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P-host preference of Rugose spiralling whitefly, *Aleurodicus rugioperculatus* martin (Hemiptera: Aleyrodidae)

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Abstract
Host preference of an invasive insect pest, Rugose Spiralling Whitefly (RSW), *Aleurodicus rugioperculatus* was studied in coconut palm (*Cocos nucifera*) and banana (*Musa paradisica*) in Tamil Nadu. It is widely seen in Pollachi and Udumalpet blocks of Coimbatore, Pattukottai and Peravoorani blocks of Thanjavur Districts. Maximum adult spiralling whitefly of 60% was recorded in coconut while it was 40% in banana at Pollachi block of Coimbatore District. The natural parasitisation level ranged from 5% to 30% in Tamil Nadu. Maximum the pest was attacked by *Encarsia dispersa* than *Encarsia guadeloupae.* Parasitisation level was more in banana plantation than coconut.

Keywords: Rugose spiralling whitefly, host preference, parasitisation level

Introduction
Rugose spiralling whitefly (RSW), originated from Central America and its incidence was confirmed from 22 countries in Central and North America limited to Mexico, Guatemala and Florida (Evans, 2008). RSW is a highly polyphagous pest, which feeds on 118 plant species mainly occurs on banana, coconut, some edible plants, palm and fewweeds (Stocks, 2012). In coconut, RSW prefers to colonize on hybrid and dwarf varieties, especially Chowghat orange dwarf, Malaysian orange dwarf (Stocks and Hodges, 2012; Kumar *et al*., 2013). The feeding site of RSW was observed to colonize almost each and every part of the coconut palm including inflorescence, exocarp. The entire under surface of leaf lamina, flower and bunch of banana are attacked.

Materials and Methods
The following work was undertaken at Department of Plant Protection, Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli District. Extensive field survey was conducted at Pollachi and Udumalpet blocks of Tiruppur District, Peravurani and Pattukottai blocks of Thanjavur District in Tamil Nadu. The samples collected were identified as rugose spiraling whitefly on the basis of the distinguishing features of the species identified by Martin (2004). About eighty infested leaflets of coconut and eighty banana leaf samples having egg spirals were collected and observed for the number of adult emergence and natural incidence of parasitoids. The emerged adults were allowed in fresh coconut and banana leaves kept in a container to record the host (Oviposition site) preference on both coconut and banana. The number of progeny produced from two hosts was recorded. The weather data from January to April 2019 were correlated with the longevity of RSW. Statistical analysis was done using Agres-Agdata software. The data on number of RSW were convertedto square roottransformation. Percent parasitism data of RSW was subjected to arc sine transformation before analyses.

Results and Discussion
The study on oviposition preference of RSW in coconut and banana showed that the females laid creamy yellow eggs on the under surface of banana leaves in the concentric spiral fashion. The eggs hatched and the nymphswere developed by sucking the plant sap from the undersurface of the leaf, exuding honey dew uponwith *Capnodium*fungus, presenting a charcoal black appearance. The first instar crawlers were more active and preferred to feed on banana having glabrous and smooth leaf as compared to rough and hairy surface in coconut. Therefore, banana having smooth surface are attracted by females for their oviposition (Fig 1).

Table 1: Oviposition Preference of RSW on different hosts

Number of egg spirals	Banana	Coconut
2 Egg spirals	60.00 (7.78)[a]	50.00 (6.67)[a]
5 Egg spirals	40.00 (6.36)[b]	38.00 (5.66)[b]
8 Egg spirals	30.00 (5.52)[c]	25.00 (3.94)[c]
10 Egg spirals	10.00 (3.25)[d]	5.00 (2.35)[d]
SEd	2.64	2.04
CD(0.05)	6.1	4.70
CV %	9.26	8.47

Mean of three replication.

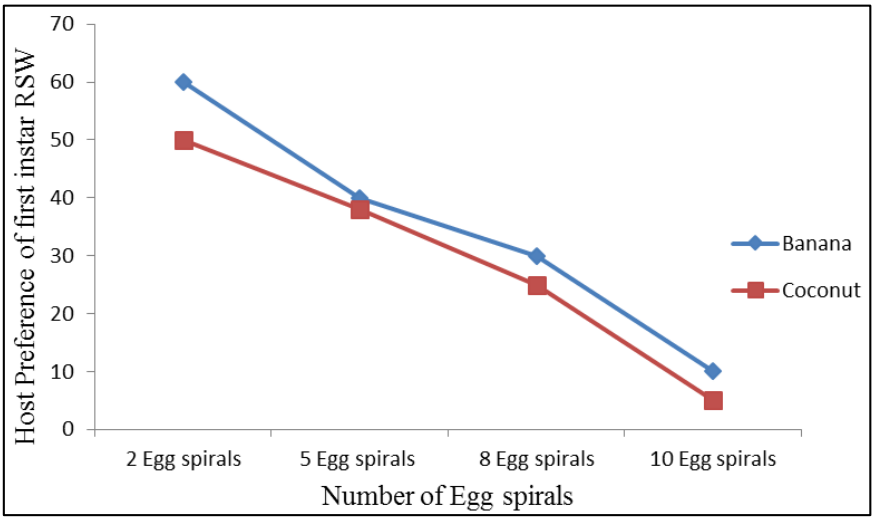

Fig 1: Figures within parentheses are square root transformed values.

Study to estimate per cent damage of rugose spiraling white fly showed that more number of adults were emerged from banana than coconut due to greater number of egg spirals in the banana, however the survival of adult RSW was more in coconut leaflets than banana. Adults preferred to rough surface of coconut than smooth surfaceof bananato complete its lifecycle. The behavior of RSW crawlers was just opposite to the behavior of adults (Fig. 2)

Table 2: Infestation of Rugose Spiraling Whitefly Adults in Banana and Coconut

Number of Leaves	Number of Adults	
	Banana	Coconut
10 Lealets	40.5(6.37)[e]	70.2(8.38)[e]
20 Lealets	60.3(7.77)[d]	98.7(9.94)[d]
30 Lealets	85.4(9.24)[c]	102.8(10.14)[c]
40 Lealets	120.5(10.98)[b]	135.7(11.65)[b]
50 Lealets	147.8(12.16)[a]	165.4(12.86)[a]
SEd	1.05	1.44
CD(0.05)	2.35	3.22

Mean of three replications;

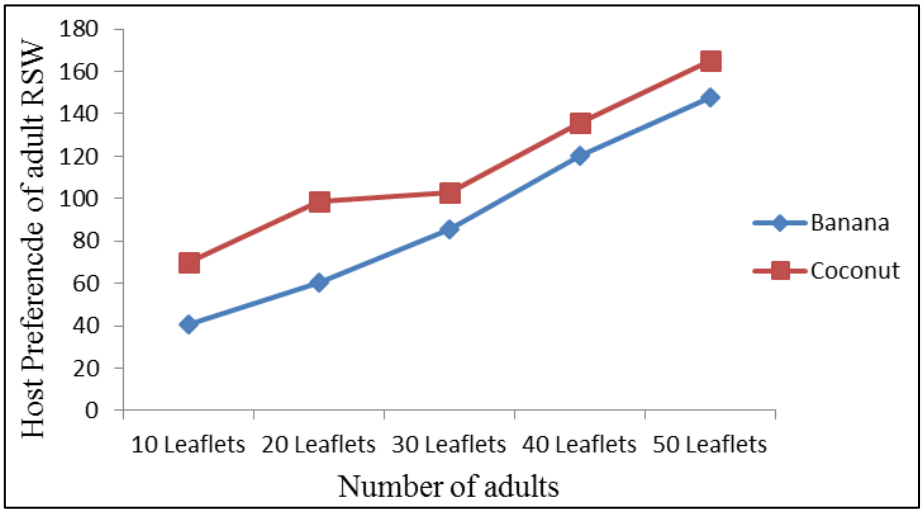

Fig 2: Figures within parentheses are square root transformed values

Martin (2004) reported that there are about 15 hosts belonging to 13 botanical families harbours the different life stages of the Rugose Spiralling Whitefly. Among them only eight supported all the life stages of the insects while the remaining hosts harboured only the egg stage indicating the unsuitability of the host. Our findings are also in line with this. Based on the number of adults, it was observed that the more damage is in the coconut than the banana. Adults prefer rough surface (coconut) than the smooth surface (Banana). But the first instar nymphs prefer smooth surface of banana for sucking the sap. Second instar of the crawler are immobile and our findings shows that RSW moves from banana to coconut during the 3rd instar and adult emerges in the coconut and shows heavy infestation in the coconut than the banana.

Rugose spiraling whitefly is unable to survive under high temperature of Tiruchirappalli district. For the well growth and establishment of Rugose spiraling whitefly, shady places are needed. This is the reason that Rugose spiraling whitefly are found usually on the undersurface of leaves. These observations matches with the observation that dwarf coconut varieties are more prone to heavy infestation than the tall trees. Tall trees receives more sunlight than the dwarf varieties. (Figure 3).

Table 3: Effect of temperature on longevity of rugose spiraling whitefly

Date of observation	Average temperature (^{0}C)	Longevity (days)
11.1.2019	33	7
24.2.2019	35	5
10.3.2019	38	3
1.4.2019	39	1

Table 4 Effect of parasitoid on host population

Parasitism level found to vary with the host plant. The parasitized eggs were observed as a change in egg colour from white to off white/creamy. More parasitism is observed in banana than coconut. Parasitism levels were found to be highly density dependent and also varied with the host plant. Percentage of parasitism is directly proportional to the percentage of nymph population irrespective of the crop plant. (Figure 4)

Table 4: Per cent Parasitism of Rugose Spiralling Whitefly on different host

Per cent parasitism	Banana	Coconut
5 %	40(39.23)^a	60(50.77)^a
10%	20(26.59)^b	15(22.79)^b
20%	20(26.57)^b	10(18.43)^{bc}
30%	10(18.43)^{bc}	5(12.92)^c
40%	5(12.92)^c	3(9.97)^c
SEd	5.59	3.14
CD(0.05)	12.47	7.01

Table 5: Host density and per cent parasitism (%) of rugose spiralling whitefly in banana

Number of Nymphs	Percentage of parasitism
20	5(12.92)^e
30	15(22.79)^d
40	25(30.00)^c
50	30(33.21)^b
60	40(39.23)^a
SEd	1.52
CD(0.05)	3.38

Table 6: Host density and per cent parasitism (%) of rugose spiralling whitefly in coconut

Number of Nymphs	Percentage of Parasitism
20	3(9.97)^e
30	10(18.43)^d
40	20(26.57)^c
50	25(30.00)^b
60	30(33.29)^a
SEd	1.03
CD(0.05)	2.30

Fig 3: Egg spirals of Rugose Spiraling Whitefly in Coconut and Banana

Fig 4: Adults of Rugose Spiraling Whitefly in Coconut and Banana

Fig 5: Infestation of RSW in Dwarf Coconut Tree

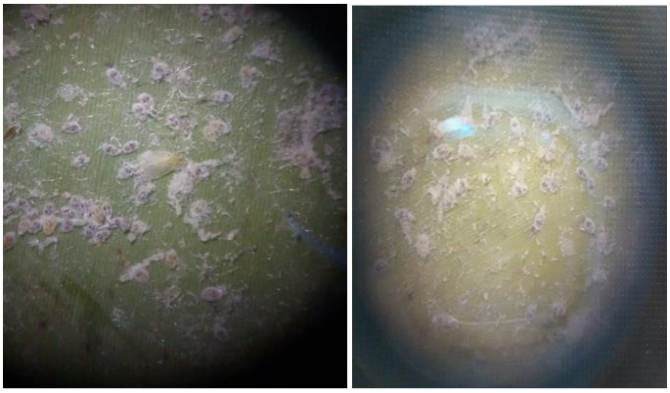

Fig 6: Parasitized nymph of Rugose Spiralling Whitefly in Coconut and Banana

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