The Planter, Kuala Lumpur, ***95*** *(1115): 83-89 (2019)*

The Inference of the Impact of Rugose Spiraling Whitefly on Oil Palm Fresh Fruit Bunch Yield in India

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Rugose spiraling whitefly incidence is becoming a serious issue in the plantation crops of West and East Godavari districts of Andhra Pradesh, India in the recent years. In oil palm nutrient draining due to continuous sucking of the cell sap by the nymphs and adults is the prime reason for loss of yield. Depending on the severity of the pest incidence, fresh fruit bunch (FFB) yield losses varying between 20- 45 per cent in the farmers' fields at village levels and 30-42 per cent at mandal (an administrative division in the state of Andhra Pradesh, India) levels was observed at twelve months after the initiation of the incidence. Sooty mould fungus development on the honeydew secretions made the leaves become black and unfit for photosynthetic activity which could also be one of the causes for yield loss.

Keywords: *Rugose spiraling whitefly, Godavari districts, Andhra Pradesh, oil palm, sooty mould, honeydew.*

Rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* (Martin: Hemiptera: Aleyrodidae) (*Figure 1*) is a tiny flying insect with white wings and light brown colour streaks on them (Martin, 2004). The pest prefers to feed on Arecaceae family plants. Of these, coconut (*Cocos nucifera*) is the most preferred one followed by oil palm (*Elaeis guineensis*), ornamental areca palm (*Dypsis lutescens*) and least preferred is the arecanut (*Areca catechu*). The pest which is native to Florida, USA (Mannion, 2010) can complete its life cycle in nearly thirty-three days. In India, its appearance was first reported in Kerala in 2016 from where it has gone to Pollachi, Tamil Nadu (Chandrika Mohan *et al.*, 2017).

In Andhra Pradesh, the incidence was first observed in the second half of 2017 when some

Figure 1 Nymphs (left) and adults (right) of rugose spiraling whitefly

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enthusiastic farmers started bringing coconut plants from Kerala. It is likely that the pest might have migrated along with the coconut plants. Since a number of nurseries from Kadiyam (16.9135908, 81.8182663) also import many plants from Kerala, the pest probably migrated and settled in Kadiyam and nearby areas.

In West Godavari district, the pest incidence was first observed in oil palm plantations of Kalavalapalli (16.9482108, 81.6398112) area. The origin could be due to the establishment of coconut nursery in this area, again brought from Kerala (Kalidas, 2018).

The pest lays eggs in a serpentine/spiral manner on the undersurface of the leaves (*Figure 2*). On each leaflet there will be approximately thirteen to thirty spirals depending on the severity. While laying eggs, the pest excretes a waxy material to cover up the eggs and immature stages most probably as a protection (Vivek Kumar *et al.*, 2013). Though the pest lays the eggs on each and every green leaf it comes across, but all of them may not allow the completion of the life cycle and hence cannot be considered as host plants *viz.* coconut, oil palm, banana, guava and heliconia.

Figure 2 Egg colonies of rugose spiraling whitefly laid in spiraling fashion

The nymphs and adults suck the sap from the leaves. Since they suck more than they need, the excess sap comes out as honeydew falling on the lower leaves of the same or other plants including weeds. This attracts black sooty mould fungus, *Leptoxyphium* sp. which forms as a layer hindering the photosynthetic activity. However, no quantification has been done on this aspect. In USA nearly 118 plants have been notified as host plants and in India, nearly twenty plants of different families have been observed hosting the pest population (Francis *et al.*, 2016).

Studies have not been made regarding its infestation and yield losses on oil palm anywhere in the world. Hence the present study was carried out to find out the losses due to the pest attack on oil palm fresh fruit bunch (FFB) yield in the severely infested areas in West Godavari district of Andhra Pradesh.

MATERIALS AND METHODS

Twenty plantations from five villages namely Kalavalapalli (16.9482108, 81.6398112), Chagallu (16.991726, 81.666687), Chikkala (16.9704765, 81.5939132) of Chagallu mandal and Korumamidi (16.9461518, 81.5719819), Medipalle (16.9218292, 81.5500441) of Nidadavolu mandal in West Godavari district of Andhra Pradesh (*Figure 3*), where the pest was first observed and causing severe incidence and infestation on oil palm were selected for the study. All the plantations were worst hit by the pest having more than ten spirals per leaflet. All the leaves present in the lower two whorls (16 out of 40 leaves on an average) were completely covered with sooty mould on the upper surface of the leaflets. The oil palm yield in the form of FFB (tonnes per hectare) of the preceding as well as the following years of the incidence i.e. 2016-2017 (where no

Figure 3 Experimental areas in West Godavari district of Andhra Pradesh state of India

incidence of the pest was recorded), 2017-2018 (where severe incidence was observed with the presence of pest on all the lower leaves - *Figure 4*) and 2018-early 2019 (where the incidence was continued with the presence of sooty mould on lower and middle whorls of leaves - *Figure 5*). was collected from the farmers. Similarly, the quantity of FFB received by the processing company from these areas through their collection centres was also collected for the same period for comparison as well as correlation purposes. Productivity levels and percent changes were calculated using simple mathemathics.

RESULTS AND DISCUSSIONS

Incidence and infestation of rugose spiraling whitefly

The incidence was first observed on oil palm in October, 2017 in Kalavalapalli village of Chagallu mandal of West Godavari district in a few plantations. Initially it was observed on almost all the green leafy plants causing nutrient drainage by means of sucking the cell sap. Continuous sucking of cell sap by nymphs and adults of the whitefly released the excess sap through the anus in the form of honeydew (a sugar rich sticky liquid). This further led to sooty

Figure 4 Severe incidence of rugose spiraling whitefly (right: undersurface, left: upper surface)

Figure 5 Severe incidence of sooty mould on lower and middle leaves

Figure 6 Damage due to sooty mould on coconut (premature yellowing)

Figure 7 Sooty mould damage on banana (leaf drying)

Figure 8 Sooty mould and its flakes (inset) on oil palm leaves

mould development on the honeydew secretions that fell on the lower leaves, affecting the photosynthetic activity of the palm. Based on the severity of the pest incidence, the sooty mould appearance was observed at high to very high levels. Except for logical interpretations, quantifications on the loss of photosynthetic active leaf area and thereby the yield reductions in oil palm were however not made until todate Heavy black sooty mould development on the upper surface of the leaves in the rugose spiraling whitefly infested areas was observed in all the plants during the latter months of infestation. In coconut, severity led to yellowing of leaves while in banana drying was observed as the symptoms. In oil palm such symptoms were not observed. When disturbed the sooty mould detached from the oil palm leaves as flakes which was not so in case of others (*Figures 6-8*).

In January 2018, the average pest incidence on oil palm was observed at 5.04 per cent with an average percent incidence (spirals per pinnae; 5 pinnae per palm; 20 palms per hectare) ranging from 2.6 to 8.8 with 1-15 spirals per pinnae at random. It was 18.88 per cent in coconut, 2.88 per cent in guava and 7.4 per cent in cocoa. In the case of banana the pest incidence was observed with heavy sooty mould. This was mainly due to the drifting of honeydew secretion from the coconut and oil palm plants where banana was also an inter crop.

Impact on FFB yield loss

Both the nymphs and adults of whitefly suck the cell sap and thereby drain away the nutrients. This results in nutrient loss affecting the FFB production leading to loss of yield. Secondly, the excess sap that was drawn by the pest excreted out as honeydew which falls on the upper surface of the lower leaves. The sooty mould fungus that formed as a layer over the honeydew turned the green leaves to black. This hindered the photosynthetic activity leading to poor growth of the FFB. Hence both direct as well as indirect damage occurred due to the pest feeding affected the FFB growth and thereby its yield. Hence in the present study, data on FFB production in the whitefly infested plantations in the preceding years of pest attack and during the present years was collected from the farmers as well as processors and are given in *Tables 1* and *2*.

It is observed that in Kalavalapalli of Chagallu mandal which is worst hit by the pest and was the first to be attacked, the average yield levels (measured in the form of productivity per hectare) were 25.64 tonnes per hectare from 2016 to 2017, increased to 30.28 tonnes per hectare during 2017 to 2018 but reduced drastically to 16.53 tonnes per hectare from 2018 to early 2019 (*Table 1*). This downtrend during 2018 to early 2019 could be attributed to the pest attack. The change in percentage that was calculated based on the yields recorded during the reported period indicates that during 2016-2017 to 2017-2018 period the productivity was in increasing trend. Whereas during 2017-2018 when the pest incidence was observed, productivity decreased resulting in low yields. This further reached the lowest during 2018-2019 with a change of -45.41 per cent negative trend indicating that the yield has been constantly reduced in this village since 2017-2018.

Similar trend was observed in Chikkala village of same mandal with increasing trend in the total yield during 2016-17 to 2017-2018 but drastically lowered during 2018-2019 period with percent change of -39.81. The other village, Chagallu in the Chagallu mandal also showed the same trend with 29.31 tonnes per hectare of productivity during 2016-2017, slightly reduced to 27.87 tonnes per hectare during 2017-2018 and drastically lowered to 20.92 tonnes during 2018-2019. The percent change that was recorded in this village was -4.91 and -20.30 respectively during 2017-2018 and 2018-2019. Since all the three villages namely Chagallu, Chikkala and Kalavalapalli had recorded severe incidence of the whitefly during the reported period, the reduction in the yield could be attributed to severe pest infestation. In the Nidadavolu mandal, the pest incidence was observed little late compared to Chagallu mandal. Based on the observations recorded on the yield levels in this mandal in Medipalli and Korumamidi villages, it is seen that the productivity increased from 2016-2017 and 2017 to 2018 as there was no incidence during 2017 to 2018 or just started. However, in both the villages the incidence was reported at the end of 2017-2018 and that caused the negative impact during 2018-2019 with negative percent change in the productivity with -25.00 and -20.74 respectively.

To confirm the yield losses due to whitefly menace in the reported villages, data on FFB received by the processing companies was also collected for the same years and are given in *Table 2*. The results clearly indicate that the productivity in both the mandals increased during 2016-2017 and 2017-2018 with positive change of 9.26 and 18.68 per cent while it was negative during 2018-2019 with -30.68 and -42.28 in Chagallu and Nidadavolu mandals

TABLE 1
OIL PALM FFB PRODUCTION (TONNES) AND PRODUCTIVITY (TONNES/HA.) IN RUGOSE SPIRALING WHITEFLY INFESTED AREAS OF WEST GODAVARI DISTRICT

		2016-17		*2017-18*			*2018-19*		
Village/ Mandal	*Area (ha)*	*Production (t)*	*Productivity (t/ha)*	*Production (t)*	*Productivity (t/ha)*	*% Change*	*Production (t)*	*Productivity (t/ha)*	*% Change*
Kalayalapalli/ Chagallu	16.187	415.18	25.64	490.23	30.28	18.07	267.61	16.53	-45.41
Chikkala/ Chagallu	36.017	609.26	16.91	891.01	24.73	46.24	536.23	14.88	-39.81
Chagallu/ Chagallu	2.023	59.32	29.31	56.41	27.87	-4.91	42.33	20.92	-24.96
Medipalle/ Nidadavolu	3.642	62.99	17.29	88.62	24.33	40.70	66.47	18.25	-25.00
Korumamidi/ Nidadavolu	8.498	222.30	26.15	249.31	29.33	12.15	197.60	23.25	-20.74

TABLE 2
MANDAL WISE FFB PRODUCTIVITY (TONNES/HA) LOSS DUE TO RUGOSE SPIRALING WHITEFLY IN WEST GODAVARI DISTRICT

	2016-17			2017-18				2018-19			
Mandal	Area (ha)	FFB (t)	Prod. (t/ha)	Area (ha)	FFB (t)	Prod. (t/ha)	% Change	Area (ha)	FFB (t)	Prod. (t/ha)	% Change
Chagallu	823	13002	15.79	660	14207	21.52	9.26	722	9848	13.64	-30.68
Nidadavolu	714	7446	10.42	742	8837	11.91	18.68	465	5100	10.96	-42.28

FFB = fresh fruit bunch
Prod. = productivity

respectively. This indicates the reduction in the yield levels in both the mandals could be due to whitefly incidence and its infestation only and not related to any other factors.

SUMMARY AND CONCLUSION

Rugose spiraling whitefly caused two types of damage to the oil palm plants. Sucking the cell sap from oil palm leaves by staying on the undersurface of leaves led to direct loss of nutrients while the sooty mould fungus caused indirect damage by affecting the photosynthetic activity of the leaves. The two activities of the pest incidence caused yield losses of up to 45 per cent in both the mandals during 2018-2019. This may further increase unless the pest is managed properly. Although the symptoms of the pest infestation was reported by Kalidas (2018) and Vivek Kumar *et al.* (2013) however no authentic report has been published on the yield losses in oil palm. This study is first of its kind on the losses due to the invasive pest, rugose spiraling whitefly on oil palm.

ACKNOWLEDGEMENT

The help rendered by the oil palm farmers of Nidadavolu and Chagallu mandals of West Godavari district of Andhra Pradesh and their processing company for sparing the required data on yield losses is highly acknowledged.

REFERENCES

CHANDRIKA M., JOSEPHRAJKUMAR, A., MERIN BABU, PRATHIBHA, P.S., KRISHNA KUMAR, V., HEGDE, V. and CHOWDAPPA, P. 2017. Invasive Rugose Spiralling Whitefly on Coconut. *Technical Bulletin No. 117*, (Centenary Series 60), ICAR-CPCRI, Regional Station, Kayamkulam, 16 p.

FRANCIS, A., STOCKS, I.C., SMITH, T.R., BOUGHTON, A.J., MANNION, C. and OSBORNE, L. 2016. Host plants and natural enemies of rugose spiraling whitefly (Hemiptera: Aleyrodidae) in Florida. *Florida Entomologist* **99**: 150-153.

KALIDAS, P. 2018. Rugose spiraling whitefly- A new pest of oil palm in India. *The Planter* **94** (1103):93-98.

MANNION, C. 2010. Rugose spiraling whitefly, a new whitefly in South Florida. Tropical Research and Education Center, University of Florida. p. 5. (14 October 2013)

MARTIN, J. H. 2004. The whiteflies of Belize (Hemiptera: Aleyrodidae) Part 1 - introduction and account of the subfamily Aleurodicinae Quaintance & Baker. *Zootaxa* **681**: 1-119.

VIVEK KUMAR, CINDY L. MCKENZIE, CATHARINE MANNION, IAN STOCKS, TREVOR SMITH, and LANCE S. OSBORNE. 2013. Rugose spiraling whitefly Aleurodicus rugioperculatus Martin (Hemiptera: Aleyrodidae). *EENY578. University of Florida, IFAS Extension.* https://edis.ifas.ufl.edu/pdffiles/IN/IN101500.pdf.