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Surveillance, assessment of infestation, biology, host range of an invasive rugose spiraling whitefly, *Aleurodicus rugioperculatus* Martin and status of its natural enemies in Tamil Nadu

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Abstract
Systematic survey has been carried out to assess the intensity of infestation of new invasive rugose spiralling whitefly (RSWF), *Aleurodicus rugioperculatus* Martin. during the period from June 2018 to March 2020 in major coconut growing districts of Tamil Nadu *viz*., Coimbatore, Tiruppur, Dindugul, Theni, Tirunelveli, Kanniyakumari and Thanjavur. The intensity of infestation of RSWF was significantly high in Tirunelveli (70.5%) and Kanniyakumari district (75.8%) during 2018-19 and 2019-20, respectively. The natural parasitisation of RSWF by *Encarsia guadeloupae* was found to be high in Dindugul district (55.9%) and Coimbatore district (65%) during 2018-19 and 2019-20, respectively. The first, second, third and fourth instar nymphal developmental period recorded on chowghat orange dwarf coconut trees were 55, 5.2, 7.8 and 9.2 days respectively. The adult longevity was 20.5 days. The total lifecycle period of the RSWF was 54.9 days in chowghat orange dwarf coconut. A total of 41 plants belongs to 21 families were identified as host plants. In the present study, one species of Aphelinid nymphal parasitoid and 9 species of predators were recorded. Among all-natural enemies, the aphelinid parasitoid, *E. guadeloupae* plays a major role in suppressing the population of RSWF and the level of natural parasitism was found to be upto 65 per cent.

Keywords: Coconut, invasive, host and rugose spiralling whitefly

Introduction
The whitefly genus *Aleurodicus* Douglas comprising 35 species, of which only the spiralling whitefly *Aleurodicus dispersus* Russel was so far known to occur in India (Martin, 2008) [10]. The Rugose Spiraling Whitefly (RSWF) (*Aleurodicus rugioperculatus*) (Aleurodidae: Hemiptera) was described by Martin from Belize in Central America in 2004 (Martin, 2004) [11]. It invaded Florida in the United States during 2009 and Guatemala (Stocks, 2012) [17]. The RSWF is polyphagous found to feed more than 118 hosts belonging to 43 plant families of economically important crops in the United States (Francies *et al*., 2016) [6]. RSWF was noticed in a severe form in coconut palms. (Arecales: Arecaceae) in Pollachi, Coimbatore district, Tamil Nadu (10.491ºN; 76.980ºE), India during August- September, 2016 (Srinivasan *et al*., 2016; Sunraraj and Selvaraj 2017) [15, 18], Changanassery, Kottayam District, Kerala in India (Shanas *et al*., 2016) [14] and other parts of the country (Chalapathy Rao *et al*., 2018; Karthy *et al*., 2018; Chandrika Mohan *et al*, 2016) [2, 7, 3]. Both nymphs and adult whitefly suck the sap by their sucking feeding habit, siphon out coconut sap by selective feeding from the abaxial of the coconut leaflets. De-sapping by RSWF would induce stress on the palms due to removal of water and nutrients, but neither colour change nor necrosis of leaflets has been reported (Chandrika Mohan *et al*., 2016) [3]. Extensive feeding of the insect also leads to the excretion of honey dew which subsequently gets deposited on the upper surface of the leaves down beneath and also on other under storey crops. In case of severe attack, egg spirals could be located on leaf petiole as well as on tender coconuts. Honey dew excrement, being sweet and watery, attracts ants and encourages growth of the fungus, which causes disfigurement of leaves affecting the photosynthetic efficiency of the plant. With this back ground systematic surveillance has been conducted during 2018-19 and 2019-20 to assess the intensity of damage, biology, it natural enemies and host range of RSWF.

Materials and Methods

Extensive field surveys were carried out to assess the level and intensity of damage by RSWF and their host range, coconut varietal reaction and status of its natural enemies during June 2018 to March 2020 in major coconut growing districts of Tamil Nadu in *Viz*., Coimbatore, Tiruppur, Dindigul, Theni, Kanyakumari, Tirunelveli, Tiruvarur and Thanjavur. Intensity of damage and damage grade index were assessed in randomly selected in 10 trees in a garden. The surveillance were conducted in five locations in each district. The intensity of RSWF pest damage from four pest infested leaves per palm from outer/middle whorl representing four directions (No. of leaflets infested by RSWF/Total leaflets per leaf). The damage grade index was calculated using the damage rating scale for RSWF by Srinivasan *et al.* (2016) [15]. The damage grade index of *A. rugioperculatus* in different coconut varieties was assessed from 20 palms at Coconut Research Station, Aliyarnagar.

Host plant leaves infested with different stage of nymphs, puparium in the paper envelops and small adults white flies in 70% alcohol were collected as described by Dubey and David (2012) [4] along with relevant collection data. Part of the collection of host plant leaves/parts infested with immature stages and puparium were placed in rearing jar for the emergence of parasitoids. The emerging parasitoids were collected using aspirator and preserved in vials containing 70% ethanol. During the survey period, collected parasitoids and predators were identified at biosystematics laboratory, Department of Agrl. Entomology, TNAU, Coimbatore.

Biology

Biology of *A. rugioperculatus* was studied on chowghat orange dwarf coconut seedling in a shade net house at 25-30ºC and 70 to 8% relative humidity at Coconut Research Station, Aliyarnagar. Ten leaves with egg spirals were tagged with date of egg laying and the clip cages were removed after egg laying by female. The leaves with egg spirals were collected and kept in a plastic container for the emergence of nymphs from the eggs. The leaves were examined every 24 h. for the nymphal emergence. Incubation period was calculated from date of egg laying to till the nymphal emergence. Five replications were maintained.

Nymphal period

Ten leaves with first instar nymphs were tagged with date of emergence. The leaves were examined using a hand magnifier lens (40x) lens on every 24 h. to study the nymphal growth and development. The period of each instar from first to fourth instar and the total developmental period were calculated.

Pupal period and adult emergence

Ten leaves with fourth instars were tagged to study the pupal period. The leaves were examined using a hand magnifier lens (40x) on every 24 h. for the emergence of adults from the pupae. The adult were trapped using muslin cloth cages for recording adult longevity.

Adult longevity

Newly emerged male and female adults of RSWF were confined in a small leaf clip cages in the respective host plants. The adult mortality were observed daily. The longevity of adults were recorded till all the adults were dead.

Total lifecycle period

Total developmental period was calculated from date of egg laying to adult emergence.

Natural parasitization of *Encarsia guadeloupae*

The *E. guadeloupae* adult wasp parasite in early instar of RSWF nymphs and the parasitised nymphs were turn brown or black in color, adult wasp were emerged from fourth instar or pre-puparium of RSWF nymphs by making circular hole on the puape of the RSWF. The per cent parasitism was calculated based on the number puparium parasitized as against unparasitized pupae in the host leaves. During the survey, rugose spiraling whitefly infested samples were collected from the field were kept in the laboratory condition to observe the emergence of parasitoids. The number of puparial cases with and without emergence was examined and recorded under microscope to calculate the per cent natural parasitism by *E. guadeloupae*.

Host range of RSWF

During the present survey, various host plants harbouring different life stages of RSWF were documented. The present parasitisation of *E. guadeluopae* was recorded in some of the host plants.

Damage rating scale for the infestation of *A. rugioperculatus*

To assess the intensity of infestation the damage rating scale developed by Srinivasan *et al*., (2016) [15].

Adult population	Grade	Category	Infestation index
No adult population and sooty mold encrustation noticed	0	Nil	0.0
Fewer than 10 adults per leaflet; presence of sooty mold encrustation in 5- 6 lowermost fronds	1	Low	0.01 to 1.0
Ten to 20 adults per leaflet; presence of sooty mold encrustation in 10-12 fronds	2	Medium	1.01 to 2.0
More than 20 adults per leaflet; presence of sooty mold encrustation in more than 12 fronds	3	High	2.01 o 3.0

A minimum of 20 palms were randomly selected in a garden diagonally and the damage intensity was assessed. An infestation index was also arrived at using the formula given below to categorize the gardens as low/ medium/ high intensity.

$$\text{Infestation Index} = \frac{(\text{No. of palms under Scale 0 X 0}) + (\text{No. of palms under Scale 1 X 1}) + \ldots + (\text{No. of palms under Scale 3 X 3})}{\text{Total no. of palms observed}}$$

Statistical analysis

The data were analyzed using analysis of variance (ANOVA) using online OPSTAT developed by Computer Section Chaudhary Charan Singh Haryana Agricultural University (CCSHAU), Hisar, Haryana, India. Data in the form of percentages were transformed to arcsine values.

Results and Discussion

Intensity of infestation and grade index of *A. rugioperculatus*

The intensity of infestation and grade index of RSWF was recorded in Coimbatore, Tiruppur, Kanayakumari, Tirunelveli, Thanjur, Theni and Dindigul districts of Tamil Nadu, India during the period from 2018-19 and 2019-2020. The results from the table 1 revealed that the intensity of infestation of RSWF was significantly high in Tirunelveli district (70.5%) followed by in Kanniyakumari (65.5%), Theni (60.7%), Tiruppur (60.2%) and Coimbatore (54.5%) districts during 2018-19. On the other hand, during the same period the intensity of infestation was significantly low in Dindugul district (25.7%). The damage grade index was medium in Kanniykumari district (1.1) and it was low in all other districts.

Almost the same trend was also noticed during 2019-20 period. The intensity of damage was significantly high Kanniykumari and Tirunelveli districts 75.8% and 75.4% respectively, followed by other districts. The intensity of damage was significantly low in Dindugul district (20.5%). Of late The intensity of damage was slightly raised in all the districts surveyed except in Dindugul and Thanjavur district where the intensity of infestation was slightly reduced. The infestation index was low in all the districts except in Kanniyakumari district, where it was medium during 2018-19. However during 2019-20 the infestation index was also slightly increased like, intensity of infestation. Dindugul and Thanjavur districts comes under low category and Coimbatore, Tiruppur, Theni and Kanniyakumari comes under Medium category (Table 1).

Natural parasitization of RSWF by *Encarsia guadeloupae*

The percent natural parasitisation (Figure 1) was ranged from 40.6 to 65.0% in the districts surveyed. The percent parasitisation was high in Dindugul district (55.9%) and it was low in Kanniyakumari district (40.6%) during 2018-19. Whereas, during 2019-20 the parasitisation was high in Coimbatore (65%) district and low in Dindugul district (40.6%). When comparing the parasitisation during 2018-19 and 2019-20 the percent parasitisation was increased in all the districts except in Dindugul district where, the percent parasitisation was reduced from 55.9% to 40.6% (Table 2). This might be due the overall intensity of infestation and damage index was very low when compared to the other districts. However, the mean percent parasitisation was increased from 50.4 to 55.7% when compare to the mean percent parasitisation during 2018-19 and 2019-20.

Infestation index of *A. rugioperculatus* in different varieties of coconut

RSWF damage index indicating that the dwarf coconut palms were susceptible to *A. rugioperculatus* when bcompared to all tall palms. The infestation index was high in Chowghat Orange Dwarf (COD) (2.6), followed by in Malaysian Yellow Dwarf (MYD) (2.5) COD x WCT hybrid (2.5), Malaysian Green Dwarf (MGD) (2.4). Medium level of infestation was recorded in Kenthali Dwarf (KTD) (1.5). The infestation was low in WCT (0.6) and in Arasampatti tall (0.6) (Table 2). This results was supported by previous works (Srinivasan *et al*., 2016; Elango *et al*., 2019: Krishnarao and Chalapathy Rao, 2019) [15, 5, 8].

Biology of *A. rugioperculatus* on coconut

Egg stage

Eggs were smooth, elliptical, whitish to yellow in colour, 0.4 mm long translucent with a short stalk and are associated with irregular spiralling deposits of white flocculent wax surrounding each egg in circular spiraling fashion and deposited mainly on under surface of the leaves of coconut. It is having incubation period of 6.7 days (Table 3).

Nymphal developmental period

Rugose spiraling whitefly has four distinct nymphal instars. The first-instar are known as crawlers because it is the only mobile immature stage with distinct antennae hatches out of the egg, and looks for a place to begin feeding with its needle – like mouth parts used to suck plant sap. Crawlers moult into immature stages that are immobile and have oval shaped soft bodies that are cream-coloured and studded with white waxy material on the sides (Mannion, 2010 Mayer *et al.*, 2010) [9, 12]. Immature stages become more convex with the advancement of life cycle. The nymphs are light to golden yellow in colour, and will produce a dense, cottony wax as well as long, thin waxy filaments which get denser over time (Stocks and Hodges, 2012) [16]. The first, second, third and fourth instar nymphal developmental period recorded on dwarf coconut trees are 55, 5.2, 7.8 and 9.2 days respectively. The total nymphal period was 27.7 days (Table 3).

The final immature stage or fourth instar is called pseudo-puparium, which is about 1 mm in length and is used in taxonomic identification, which is morphologically distinct from other instars. It is characterized by an apically acute lingual that is exerted and slightly short of the posterior margin of the pupa and a quadrate operculum with wrinkled or ‘rugose’ texture. The marginal pores are arranged laterally and posteriorly into clusters that occur between the marginal compound pores.

Adult emergence and adult longevity

Rugose spiraling whitefly adults are about three times larger (approx. 2.5mm) than the commonly found whiteflies and are lethargic in nature. Although taxonomic identification is required for species confirmation, rugose spiraling whitefly adults can be distinguished by their large size and the presence of a pair of irregular light brown bands across the wings (Stocks and Hodges, 2012) [16]. Males have long pincer-like structures at the end of their abdomen. Adults emerged from the pupae through a 'T' shape exit slit on the dorsal surface of the pupae. The wings of newly emerged adults were clear after unfurling, later covered with a coat of white waxy powder. The eyes were dark reddish brown and each forewing had two characteristic dark spots. The adult emerged from the pseudo pupae on 34.4 days. The adult longevity range was 20.5 days. The total developmental period of the RSWF was 54.9 days (Table 3).

Occurrence of natural enemies against *A. rugioperculatus* in Tamil Nadu condition.

In the present study, one species of Aphelinid nymphal parasitoid and 9 species of predator’s family Coccinellidae and Chrysopidae were observed in the RSWF affected coconut gardens. The *Chrysoperla zastrowisillem* and *Mallada desjardinsi* from Chrysophidae and six coccinellid predators were recorded. The red ant *Oecophyllas maragdina* was also recorded. Among the all-natural enemies, the aphelinid parasitoid, *E. guadeloupae* plays a major role in

managing the new invasive pest (Table 4). The *E. guadeloupae* parasitization range from 20-60% in coconut crop ecosystem followed by 40-70% in banana crop ecosystem (Srinivasan *et al*., 2016 and Selvaraj *et al*., 2016) [15, 13]

Studies on the host plant range of Rugose Spiraling White fly

RSWF can assail 118 plant species from 43 families; comprise a combination of edibles, ornamentals, palms, weeds, as well as native and invasive plant species (Mannion, 2010; Stocks, 2012 and Francis *et al.*, 2016) [9, 17, 6]. Surveillance during June 2018 to March 2020, recorded several host plants harbored the different life stages of RSWF. Mostly, RSWF damage was confined to the coconut, banana, custard apple and guava with high prone intensity. The hosts presented in the table 5 were supported the all life stages (Egg to Adult) of RSWF. Among host plants, the parasitisation by *E. guadeloupae* was high (80. 5%) in coconut followed by in banana (65.5%) and custard apple (60.8%). The most preferred hosts were banana, custard apple, guava and *Cana indica* along with coconut. Besides this interestingly, some plant species listed in the table 6 was supported only some life stages of RSWF. Arecanut, Neem, Parthenium, Mango, Tapioca, Pepper, Ornamental Creeper and Sapota recorded only the egg stages of the pest. As many as 40 hosts belonging to 21 families were identified as alternate host plants with occurrence of different life stages of the RSWF.

A total of 17 plant species under 11 families were recorded as preferred host range of *A. rugioperculatus* in Kerala (Shanas *et al*., 2016) [14]. On the other hand, Mannion, (2010) [9] reported ample array of host plants for rugose spiralling whitefly which includes palms, woody ornamentals and fruits. Francis *et al.* 2016 [6] recorded the hosts from 2009 to 2012, revealed that 22% of RSWF affected hosts were palm species, 16% were gumbo limbo, 10% *Calophyllum* spp., 9% avocado, 4% black olive, and 3% mango varieties. Shanas *et al*., 2016 reported a whole of 17 plant species under 11 families as preferred hosts of *A. rugioperculatus* where as Srinivasan *et al.* 2016 [15] recorded several preferred hosts (coconut, banana, okra, sapota, custard apple, citrus, nutmeg, hibiscus and guava) and alternate hosts but they cannot support all life stages (arecanut, mango, cassava, parthenium and pepper) in Tamil Nadu. The current observations are in line with earlier workers (Francis *et al.*, 2016; Srinivasan *et al.*, 2016; Chakravarthy *et al.*, 2017; Karthy *et al*., 2018) [6, 15, 1, 7].

Table 1: Intensity of infestation and grade index of *A. rugioperculatus* in different districts of Tamil Nadu

Districts	2018-19		2019-20	
	Intensity of infestation (%)	Infestation index	Intensity of infestation (%)	Infestation index
Coimbatore	54.5 (47.6)	1.0 (Low)	60.7 (51.2)	1.2 (Medium)
Tiruppur	60.2 (50.9)	1.0 (Low)	68.7 (56.0)	1.3 (Medium)
Dindugul	25.7 (29.9)	0.9 (Low)	20.5 (26.0)	0.8 (Low)
Theni	60.7 (51.2)	0.9 (Low)	70.5 (57.2)	1.3 (Medium)
Tirunelveli	70.5 (57.2)	1.0 (Low)	75.4 (60.4)	1.0 (Low)
Kanniyakumari	65.5 (54.3)	1.1 (Medium)	75.8 (61.1)	1.5 (Medium)
Thanjavur	30.5 (33.5)	0.9(Low)	23.7 (29.1)	0.7 (Low)
C.D.	6.6	N/A	7.3	0.4
SE(m)	2.3	0.1	2.5	0.1
SE(d)	3.2	0.1	3.5	0.2
C.V.	11.0	19.4	11.5	27.0

*Mean of five locations; significant at 1%; figures in parentheses are arcsine transformed values

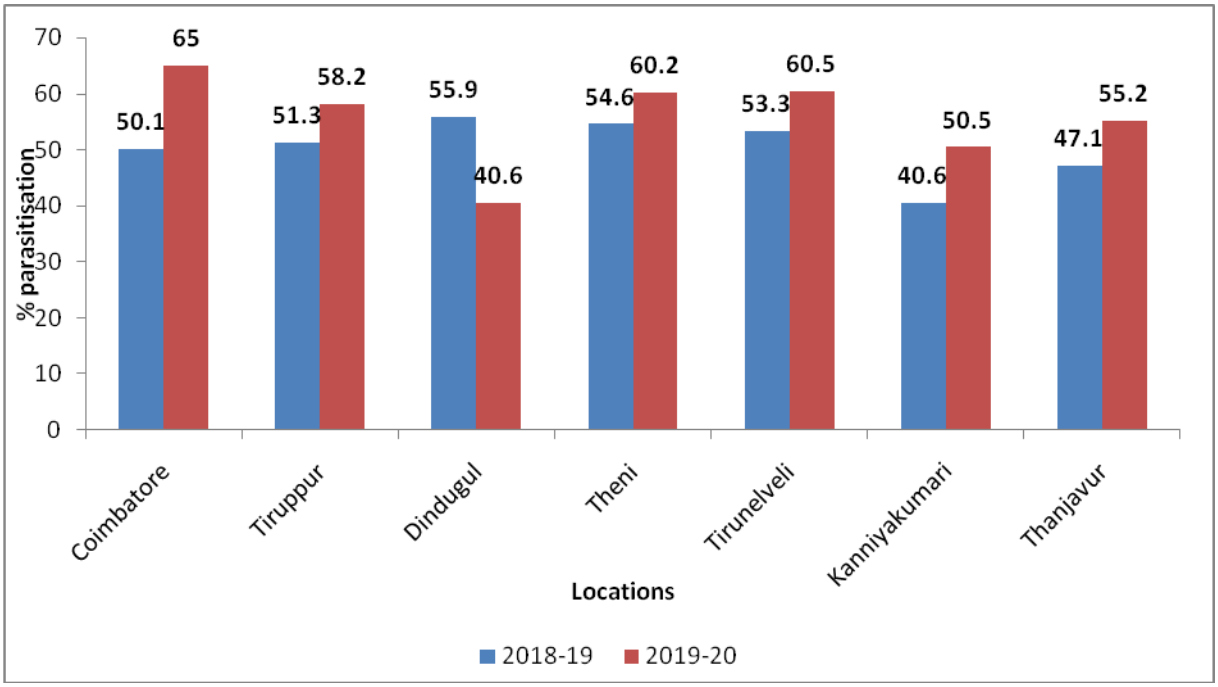

Fig 1: Natural parasitization of RSWF by *E. guadeloupae* in Tamil Nadu.

Table 2: Damage grade index of *A. rugioperculatus* in different coconut varieties

Coconut varieties	No. of palms under the Grade				Infestation index*	Category
	0	1	2	3		
Chowghat Orange Dwarf (COD)	0	2	5	13	2.6	High
West Coast Tall (WCT)	10	9	1	0	0.6	Low
Malaysian Green Dwarf (MGD)	0	2	3	10	2.4	High
Malaysian Yellow Dwarf (MYD)	0	0	1	7	2.5	High
Kenthali Dwarf(KTD)	2	11	9	0	1.5	Medium
Arasampatti Tall(ART 1)	9	10	1	0	0.6	Low
COD× WCT hybrid	0	3	5	12	2.5	High

*Infestation index were recorded from 20 palms in each variety

Table 3: Biology of RSWF in coconut

Life stages	Duration (Days)
Egg	6.7
I instar nymphs	5.5
II instar nymphs	5.2
III instar nymphs	7.8
IV instar nymphs	9.2
Total nymphal period	**27. 7**
Adult emergence/ longevity	20.5
Total developmental period	54.9
C.D.	0.503
SE(m)	0.173
SE(d)	0.244
C.V.	2.461

*Mean of five replication

Table 4: Natural enemies recoded feeding on *A. rugioperculatus* in Tamil Nadu

Parasitoid/ predator	Name of the predator/ parasitoid	Parasitoid/ predator	Family: Order
I. Chrysopids	*Chrysoperla zastrowisillem* (Esben- Petersen)	Predator	Neuroptera: Chrysopidae
	Mallada desjardinsi (Navas)	Predator	Neuroptera: Chrysopidae
II. Coccinellids	*Chilocorus nigrita* (Fabricius)	Predator	Coleoptera: Coccinellidae
	Coccinella transversalis (Fabricius)	Predator	Coleoptera: Coccinellidae
	Menochilus sexmaculatus (Fabricius)	Predator	Coleoptera: Coccinellidae
	Propylea dissecta (Mulsant)	Predator	Coleoptera: Coccinellidae
	Scymnus nubilis(Mulsant)	Predator	Coleoptera: Coccinellidae
	Scymnus saciformis (Mots.)	Predator	Coleoptera: Coccinellidae
III. Red ant	*Oecophyllas maragdina* (Fabricius)	**Predator**	Hymenoptera: Formicidae
Parasitoid			
I. Aphelinid	*Encarsia guadeloupae* (Viggiani)	Parasitoid	Hymenoptera: Aphelinidae

Table 5: level of parasitisation in different host plants

S. No	Common Name	Scientific name	Family	Parasitisation	Life stage		
					Egg	Nymph	Adult
1.	Coconut	*Cocos nucifera* L.	Arecaceae	80.5	+	+	+
2.	Banana	*Musa paradisiaca* L.	Musaceae	65.5	+	+	+
3.	Custard apple	*Annonas quamosa* L.	Annonaceae	60.8	+	+	+
4.	Guava	*Psidium guajava* L.	Myrtaceae	48.5	+	+	+
5.	Indian shot, African arrowroot,	*Cana indica*,	Cannaceae	50.2	+	+	+
6.	Bhendi	*Abelmoschus esculentus* (L.)	Malvaceae	45.3	+	+	+
7.	Sapota	*Achras zapota* (L.)	Sapotaceae	35.2	+	+	+
8.	Citrus	*Citrus limon* (L.)	Rutaceae	35.2	+	+	+
9.	Hibiscus	*Hibiscus rosa-sinensis* L.	Malvaceae	40.5	+	+	+
10.	Cacao	Theobroma cacao	Malvaceae	30.5	+	+	+
11.	Betel vine	*Piper betle*	Piperaceae	40.2	+	+	+
12.	Nutmeg	*Myristica fragrans* (Houtt.)	Myristicaceae	42.2	+	+	+
13.	Oil palm	*Elaeis guineensis*	Arecaceae	35.3	+	+	+

+ present

Table 6: Host plants recorded for RWS in Tamil Nadu

S. No	Common Name	Scientific name	Family	Life stage		
				Egg	Nymph	Adult
1.	Arecanut	*Areca catechu* L.	Arecaceae	+	-	-
2.	Tapioca	Manihot esculanta Crantz	Euphorbiaceae	+	-	-
3.	Neem	*Azadirachta indica* A. Juss.	Meliaceae	+	-	-
4.	Physic nut	*Jatropha curcas* L.	Euphorbiaceae	+	-	-
5.	Mango	*Mangifera indica* L.	Anacardiaceae	+	-	-
6.	Cassava	*Manihot esculenta* Crantz.	Euphorbiaceae	+	-	-
7.	Congress grass	*Parthenium hysterophorus* L.	Asteraceae	+	-	-
8.	Pepper	*Piper nigrum* L.	Piperaceae	+	-	-
9.	Night-flowering jasmine/ parijat	*Nyctanthes arbor-tristis*,	Oleaceae	+	-	-
10.	Sandalwood	*Santalum album*	Santalaceae	+	-	-
11.	Ixora	*Ixora coccinea*	Rubiaceae	+	-	-
12.	Mozhakani / Orange climber	*Toddalia asiatica*	Rutaceae	+	-	-
13.	Spanish cherry or medlar,or bullet wood	*Mimusopselengi*	Sapotaceae	+	-	-
14.	Breadfruit	*Artocarpus altilis*	Moraceae	+	-	-
15.	Nanthiavattai / crape jasmine	*Tabernaemontana divaricate*	Apocynaceae	+	-	-
16.	Yam	*Dioscorea alata*	Dioscoreaceae	+	-	-
17.	Ram seetha tree/ Mulseetha/ Soursop fruit	*Annona muricata*	Annonaceae	+	-	-
18.	Champak	*Magnolia champaca*,	Magnoliaceae	+	-	-
19.	Milk weed	*Calotropis gigantean*	Asclepiadaceae	+	-	-
20.	Candle bush	*Sennaalata*	Fabaceae	+	-	-
21.	CO 1 – Cumbu Napier Fodder	*Pennisetum purpureum*	Poaceae	+	-	-
22.	Crotons	*Codiaeum variegatum*	Euphorbiaceae.	+	-	-
23.	Arabian jasmine	*Jasminum sambac*	Oleaceae	+	-	-
24.	Indian goose berry/ Amla	*Phyllanthus emblica*	Phyllanthaceae	+	-	-
25.	Manoranjitham/ tail grape	*Artabotry shexapetalus*	Annonaceae	+	-	-
26.	Pavalamalli/ Star jasmine	*Jasminum multiflorum*	Oleaceae	+	-	-
27	Asian pigeon wings	*Clitoria ternate*	Fabaceae	+	-	-
28	Jack fruit	*Artocarpus heterophyllus*	Moraceae	+	-	-

+ present, - absent

Conclusion

Rugose spiralling whitefly is a notorius pest on coconut and invaded in India. Wide spread infestation has been noticed in all the coconut growing districts of Tamil Nadu. It caused huge crisis to farmers due to its polyphagous nature. Regular surveillance has to be undertaken to identify hot spot areas of the rugose spiralling whitefly infestation and awareness has to be created among all the coconut farmers for the management and to prevent faster spread of this pest by strengthening the quarantine measures is the need of the hour. Aphelinid parasitoid, *E. guadeloupae* plays a major role in suppressing the population of RSWF apart from several predators. Conservation of these biological control agents will help us to keep this pest under check.

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