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Seasonal Incidence of Major Sternorrhynchan Insect Pests Infesting Arecanut In South India

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ABSTRACT

Field experiments were conducted during 2019-20 to know the seasonal incidence of three species of sternorrhynchan insect pests infesting in arecanut *viz.,* whitefly, *Aleurocanthus arecae*, armoured scale, *Chrysomphalus aonidum* and mealybug, *Pseudococcus longispinus* in two different locations under southern transitional zone. The study revealed that, all the three species infesting arecanut were active throughout the year. Correlation studies of whiteflies showed that, rainfall was significantly positively correlated and maximum temperature and sunshine hours were significantly negatively correlated. For armoured scales, non-significant positive correlation with minimum temperature and for the mealybug resulted that the maximum temperature was significantly positively correlated whereas the relative humidity was significantly negatively correlated.

Figure : 00 References : 11 Tables : 04
KEY WORDS : *Aleurocanthus arecae*, *Areca catechu*, *Chrysomphalus aonidum*, Karnataka, *Pseudococcus longispinus*.

Introduction

Arecanut is the most significant plantation crops growing in India in different regions of the country. It has few medicinal values against disease like cough, fits, worm, anemia, leukoderma, obesity *etc.* From ancient time, arecanut is used in several religious and social ceremonies and in some parts of India it is used as ornamental plant also[5].

In India, it is grown in different states like Karnataka, Kerala, Assam and West Bengal. Among the states, this perennial plantation crop is extensively growing in Karnataka. Karnataka alone produces 70.33 percent of arecanut (6.00 lakh tonnes) from an area of 2.79 lakh hectare[1]. Among all the districts of the state, Shivamogga stands first in both area (21.06%) and production (21.30%) followed by Davanagere, Dakshina Kannada, Tumkur, Chikkamagaluru and Chitradurga. These districts together account 83.63 percent of the total area and 82.10 per cent of the total production of arecanut in the state[1].

The cultivation of arecanut is hampered by different species of insect and non-insect pests. Among all the insect pests only few are major pests affecting the production of arecanut *viz.,* white grub, *Leucopholis lepidophora*; spindle bug, *Carvalhoia arecae*; inflorescence caterpillar, *Tirathaba mundella*; inorescence caterpillar, *Tirathaba mundella*; pentatomid bug, *Halyomorpha marmorea;* inorescence aphid, *Cerataphis lataniae* and scale insect, *Icerya aegyptiaca*[9].

In the recent past, the infestation of the sternorrhynchan insect pests became severe in arecanut. Our preliminary survey indicated that three species of sternorrhynchan insect pests infesting in arecanut *viz.,* whitefly, *Aleurocanthus arecae*, armoured scale, *Chrysomphalus aonidum* and mealybug, *Pseudococcus longispinus* were dominant in Arecanut gardens. The

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heavy infestation of these sternorrhynchan was observed on leaves, nuts, roots and inflorescence. They are forming black sooty mould fungus and affecting the photosynthetic activities, growth and yield of the plants. The study was undertaken to know the effect of the seasonal fluctuation of weather parameters on these sternorrhynchan insect pests thereby giving basic information to their successful management.

Material and Methods

An experiment on seasonal incidence of sternorrhynchan sucking insect pests *i.e.,* whitefly, *A. arecae*; armoured scale, *C. aonidum* and mealybugs, *P. longispinus* was conducted in two different locations *viz.,* UAHS, College of Agriculture, Shivamogga and AHRS, Honnavile. The gardens selected had 4 years old plantation and were insecticide free blocks but with all package of practices followed. Observation on seasonal incidence of arecanut sternorrhynchan insects was recorded at fortnightly intervals for a period of one year in two different gardens which comes under southern transitional zone.

For population counts, 5cm^2 leaf surface area was selected on 10 randomly selected plants and labelled. Sixteen, 5×1cm^2 long leaf parts were selected from these 10 plants, having insect infestation at fortnightly interval. From each sample, the live individuals were recorded using hand lens (1.5 cm^2).

The incidence of all identified insect pests was correlated with various weather parameters *viz*., rainfall (X_1), maximum temperature (X_2), minimum temperature ($X_{3)}$, morning relative humidity ($X_{4)}$, afternoon relative humidity ($X_{5)}$ and sunshine hours ($X_{6)}$ (data were obtained from Gramin Krishi Mausam Sewa Unit, University of Agricultural and Horticultural Science, Shivamogga and Agricultural and Horticultural Research Station, Honnavile). Multiple regression analysis was also carried out to know the influence of abiotic factors on the seasonal incidence of these selected major sternorrhynchan insect pests.

Results and Discussion

UAHS, College of Agriculture, Shivamogga (Location I)

Arecanut whitefly, *A. arecae* revealed that the population of *A. arecae* was active throughout the year. The mean population of *A. arecae*/5cm^2 leaf area varied from 7.20 to 44.70. The maximum population of *A. arecae* was recorded in the first fortnight of August (44.70/5cm^2 leaf area) and minimum in the first fortnight of February (7.20/5cm^2 leaf area). The overall mean number of *A. arecae* population recorded was 19.32 ± 11.27/5cm^2 leaf area (Table-1). The correlation analysis among the six weather parameters showed that the population of *A. arecae* was significantly positively correlated with total rainfall (r = 0.722**), minimum temperature (r = 0.664**), morning relative humidity (r = 0.548**) and afternoon relative humidity (r = 0.827**) and significantly negatively correlated with maximum temperature (r = -0.797**), sunshine hours (r = -0.912**). When the data were subjected to multiple linear regression analysis, the equation $Y= 117.852+0.035X_1-5.845X_2+3.610X_3+0.016X_{4-}0.341X_{5-}0.065X_6$ with an adjusted R^2 value of 0.96 indicates that, the parameters influenced the *A. arecae* population in field to the extent of 96 percent with these eight weather parameters (Table-3).

Armoured scale, *C. aonidum* revealed that the population of *C. aonidum* was active throughout the year. The mean population of *C. aonidum*/5cm^2 leaf area varied from 1.60 to 13.50. The maximum mean population of *C. aonidum* were recorded in the second fortnight of April (13.50/5cm^2 leaf area) and the minimum was in the second fortnight of January (1.60/5cm^2 leaf area). The overall mean number of *C. aonidum* population recorded was 5.05±4.05/ 5cm^2 leaf area (Table-1). The population of *C. aonidum* was significantly negatively correlated with morning relative humidity (r = -0.758**) and afternoon relative humidity (r = -0.757**) and significantly positively correlated with maximum temperature (r = 0.786**), sunshine hours (r = -0.472*). There was non-significant positive correlation with minimum temperature (r = 0.213) and non-significant negative correlation with rainfall (r = -0.258). When the data were subjected to multiple linear regression analysis, equation $Y= -23.76+0.001X_1+0.275X_2+ 1.245X_{3-}0.015X_{4-}0.135X_5+0.914X_6$ with an adjusted R^2 value of 0.84, indicates that, the parameters influenced the *C. aonidum* population in field to the extent of 84 percent with these six weather parameters (Table-3).

Mealybug, *P. longispinus* revealed that the population of *P. longispinus* was active throughout the year. The mean population of *P. longispinus*/5cm^2 leaf area ranged from 1.10 to 9.90. The mean population of *P. longispinus* recorded was maximum in the second fortnight of April (9.90/5cm^2 leaf area) and minimum in the second fortnight of October, November and January (1.10/5cm^2 leaf area). The overall mean number of *P. longispinus* was recorded 2.73±2.58/5cm^2 leaf area (Table-1). Correlation analysis among the six weather parameters, indicated that the population of *P. longispinus* was significantly negatively correlated with morning relative humidity (r = -0.637**) and afternoon relative humidity (r = -0.695**) and significantly positively correlated with maximum temperature (r = 0.786**). There was non-significant positive correlation with minimum temperature (r = 0.273) and non-significant negative correlation with total rainfall

TABLE-1 : Seasonal incidence of sternorrhynchan insect pests of arecanut during 2019-20 in UAHS, Shivamogga (Location-I)

Date	Mean number of insect pests/5cm^2 leaf area*		
	Whiteflies	**Scales**	**Mealybugs**
15/08/2019	44.70	3.20	1.50
31/08/2019	41.90	3.00	1.20
15/09/2019	28.90	2.80	1.40
30/09/2019	27.50	2.60	1.30
15/10/2019	26.70	2.20	1.20
31/10/2019	24.50	1.80	1.10
15/11/2019	22.60	3.10	1.30
30/11/2019	20.80	2.90	1.10
15/12/2019	15.10	2.50	1.30
31/12/2019	13.20	2.10	1.20
15/01/2020	10.40	2.00	1.10
31/01/2020	9.10	1.60	1.70
15/02/2020	7.20	6.10	2.60
29/02/2020	8.60	8.70	3.90
15/03/2020	9.40	9.50	4.40
31/03/2020	11.20	10.80	4.90
15/04/2020	11.30	12.60	8.00
31/04/2020	14.70	13.50	9.90
Overall Mean±SD	**19.32±11.27**	**5.05±4.05**	**2.73±2.58**

*Mean of 10 palms recorded at fortnightly interval

(r = -0.223) and sunshine hours (r = -0.429). When the data were subjected to multiple linear regression analysis, equation Y= - 29.991+0.003X_1+ 0.101X_2 + 1.114X_3 + 0.0116X_4-0.111X_5 + 1.053X_6 with an adjusted R^2 value of 0.82, indicated that, the parameters induced the *P. longispinus* population in field to the extent of was 82 percent with these six weather parameters (Table-3).

AHRS, Honnavile, Shivamogga (Location-II)

The population of *A. arecae* was active throughout the year. The mean population of *A. arecae* was/5cm^2 leaf area varied from 2.50 to 21.80. However, the highest mean population of *A. arecae* was recorded maximum in the first fortnight of August (21.80/5cm^2 leaf area) and minimum in the second fortnight of January (2.50/5cm^2 leaf area). The overall mean number of *A. arecae* recorded was 9.87±6.29/5cm^2 leaf area (Table-2). The correlation analysis among the six weather parameters revealed that the population of *A. arecae* was significantly positively correlated with total rainfall (r = 0.754**), there was non-significant positive correlation among minimum temperature (r = 0.261), morning relative humidity (r = -0.171) and afternoon relative humidity (r = 0.340) and significantly negatively correlated with maximum temperature (r = -0.603**) and sunshine hours (r = -0.890**). When the data were subjected to multiple linear regression analysis, equation Y= 33.243-0.007X_1-0.488X_2+0.476X_3+0.029X_4-0.204X_5-4.204X_6 with an adjusted R^2 value of 0.87, indicates that, the parameters influenced the *A. arecae* population in field to the extent of 87 per cent with these six weather parameters (Table-4).

Armoured scale, *C. aonidum* was active throughout the year. The mean population of *C. aonidum*/5cm^2 leaf area varied from 0.80 to 6.30. The maximum population of scales was recorded in the second fortnight of April (6.30/5cm^2 leaf area) and minimum in the second fortnight of January (0.80/5cm^2 leaf area). The overall mean number of *C. aonidum* were recorded 3.16±1.88/5cm^2 leaf area (Table-2). Correlation analysis among the six weather parameters revealed that the population of *C. aonidum* was significantly negatively correlated with sunshine hours (r = -0.593**) and significantly positively correlated with total rainfall (r = 0.570**), there was non-significant positive correlation among morning relative humidity (r = -0.391), afternoon relative humidity (r = -0.155), maximum temperature (r = -0.122) and non-significant positive correlation with minimum temperature (r = 0.213). When the data were subjected to multiple linear regression analysis, equation Y= -10.024-0.002X_1+0.570X_2+0.170X_3+0.028X_4-0.055X_5-1.463X_6 with an adjusted R^2 value of 0.75, indicates that, the parameters influenced the *C. aonidum* population in field to the extent of 75 per cent with these six weather parameters (Table-4).

Mealybug, *P. longispinus* was active throughout the year. The mean population of *P. longispinus*/5cm^2 leaf area varied from 0.70 to 4.30. The highest number of *P. longispinus* were recorded in the second fortnight of April (4.30/5cm^2 leaf area) and the lowest number in the first fortnight of December (0.70/5cm^2 leaf area). The overall mean number of *P. longispinus* recorded was 1.59±1.12/5cm^2 leaf area (Table-2). The correlation analysis among the six weather parameters revealed that the population of *P. longispinus* was significantly positively correlated with maximum temperature (r = 0.725**), morning relative humidity (r = -0.561*), significantly negatively correlated with afternoon relative humidity (r = -0.830**), there was non-significant positive correlation with minimum temperature (r = 0.087) and sunshine hours (r = 0.280) and non-significant negative correlation with total rainfall (r = -0.141). When the data were subjected to multiple linear regression analysis, equation Y= 0.974-0.005X1+ 0.336X_2-0.057X_3-0.0236X_4-0.074X_5-0.565X_6 with an adjusted R^2 value of 0.84, indicates that, the parameters influenced the *P. longispinus* population in field to the extent of 84 percent with these six weather parameters (Table-4).

From the results it can be concluded that, at both the locations, the highest mean number of whiteflies were recorded during the first fortnight of August in College of Agriculture, (44.70/5cm^2 leaf area) and the lowest in Honnavile (21.80/5cm^2 leaf area) which may be due to the heavy rainfall and maximum relative humidity during this period which favored the rapid multiplication and reproduction of whiteflies. Later, the whiteflies population started decreasing due to an increase in temperature, this in agreement with earlier work[2] indicating the inverse relationship with population and temperature[8] showed the maximum incidence of whiteflies in the month of February in Kerala. The contradictory results in different places may be due to many ecological and environmental factors like cropping pattern and topography *etc*[6].

The highest number of armoured scales were recorded during the second fortnight of April in College of Agriculture, Shivamogga (13.50/5cm^2 leaf area) and minimum in Honnavile (6.30/5cm^2 leaf area). It was due to maximum temperature prevalent in this month which helped the rapid multiplication and survival of armoured scales population. Minimum population of armoured scales was recorded during the first fortnight of August to second fortnight of January. This was due to heavy rainfall and lowest temperature and this is in accordance with earlier work[3]. The maximum population of mealybugs was observed during the second fortnight of April in the College of Agriculture, Shivamogga (9.90/5cm^2 leaf area) followed by Honnavile (4.30/5cm^2 leaf area). It was due to prevalent higher temperature in this month, which helped rapid

TABLE-2 : Seasonal incidence of sternorrhynchan insect pests of arecanut during 2019-20 in AHRS, Honnavile, Shivamogga (Location-II)

Date	Mean number of insect pests/5cm^2 leaf area*		
	Whiteflies	**Scales**	**Mealybugs**
15/08/2019	21.80	5.70	1.00
31/08/2019	19.30	4.80	1.30
15/09/2019	17.60	4.60	1.20
30/09/2019	15.90	4.20	0.80
15/10/2019	15.10	5.40	1.80
31/10/2019	14.60	4.40	1.60
15/11/2019	11.50	2.60	1.20
30/11/2019	8.40	1.80	0.90
15/12/2019	5.80	1.30	0.70
31/12/2019	4.40	1.10	0.60
15/01/2020	2.80	0.90	0.80
31/01/2020	2.50	0.80	0.80
15/02/2020	2.90	1.30	1.30
29/02/2020	3.10	1.40	1.60
15/03/2020	5.30	2.80	2.50
31/03/2020	6.90	3.70	3.40
15/04/2020	8.30	4.30	3.70
31/04/2020	12.00	6.30	4.30
Overall Mean ± SD	**9.87±6.29**	**3.16±1.88**	**1.59±1.12***

*Mean of 10 palms recorded at fortnightly interval

TABLE-3 : Correlation coefficient (r) and coefficient of determination (R^2) between weather parameters and incidence of whiteflies, scales and mealybugs in arecanut during 2019-20 at fortnightly interval under filed condition in UAHS, Shivamogga (Location I)

Name of the Insects	Correlation coefficient (r)						Coefficient of determination (R^2)
	Total rainfall (mm)(X_1)	Temperature (°C)		Relative humidity (%)		Sunshine (hours/day) (X_6)	
		Maximum (X_2)	Minimum (X_3)	I (X_4)	II (X_5)		
Whitefly (No./leaf)	0.722**	-0. 797**	0.664**	0.548*	0.827**	-0.912**	0.966
Scales (No./leaf)	-0.258	0.786**	0.213	-0.758**	-0.757**	0.472*	0.846
Mealybugs (No./leaf)	-0.223	0.762**	0.273	-0.637**	-0.695**	0.429	0.820

N=18; **Correlation is significant at the 0.01 level; Table r value at p=0.01 is 0.589

*Correlation is significant at the 0.05 level; Table r value at p=0.05 is 0.468

TABLE-4 : Correlation coefficient (r) and coefficient of determination (R^2) between weather parameters and incidence of whiteflies, scales and mealybugs in arecanut during 2019-20 at fortnightly interval under filed condition in AHRS, Honnavile, Shivamogga (Location II)

Name of the Insects	Correlation coefficient (r)								Coefficient of determination (R^2)
	Total rainfall (mm) (X_1)	Temperature (°C)		Relative humidity (%)		Sunshine (hours/ day) (X_6)	Wind speed Km/hr. (X_7)	Evaporation (mm/day) (X_8)	
		Maximum (X_2)	Minimum (X_3)	I (X_4)	II (X_5)				
Whitefly (No/leaf)	0.754**	-0.603**	0.261	-0.171	0.340	-0. 890**	0.601**	-0.599**	0.870
Scales (No/leaf)	0.570**	-0.122	0.292	-0.391	-0.155	-0.593**	0.477*	-0. 245	0.750
Mealybugs (No/leaf)	-0.141	0.725**	0.087	-0.561*	-0.830**	0.280	0.008	0.524*	0.840

N=18; **Correlation is significant at the 0.01 level; Table r value at p=0.01 is 0.589

*Correlation is significant at the 0.05 level; Table r value at p=0.05 is 0.468

multiplication and survival of mealybugs populations. The lowest population was observed during the second fortnight of October and November and first fortnight of January. This is due to the lowest rainfall and lowest temperature in these periods, which affected the rapid multiplication and survival. These results are in line with earlier works[8].

From both the locations, correlation studies of whiteflies showed that, rainfall was significantly positively correlated. It is in accordance[2]. A significant negative correlation with maximum temperature, which is in accordance[4]. Morning relative humidity and afternoon relative humidity were significantly positively correlated with whiteflies population in College of Agriculture, a similar kind of result was obtained earlier[7]. A significant negative correlation with sunshine hours, is in accordance[4]. At Honnavile, the armoured scales showed significant positive correlation with rainfall and with maximum temperature. Significant negative correlation was found with morning relative humidity and afternoon relative humidity at College of Agriculture. Correlation studies of mealybugs from both locations showed that, maximum temperature was significantly positively correlated, morning and afternoon relative humidity was significantly negatively correlated.

Conclusion

The study indicated the influence of different weather parameters in a different manner for different sucking pests. Further study for few more years may throw a light on the developmental factors of these pests as influenced by weather parameters. This may help in forecasting the incidence of these important sucking pests of Areca nut.

References

1. Anonymous. Final estimates of district wise area, production and yield of principal crops in Karnataka for the year 2017-18, 2018; Directorate of Economics and Statistics, Government of Karnataka, Bengaluru, Karnataka.
2. Bandyopadhyay UK, Sahu PK, Raina SK, Santhakumar MV, Chakraborty N, Sen SK. Studies on the seasonal incidence of the whitefly (*Dialeuropora decempuncta* Quaintance and Baker) causing leaf curl on mulberry in relation to abiotic factors. *Int. J. Indust. Entomol.* 2000; **1**(1): 65-71.
3. Basavaraju SL, Revanappa SB, Prashant K, Rajkumar, Kanatt A, Sowmya HC, Gajanan, KD, Srinivas, N. Bio-ecology and management of arecanut scale, *Parasaissetia nigra* (Neitner) and mealybug, *Dysmicoccus brevipes* (Cockerell). *Indian J. Agric. Res*. 2013; **47**(5): 436-440.
4. Chavan SM, Kumar S, Arve SS. Population dynamics and development of suitable pest management module against major insect pests of tomato (*Solanum lycopersicum*). *J. Appl. Hortic.* 2013; **15**(2): 150-155.
5. Indian Horticulture. Database Published by National Horticultural Board, Ministry of Agriculture. 2014; Government of India, Sector-18, Gurgaon
6. Khaliq A, Javed M, Sohail M, Sagheer M. Environmental effects on insects and their population dynamics. *J. Entomol. Zool. Stud.* 2014; **2**(2): 1-7.
7. Masood N, Ashfaq M, Iqbal M, Hussain T, Ahmad S. Whitefly (*Aleurolobus barodensis* Mask.) spatiotemporal trends in semi-arid agro-ecological zones of Pakistan. *Pak. J. Agri. Sci.* 2013; **50**(1): 69-74.
8. Palaniswami MS, Pillai KS, Nair RR, Mohandas C. A new cassava pest in India, *Cassava Newslett*. 1995; **19**: 6-7.
9. Ragupathy A, Ayyasamy R A. guide on crop pests. Namrutha Publications. 2016; Chennai
10. Reddy SG, Kumari A. Seasonal incidence of black scale, *Saissetia oleae* (Olivier) on the fern, *Thelypteris tylodes* (Kunze) from western Himalaya. *Indian J. Exp. Biol.* 2019; **57**(1): 59-62.
11. Shanbhag RR, Sundararaj R. Population dynamics of the striped mealybug, *Ferrisia virgata* (Cockerell) (Hemiptera: Pseudococcidae) and the scope of its biological suppression in the present scenario of cultivation of Indian sandalwood. Bangalore, Karnataka. *Agric. Res. Tech. Open Access*. 2017; **11**(2): 45-50.