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New record of rugose Spiraling Whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) on different host plants in India and Gujarat

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Abstract

First record of occurrence and infestation of Rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) on coconut was recently reported from the villages of Mangrol and Veraval in the Saurashtra region of Gujarat state. However, during the survey, this invasive pest is also first time observed on Sapota, Mango, Banana, Custard Apple, Guava, Curry tree, Papaya, White wax jambu, Indian Almond, Sorghum and Groundnut in Gujarat state. Among these hosts, the RSW is recorded firstly on Custard Apple, Curry tree, Sorghum and Groundnut in India. The population of RSW was observed severely on both the leaves and fruits of all the hosts. The samples of nymphs and adults of RSW were collected from all the infested hosts and brought to the Biocontrol Research Laboratory, Department of Entomology, Junagadh Agricultural University, Junagadh for further identification. On the basis of spiral pattern of egg laying, morphology and molecular identification, the pest confirmed as Rugose Spiraling Whitefly (RSW), *Aleurodicus rugioperculatus* Martin. This is the first confirmed report of this pest on four hosts in India and eight hosts in Gujarat state.

Keywords: *Aleurodicus rugioperculatus*, Gujarat, host plants, invasive, spiraling whitefly

Introduction

Whiteflies are polyphagous pest belong to a single superfamily, Aleyrodoidea, within the suborder Sternorrhyncha of order Hemiptera. The whitefly genus *Aleurodicus* Douglas involves 35 different species, of which only the spiraling whitefly *Aleurodicus disperses* Russel was so far known to damaging plants in India [1]. This perilous invasive pest was firstly reported from coconut (*Cocos nucifera* L.) at Pollachi, Tamil Nadu in India during August, 2016 [2]. In Gujarat, the pest was firstly reported by Dr. D. M. Jethva and his associates from Husenabad village of Mangrol taluka of Junagadh district from coconut plantation [3]. *A. rugioperculatus* was originated from Belize [4] and belongs to the niveus species-group of *Aleurodicus* [5]. It is naturally distributed in Belize, Guatemala, Mexico [5] and subsequently, it has spread to 22 other countries in Central and South America, including Florida, USA. The RSW is highly polyphagous pest having around 118 hosts belonging to 43 different families which includes economically important crops of the United States [6]. The occurrence of this pest was confirmed during the survey in the Mangrol taluka of Junagadh district as well as Gir-Somnath district.

Occurrence of Rugose Spiraling Whitefly in India and Gujarat state

At first Rugose Spiraling Whitefly was observed in villages of Mangrol taluka of Junagadh district on coconut plantation. Based on typical characteristics of RSW, sample was collected from different location and brought to the Biocontrol Research Laboratory, Department of Entomology, Junagadh Agricultural University, Junagadh for morphological identification which was confirmed by senior author and Associate Research Scientist Dr. D M Jethva as Rugose Spiraling Whitefly based on characteristics described by Martin [5]. The incidence of RSW was confirmed after the survey in Saurashtra region of Gujarat state, while it was found severe in the Mangrol taluka of Junagadh district as well as Gir-Somnath district. The pest was detected in all over coastal belt from Mangrol to Veraval and neighbouring villages. During the survey, this pest was also observed on different host plants and their samples were collected for further identification.

A total of 12 different hosts (Table 1) were identified during survey. Among them, eight are firstly identified as host plant of RSW in Gujarat, while host plants like Groundnut, Sorghum, Curry tree and Custard apple are firstly recorded as preferred host of RSW in India. As higher economic importance of groundnut crop mainly in Saurashtra region of Gujarat state, the concern about occurrence of RSW has raised the risk of becoming major pest.

However, this dangerous invasive pest was firstly reported on coconut (*Cocos nucifera* L.) at Pollachi, Tamil Nadu in India during August, 2016^[7]. The RSW affected 22% palm species, 16 % gumbo limbo, 10 % on *Callophyllum* spp., 9 % avocado, 3 % mango and within the Areaceae (palms), 44% coconut and total of 17 plant species under 11 families were recorded as preferred hosts of *A. rugioperculatus*^[8].

Table 1: Host plants on which *A. rugioperculatus* reported for the first time in India and Gujarat state

Sr. No	Common Name	Scientific Name	Family
1.	Coconut	<i>Cocos nucifera</i> L.	Areaceae
2.	Sapota	<i>Manilkara zapota</i> L.	Sapotaceae
3.	Mango	<i>Mangifera indica</i> L.	Anacardiaceae
4.	Banana	<i>Musa</i> sp.	Musaceae
5.	Custard Apple*	<i>Annona reticulata</i>	Annonaceae
6.	Guava	<i>Psidium guajava</i> L.	Myrtaceae
7.	Curry tree*	<i>Murraya koenigii</i> L.	Rutaceae
8.	Papaya	<i>Carica papaya</i> L.	Caricaceae
9.	White wax jambu	<i>Syzygium samarangense</i>	Myrtaceae
10.	Indian Almond	<i>Terminalia catappa</i> L.	Combretaceae
11.	Sorghum*	<i>Sorghum bicolor</i>	Poaceae
12.	Groundnut*	<i>Arachis hypogaea</i>	Leguminosae

*Hosts on which *A. rugioperculatus* has occurred for the first time in India

Biology

The females lay smooth, elliptical, whitish to yellow, translucent eggs on underside of the leaves along with fruits in concentric circular or spiral pattern which was covered with the white wax like material (Fig. 1A).

Rugose spiralling whitefly has 5 developmental stages. The first instar known as the crawler stage (because it is the only mobile immature stage) hatches out of the egg, and looks for a place to begin feeding on plant sap with its needle-like mouth parts. Crawlers moult into immature stages that are immobile, oval and flat initially but become more convex with the headway of its life cycle^[9]. Nymphs were observed and they are light to golden yellow in colour in a concentrate manner fully covered with the waxy material and wax

filaments are thin which may become denser after time lapse (Fig. 1B).

Woolly wax covered puparia was observed in the colonies under the leaves. Puparia of *A. rugioperculatus* are 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^[1].

Adults are congregated with covering whole leaves and found to suck the sap under surface of leaves/leaflets (Fig. 1C). They are larger in size (about three times) as compared to commonly found whiteflies. rugose spiralling whitefly adults can be distinguished by their large size and the presence of a pair of irregular light brown bands across the wings^[5].

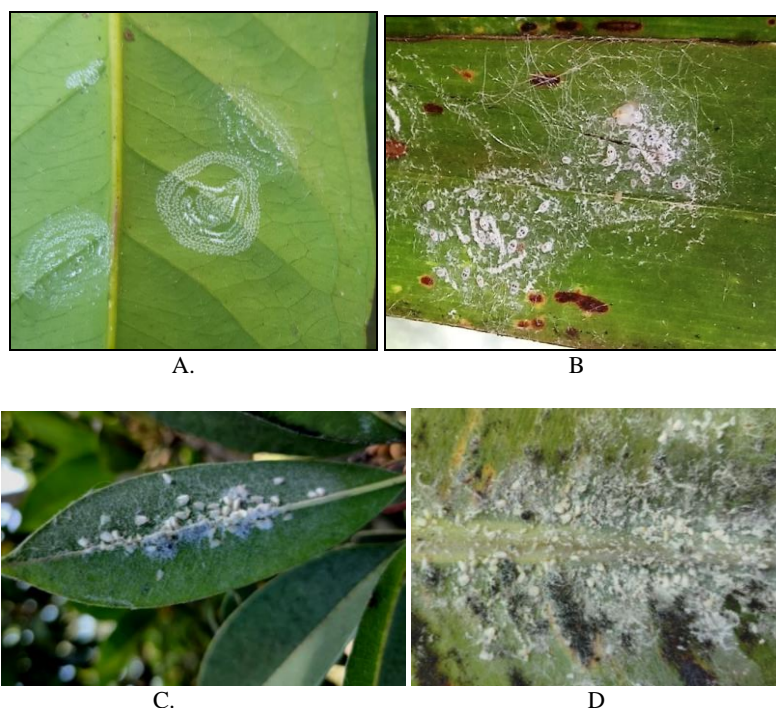


Fig 1: Life stages of RSW: A) Eggs B) Nymphs C) Adults

Severity of Rugose Spiraling Whitefly

The invasive pest *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae), commonly known as the rugose spiraling whitefly (RSW) was firstly observed in the 12 different host plants after reported in coconut from Saurashtra region of Gujarat. The characteristics of RSW were shown same as observed in the coconut palm. The females laid the eggs in a circular or spiral fashion usually on the abaxial

surface of leaves and the eggs were covered with wax. The hosts which were observed having the nymphs and adults congregated on the leaves of plants, which resulted into abundant honeydew due to their feeding. The leaves were became black due to the honeydew and turns into the development of sooty mould. The following stages were observed during the survey for the confirmed report of this invasive pest in all these hosts.



Fig 2: Occurance of Rugose Spiraling Whitefly, *A. rugioperculatus* in different hosts A. Coconut, B. Sapota, C. Maango, D. Banana, E. Custard Apple, F. Guava, G. Curry tree, H. Papaya, I. White wax jambu, J. Indian Almond, K. Sorghum, L. Groundnut

Molecular identification

The molecular characterization of RSW was carried out at SLS Research Pvt. Ltd., Surat. DNA sequencing reaction of PCR amplicon was carried out with primer HCOI and LCOI using BDT v3.1 cycle sequencing kit on ABI 3730xl Genetic Analyzer. The gene sequence was used to carry out BLAST with the database of NCBI Genbank database. Based on maximum identity score, first ten sequences were selected for alignment analysis using software programs. The analysis results over search confirmed the target species belongs to *A. rugioeperculatus*.

Conclusion

As the invasive pest, *A. rugioeperculatus* has been already reported in coconut with causing significant damage in Saurashtra region of Gujarat state. But recently it has been seen that this pest invaded into the different twelve host plants. After the morphological and molecular identification of this pest, this is the first confirmed report of *A. rugioeperculatus* on Custard Apple, Curry tree, Sorghum and Groundnut in India and first time observed in Sapota, Mango, Banana, Guava, Papaya, White wax jambu and Indian Almond in Gujarat state. This evident the alarming situation to the growers of these crops as this pest may spread to other growing areas of Gujarat state.

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