



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(6): 726-730

© 2020 JEZS

Received: 14-09-2020

Accepted: 19-10-2020

S Sushmitha

Department of Entomology,
College of Horticulture, Dr. Y. S. R.
R. Horticultural University,
Venkataramannagudem, Andhra
Pradesh, India

A Sujatha

Dean of Student Affairs,
University Head (Entomology),
College of Horticulture, Dr. Y. S. R.
R. Horticultural University,
Venkataramannagudem, Andhra
Pradesh, India

N Emmanuel

Associate Professor,
(Entomology), College of
Horticulture, Dr. Y. S. R.
Horticultural University,
Venkataramannagudem, Andhra
Pradesh, India

Corresponding Author:

A Sujatha

Dean of Student Affairs,
University Head (Entomology),
College of Horticulture, Dr. Y. S. R.
R. Horticultural University,
Venkataramannagudem, Andhra
Pradesh, India

Impact of weather parameters on rugose spiraling whitefly, *Aleurodicus rugioperculatus* and its natural enemies

S Sushmitha, A Sujatha and N Emmanuel

Abstract

Rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* Martin is an invasive polyphagous pest effecting various plantation, fruits and ornamental crops. The study was conducted to know the population dynamics and its correlation with prevalent meteorological factors. Among the weather parameters, minimum and maximum temperatures had significant effect while rainfall and RH had non significant effect on both the populations of RSW and its natural enemies. However, the population of RSW was highly significant and negatively correlated with populations of natural enemies in coconut and guava gardens, which indicates that increased population of coccinellids and spiders may result in decreased RSW population.

Keywords: Rugose spiraling whitefly, weather parameters, natural enemies, *Aleurodicus*, coconut, guava

Introduction

Invasive insect pests are one of the major and most rapidly growing threats to agricultural biodiversity. Recently, infestation of invasive species, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae), commonly known as the Rugose Spiraling Whitefly (RSW) was observed in India on coconut crop growing areas of Pollachi region, Tamil Nadu and later in the region Palakkad, Kerala during July-August 2016. RSW was originally called as “gumbo limbo spiraling whitefly”, identified as serious threat for coconut palm including many other host plants in Florida [5,9] as well as various commercial plants of India.

Climatic conditions have a great influence on the population, survival, development, outbreaks, reproductive capacity and activity of pest as well as predators and parasites either directly or indirectly [1]. For developing a weather based pest fore-casting system, information regarding population dynamics in relation to prevalent meteorological parameters (temperature, relative humidity, rainfall *etc.*, is much needed. Therefore, a thorough understanding of interaction between the crop growth stage and meteorological parameters/pest dynamics is a prerequisite for weather based pest forecasting model [11]. Prediction of peak period of activity of a pest can enable us to develop suitable control measures that will ultimately add to increase in productivity [2]. Population dynamics play an important role in integrated pest management module [4].

The main difficulty in resolving the pest management issue is the inadequate knowledge about the characteristics of the pest dynamics that leads to inadequate pest management conditions. Hence, an attempt was made on the population dynamics of RSW and its relation to weather variables which are of great significance in formulating efficient pest management tactics.

Materials & Methods

Field experiments were conducted in coconut and guava gardens at College of Horticulture, Venkataramannagudem. In consecutive two years 2018 and 2019, population data was recorded at weekly interval on five randomly selected plants per plot with three leaves per plant in coconut garden as well as guava garden which were infested with RSW. Similar observations were recorded on natural enemy population on RSW *i.e.*, predators, parasitoids, microbial agents, *etc.*, from the same gardens.

The standard meteorological data *i.e.*, data on temperature, humidity and rainfall was collected from Banana Research Station, Kovvur, which is located at 41.7 km within the radius of the sampled garden and correlation between weather parameters and pest status were worked out.

Among the weather parameter; maximum and minimum temperatures ($^{\circ}\text{C}$), relative humidity (%) and rainfall (mm) were recorded at weekly intervals and correlated with the population levels of RSW and occurrence of natural enemies in coconut and guava gardens at College of Horticulture, Dr. Y. S. R Horticultural University, Venkataramannagudem, West Godavari district, Andhra Pradesh.

Statistical analysis: The influence of the weather parameters on the population levels of RSW and its natural enemies were worked out through using simple correlation using OP-stat online software. The correlation between RSW and its natural enemies population was also worked out.

Results & Discussions

I. Seasonal abundance of RSW and Natural enemies

a) Coconut

The seasonal incidence data recorded in coconut garden revealed that, the peak population of RSW/leaflet *i.e.*, 120.30 no./leaflet was present in the 1st week (22-28 September) during the period where maximum (37.00°C) and minimum temperatures (24.71°C) were prevailed, respectively and 88.57 per cent of relative humidity was recorded. The population of RSW was lowest in 15th week (29 December-04 January) with 60.70 no./leaflet during the period where maximum (28.71°C) and minimum temperatures (18.00°C) were recorded respectively and 80.85 per cent relative humidity and no rainfall was observed in that week (Table 1. and Figure 1.).

The natural enemies of RSW *viz.*, spiders and coccinellid beetles, (*M. sexmaculata*) in coconut garden were also documented (Table 1. and Figure 1.) which revealed that, the

highest number *i.e.*, 10.00 coccinellid beetles/palm was recorded in 14th week (22-28 December) and the lowest *i.e.*, 2.00 coccinellid beetles/palm was noted in 3rd week (06-12 October). The highest population of spiders *i.e.*, 9.00 spiders/palm was recorded in 15th week (29 December-4 January) and the lowest population of spiders *i.e.*, 1.00 spiders/palm was observed in 2nd week (29 September-05 October) and 7th week (03-09 November).

b) Guava

The data revealed that, the peak population of RSW/leaflet *i.e.*, 129.20 no./leaflets was present in the 5th week (09-15 November) during the period where average maximum (38.70°C) and minimum temperatures (26.70°C) were prevailed respectively and 92.71 per cent of relative humidity was recorded. The population of RSW was lowest in the 13th week (04-10 January) with 52.00 no./leaflet during the period where maximum (28.28°C) and minimum temperatures (19.43°C) and relative humidity of 93.57 per cent and 6.90 mm rainfall were recorded (Table 3. and Figure 2.).

The data on natural enemies population of RSW mainly predators *viz.*, spiders and coccinellid beetles, (*M. sexmaculata*) were also documented in guava garden (Table 3. and Figure 2.). The data revealed that, the highest number of coccinellid beetles *i.e.*, 9.00 no./plant was recorded in 15th week (18-24 January) and lowest population of coccinellid beetles *i.e.*, 1.00 no./plant was observed in 1st (12-18 October), 2nd (19-25 October) and 9th week (07- 13 December). The peak population of spiders *i.e.*, 9.00 no./palm was noted in 15th week (18-24 January) and lowest population of spiders *i.e.*, 1.00 no./palm was observed in 1st week (12-18 October) and 3rd week (06-12 October).

Table 1: Seasonal incidence of RSW and its natural enemies in coconut, 2018- 2019

Week No.	Period		Population counts			Weather parameters			
			No. of RSW/leaf	Coccinellids /palm	Spiders /palm	T min ($^{\circ}\text{C}$)	T max ($^{\circ}\text{C}$)	RH (%)	RF (mm)
1	22-Sep	- 28-Sep	120.30	0.00	0.00	24.71	37.00	88.57	0.00
2	29-Sep	- 05-Oct	107.60	0.00	1.00	24.28	36.28	88.71	4.47
3	06-Oct	- 12-Oct	110.20	2.00	3.00	23.57	35.80	94.71	0.00
4	13-Oct	- 19-Oct	96.70	0.00	0.00	23.57	36.10	91.70	0.00
5	20-Oct	- 26-Oct	74.90	5.00	4.00	24.57	33.80	90.10	1.30
6	27-Oct	- 02-Nov	77.20	3.00	0.00	23.20	34.80	93.80	0.00
7	03-Nov	- 09-Nov	74.20	3.00	1.00	21.80	34.50	86.40	0.00
8	10-Nov	- 16-Nov	89.60	4.00	4.00	23.71	34.71	83.85	0.00
9	17-Nov	- 23-Nov	86.40	6.00	6.00	22.57	32.00	83.71	0.00
10	24-Nov	- 30-Nov	78.90	7.00	5.00	22.42	32.42	85.71	0.00
11	01-Dec	- 07-Dec	87.60	9.00	6.00	20.71	30.71	89.00	6.02
12	08-Dec	- 14-Dec	68.40	8.00	7.00	19.57	29.14	95.14	0.87
13	15-Dec	- 21-Dec	74.00	6.00	4.00	22.00	33.00	88.40	0.00
14	22-Dec	- 28-Dec	61.10	10.00	7.00	17.28	29.14	94.28	0.00
15	29-Dec	- 04-Jan	60.70	9.00	9.00	18.00	28.71	80.85	0.00
16	05-Jan	- 11-Jan	64.20	8.00	6.00	18.14	30.85	82.00	0.00
17	12-Jan	- 18-Jan	65.60	8.00	6.00	19.28	30.28	97.85	3.67
18	19-Jan	- 25-Jan	72.80	6.00	4.00	21.28	32.43	93.71	0.00
19	26-Jan	- 01-Feb	68.50	9.00	5.00	22.28	30.86	92.57	0.00
20	02-Feb	- 08-Feb	76.20	8.00	4.00	19.71	31.86	90.71	0.00
21	09-Feb	- 15-Feb	69.90	8.00	6.00	21.28	30.85	94.00	0.00
22	16-Feb	- 22-Feb	78.40	5.00	4.00	22.28	31.85	90.71	0.00
23	23-Feb	- 01-Mar	98.20	6.00	3.00	22.42	32.57	79.85	0.00
24	02-Mar	- 08-Mar	86.10	4.00	0.00	21.57	34.14	79.85	0.00
25	09-Mar	- 15-Mar	77.30	7.00	4.00	22.28	32.00	82.43	0.00
26	16-Mar	- 22-Mar	79.50	7.00	3.00	20.86	32.28	89.57	0.00

Table 2: Correlation between weather parameters, RSW and its natural enemies, 2018–19 in coconut

	Tmin (°C)	Tmax (°C)	RH (%)	RF (mm)	RSW	Coccinellids	Spiders
Tmin (°C)	-	0.838**	-0.041 ^{NS}	-0.011 ^{NS}	0.731**	-0.775**	-0.684**
Tmax (°C)	-	-	-0.067 ^{NS}	-0.058 ^{NS}	0.804**	-0.949**	-0.890**
RH (%)	-	-	-	0.204 ^{NS}	-0.127 ^{NS}	0.027 ^{NS}	0.051 ^{NS}
RF (mm)	-	-	-	-	0.140 ^{NS}	0.035 ^{NS}	0.102 ^{NS}
RSW	-	-	-	-	-	-0.784**	-0.647**
Coccinellids	-	-	-	-	-	-	0.848**
Spiders	-	-	-	-	-	-	-

II. Correlation of RSW population and Natural enemies with weather factors

a) Coconut

From the correlation studies between RSW population and weather parameters in coconut garden, established that, the population of RSW was positively and highly significantly correlated with maximum temperature ($r= 0.804$) and minimum temperature ($r= 0.731$). A negative non-significant correlation ($r=-0.127$) was observed between the population of RSW and relative humidity. The rainfall recorded ($r= 0.140$) was non-significantly and positively correlated with RSW population (Table 2.).

The higher temperature prevalence will enhance the metabolic activities at faster rate in insects resulting in rapid buildup of pest population levels in a shorter period. Similarly, high RH condition will have an impact on insect population build up. Same fact was established through the present study. With increase in rainfall, the population of both pest and natural enemies got reduced because, the different life stages of the pest and natural enemies get washed out with heavy rains. But in the present study, a non- significant effect of RF was seen on both the RSW & natural enemies due to low rainfall recorded during the observation period. Similarly negative, but non-significant correlation between whitefly population and abiotic factors, relative humidity and rainfall was recorded in cotton crop [3, 10].

From the correlation studies between natural enemy populations and weather parameters in coconut garden, it was revealed that, a negative and significant correlation was observed between the population of coccinellid beetles with minimum temperature ($r= -0.775$) and maximum temperature ($r= -0.949$) whereas, with relative humidity ($r= 0.027$) and rainfall ($r= 0.035$) the correlation of the coccinellid beetles population was positive and non-significant. The population of spiders were significant and negatively correlated with minimum temperature ($r= -0.684$) and maximum temperature ($r= -0.890$). A non significant positive correlation was observed between population of spiders with relative humidity ($r= 0.051$) and rainfall ($r= 0.120$) (Table 2.).

From the data recorded on population of RSW and natural enemies in coconut garden, it was established that the population of RSW was highly significantly and negatively correlated with populations of coccinellids ($r= -0.784$) and spiders ($r= -0.647$) indicating that, the increased population levels of coccinellids and spiders (predators) may results in decreased RSW population (Table 2.).

b) Guava

Correlation studies between population of RSW with weather parameters in guava garden revealed that, the population of RSW was positively and highly significantly correlated with maximum temperature ($r= 0.668$) and minimum temperature ($r= 0.542$). A negative and positive non-significant correlation was observed between the population of RSW with rainfall ($r= -0.074$) and RH ($r= 0.091$) respectively (Table 4.).

Correlation studies between natural enemy populations with weather parameters in guava garden revealed that, a negative and significant correlation was recorded between the population of coccinellid beetles with minimum temperature ($r= -0.852$) and maximum temperature ($r= -0.950$) respectively whereas with relative humidity ($r= 0.325$) and rainfall ($r= 0.123$), a positive non significant correlation was recorded (Table 4.). The population of spiders with minimum temperature ($r= -0.821$) and maximum temperature ($r= -0.944$) was significantly negatively correlated whereas with relative humidity ($r= 0.332$) and rainfall ($r= 0.015$) a non-significant positive correlation was observed.

From the data recorded in guava garden, it was established that the population of RSW was highly significantly and negatively correlated with populations of coccinellids ($r= -0.672$) and spiders ($r= -0.718$) indicating that, the increased population of coccinellids and spiders results in decreased RSW population (Table 4.). Similarly coccinellids on okra crop also showed a significant negative correlation with maximum, minimum and mean temperatures [6, 7]. A significant negative correlation between spiders and maximum temperature was recorded in beetle vine [8].

Table 3: Seasonal incidence of RSW and its natural enemies in guava, 2018-2019

Week No.	Period		Population counts			Weather parameters			
			No. of RSW/leaf	Coccinellids/ plant	Spiders/ plant	Tmin (°C)	T max (°C)	RH (%)	RF (mm)
1	12-Oct	- 18-Oct	99.60	1.00	1.00	24.29	36.14	96.14	3.90
2	19-Oct	- 25-Oct	104.30	1.00	0.00	25.00	36.70	90.57	0.00
3	26-Oct	- 01-Nov	102.10	2.00	1.00	24.14	36.43	85.28	0.00
4	02-Nov	- 08-Nov	89.40	3.00	2.00	24.14	35.70	92.57	4.50
5	09-Nov	- 15-Nov	129.20	0.00	0.00	26.70	38.70	92.71	0.00
6	16-Nov	- 22-Nov	62.40	3.00	3.00	27.20	33.96	89.43	1.30
7	23-Nov	- 29-Nov	77.00	2.00	2.00	23.70	34.86	93.28	0.00
8	30-Nov	- 06-Dec	74.60	2.00	3.00	21.86	34.29	87.14	0.00
9	07-Dec	- 13-Dec	86.20	1.00	0.00	23.86	35.00	83.86	0.00
10	14-Dec	- 20-Dec	59.00	4.00	3.00	20.00	33.14	85.57	0.00
11	21-Dec	- 27-Dec	64.20	5.00	4.00	22.28	32.00	82.43	0.00
12	28-Dec	- 03-Jan	57.00	5.00	5.00	20.86	32.28	89.57	0.00

13	04-Jan	-	10-Jan	52.00	8.00	6.00	19.43	28.28	93.57	6.90
14	11-Jan	-	17-Jan	59.20	8.00	7.00	20.00	28.86	96.57	0.00
15	18-Jan	-	24-Jan	62.90	9.00	9.00	16.71	24.43	93.28	0.00
16	25-Jan	-	31-Jan	66.70	7.00	6.00	18.14	29.29	94.28	0.00
17	01-Feb	-	07-Feb	74.50	7.00	6.00	18.14	29.86	94.14	0.00
18	08-Feb	-	14-Feb	79.80	5.00	4.00	19.28	30.28	96.43	3.67
19	15-Feb	-	21-Feb	91.00	4.00	5.00	21.14	31.00	94.00	0.00
20	22-Feb	-	28-Feb	56.60	4.00	5.00	22.00	31.28	91.00	0.00
21	01-Mar	-	07-Mar	60.20	4.00	4.00	21.71	32.28	93.23	0.00
22	08-Mar	-	14-Mar	94.30	3.00	2.00	21.57	34.00	94.43	0.00
23	15-Mar	-	21-Mar	97.50	5.00	3.00	21.28	30.85	94.00	0.00

Table 4: Correlation between weather parameters, RSW and its natural enemies, 2018–2019 in guava

	Tmin (°C)	Tmax (°C)	RH (%)	RF (mm)	RSW	Coccinellids	Spiders
Tmin (°C)	-	0.873**	-0.298 ^{NS}	-0.001 ^{NS}	0.542**	-0.852**	-0.821**
Tmax (°C)	-	-	-0.326 ^{NS}	-0.062 ^{NS}	0.668**	-0.950**	-0.944**
RH (%)	-	-	-	0.312 ^{NS}	0.091 ^{NS}	0.325 ^{NS}	0.332 ^{NS}
RF (mm)	-	-	-	-	-0.074 ^{NS}	0.123 ^{NS}	0.015 ^{NS}
RSW	-	-	-	-	-	-0.672**	-0.718**
Coccinellids	-	-	-	-	-	-	0.941**
Spiders	-	-	-	-	-	-	-

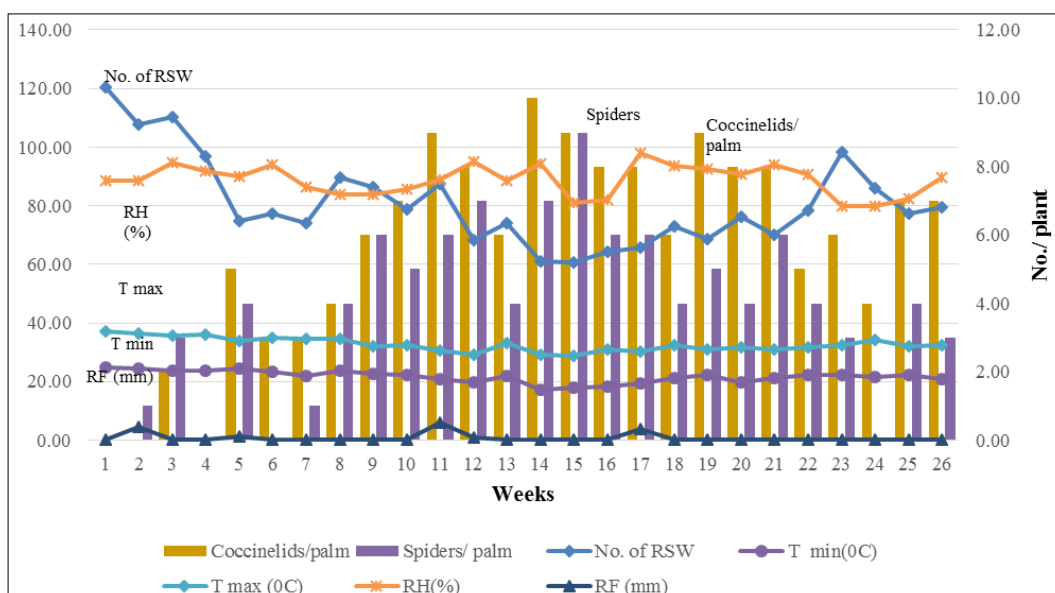


Fig 1: Seasonal incidence of RSW and its natural enemies in coconut, 2018-2019

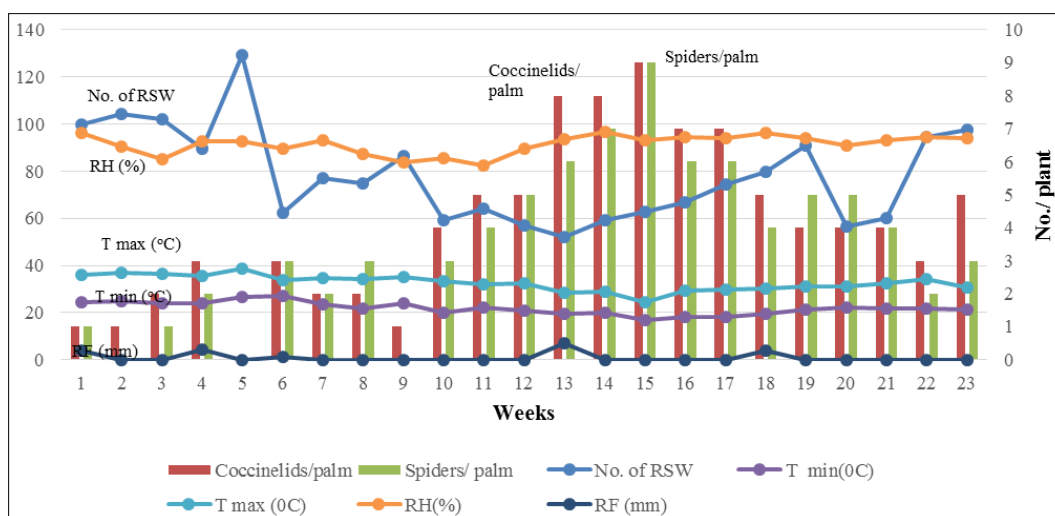


Fig 2: Seasonal incidence of RSW and its natural enemies in guava, 2018-2019

With weather parameters viz., minimum and maximum temperatures, the populations of RSW was positively and

highly significantly correlated whereas, natural enemies were negatively and highly significantly correlated in both the

coconut and guava gardens. The rainfall and RH were non significantly positively and negatively correlated with RSW population in coconut garden, respectively. While in guava the rugose population was correlated negatively with rain fall and positively with RH, respectively. The natural enemies population was non-significantly positively correlated with rainfall and RH. Whereas the population of RSW was highly significantly and negatively correlated with populations of spiders and coccinellids in coconut and guava gardens indicating that, the increased population of coccinellids and spiders may result in decreased RSW population. Hence, concluded that climatic factors will determine the seasonal activity of RSW and natural enemies in coconut and guava gardens. Thus information generated in the present study would be helpful in devising the efficient pest management strategies especially invasive RSW.

Impact of abiotic factors on population fluctuation of cotton whitefly (*Bemisia tabaci*) on transgenic and nontransgenic cotton cultivars in Faisalabad. Pakistan Entomology 2015;37(2):127-131.

References

1. Arif MJ, Abbas G, Saeed S. Cotton in danger. Dawn, The Internet Edition 4, 2007.
2. Damos PT, Sultani MS. Development and statistical evaluation of models in forecasting moth phenology of major lepidopterous peach pest complex for integrated pest management programs. Crop Protection 2010;29:1190-1199.
3. Dhaka SR, Pareek BL. Weather factors influencing population dynamics of major insect pests of cotton under semi-arid agro-ecosystem. Indian Journal of Entomology 2008;70(2):157-63.
4. Fakhri MSA, Jamal K. Population dynamics of major insect-pests of cotton in relation to abiotic factors. International Journal of Advanced Biotechnology Research 2012;2(3):500-505.
5. Kumar V, McKenzie CL, Mannion C, Stocks I, Smith T, Osborne LS. Rugose spiraling whitefly, *Aleurodicus rugioeperculatus* Martin (Hemiptera: Aleyrodidae). EENY 578. 2013; University of Florida, IFAS Extension. <<http://entnemdept.ufl.edu/creatures/orn/Aleurodicusugioeperculatus.htm>>. (accessed 20 Nov 2019)
6. Shukla N. Seasonal incidence and relation to weather parameters of aphid and their natural enemies on okra. International Journal of Scientific and Research Publication 2014;4(3):1-3.
7. Singh Y, Jha A, Verma S, Mishra VK, Singh SS. Population dynamics of sucking insect pests and its natural enemies on okra agro-ecosystem in Chitrakoot region. African Journal of Agricultural Research 2013;8(28):3814-819.
8. Sireesha K, Ramadevi P, Priya BT. Biodiversity of insect pests and their natural enemies in betelvine ecosystem in Andhra Pradesh. Karnataka Journal Agricultural Sciences 2009;22(3-Spl.):727-28.
9. Stocks IC, Hodges G. The rugose spiralling whitefly, *Aleurodicus rugioeperculatus* Martin, a new exotic whitefly in south Florida (Hemiptera: Aleyrodidae). Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 2012. http://freshfromflorida.s3.amazonaws.com/Aleurodicus_rugioeperculatus-pest-alert.pdf (last accessed 15 Mar 2020).
10. Yadav NK, Singh PS. Seasonal abundance of insect pests on mungbean and its correlation with biotic factors. Journal of Entomological Research 2012;37(4):297-99.
11. Zia K, Fareed MS, Arshad M, Hafeez F, Khan RR.