy bug and rugose spiralling whitefly was observed during November to February and the more population was recorded during second season during June to September, 2020. Bud infestation and fruit infestation of guava tea mosquito bug, *Helopeltis antonii* was observed peak during June to September while it was recorded lowest during first season (November to February). Correlation studies showed negative significant correlation with temperature and negative with rainfall in first season but highly significant positive correlation during second season, highly significant and positive correlation with relative humidity with the incidence of *Ferrisia virgata*, *Aleurodicus rugioperculatus* and *Helopeltis antonii* in guava during both the seasons. The incidence of all the sucking pests was recorded high during second season (rainy season). The present research will help to fore-warn the farmers about the occurrence of sucking pests during different seasons and will be helpful for pre-planned management strategies against these pests.

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