



Review Article

RUGOSE SPIRALLING WHITEFLY (RSW): AN INVASIVE PEST IN INDIA

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Abstract: In Gujarat, the rugose spiralling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Sternorrhyncha: Aleurodidae) is reported during the year 2019. It is an invasive and polyphagous pest that attacks a different host including coconut, banana, sapota, mango, custard apple, guava, curry tree, papaya, white wax jambu, Indian almond, curry tree, sorghum, groundnut etc. It has needle-like mouth parts and sucks cell sap from leaves. It causes stress to the plant by sucking nutrients and water. It excretes a sticky, glistening liquid substance (honeydew) on leaves which provides an excellent substrate for growth of sooty molds that reduces the photosynthesis activity. Management through cultural, mechanical, biological and chemical methods have been found effective against this pest.

Keywords: Invasive species, Rugose spiralling whitefly, Host range, Mark of identification, Biology, Nature of damage

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Introduction

The rugose spiralling whitefly (RSW), *Aleurodicus rugioperculatus* Martin is tiny moth. Female adult lay eggs in a concentric circular or spiral pattern, which is covered with white waxy matter. Corrugations/rugosity is present on the surface of pupal operculum that's why it is called as Rugose Spiralling Whitefly. It is an invasive and polyphagous pest that attacks a wide range of host plants and found to feed on 118 plant species which include edible plants, palms, fruits, woody ornamentals and weeds [1]. Division of Plant Industry, Florida had recorded host and found that RSW affect 44% coconut, 22% palm species, 16% gumbo limbo, 10% on *Callophyllum* spp., 9% avocado and 3% mango.

History and distribution

It was originally described from Belize in 2004 on coconut [2] and reported from Miami-Dade County, Florida, United States of America on gumbo limbo in 2009. In India, RSW was first reported from Kottayam, Kerala on coconut farm during July-August, 2016. It has also observed in several coconut farms in the Pollachi area of Coimbatore district [3]. In Gujarat, RSW was first reported from Saurashtra region in coconut farm during August, 2019 [4].

Host range

It is a polyphagous pest feeding on a wide range of host plants including palms, ornamentals and fruits [5]. Eleven families and 17 host plant species were recorded as preferred hosts of RSW in Kerala [6]. Coconut and banana were found the most preferred hosts. A total of 12 plant species (sapota, mango, banana, custard apple, guava, curry tree, papaya, white wax jambu, Indian almond, sorghum and groundnut) were recorded as preferred hosts of RSW in Gujarat [7].

Marks of identification

Females lay eggs on the underside of leaves in a concentric circular or spiral pattern. Eggs are elliptical and creamy white to dark yellow in color. It has 5 developmental stages.

The first instar of RSW known as the crawler stage because this instar is mobile immature stage. Nymphs are about 1.1-1.5 mm long. The nymphs are light to golden yellow in color and produce a dense, cottony wax as well as long, thin waxy filaments. Nymphal instars are oval and flat initially but become more convex with the progression of its life cycle. Adults are about three times larger 2.5 mm, lethargic in nature and the presence of a pair of irregular light brown bands across the wings [8]. The puparium is used for taxonomic identification. of RSW. Adult Females are larger than male. Males have long pincer-like structures at the end of their abdomen. Pincer is used for defense against predators and also play an important role for mating ritual of male and female.

Life cycle (Biology)

In coconut, Female eggs deposited mainly on under surface of the leaves. Eggs were smooth, elliptical, whitish to yellow and translucent. Eggs were 0.3426 ± 0.0027 mm in length. First instar nymphs were 0.3730 ± 0.0068 mm in length, 0.2132 ± 0.0045 mm in width and mean duration was 5.80 ± 0.78 days. Second instar nymphs were 0.3839 ± 0.0475 mm in length, 0.2387 ± 0.0203 mm in width and mean duration was 5.40 ± 0.50 days. Third instar nymphs were 0.6227 ± 0.0518 mm in length, 0.4148 ± 0.0494 mm in width and mean duration was 8.37 ± 0.89 days. Fourth instar nymphs were 0.6667 ± 0.0804 mm in length, 0.4317 ± 0.0334 mm in width and mean duration was 10.90 ± 0.78 days. The adult longevity was 22.7 ± 3.48 days. Total life period of the RSW was 59.00 ± 3.20 days [9].

According to Alagar et al., 2020 [10], eggs were laid on the underside of leaves in a concentric circular or spiral pattern, covered with white waxy matter and incubation period was of 6.7 days. It has five developmental stages. The total nymphal period was 27.7 days. Crawlers moult into immature stages that were immobile. Adult longevity was 20.5 days. Total developmental period of the RSW was 54.9 days.

Nature of damage

It possesses a needle-like mouth parts and sucks cell sap from leaves.

It causes stress to the plant by sucking nutrients and water. It excretes a sticky, glistening liquid substance (honeydew) on leaves which provides an excellent substrate for growth of sooty molds. The layers of sooty molds on leaves may disrupt the photosynthesis process in the host leading to physiological disorders [11]. Sometime affected palms experienced immature nut fall, stunted vegetative and reproductive growth and palms severely affected ceased nut production [12].

Management

Cultural control

Jalali *et al.* (2018) [13] concluded that coconut variety west coast tall was found resistance to RSW with minimum percent palm infestation (9.5%). Elango *et al.* (2019) [14] resulted that west coast tall and arasampatti tall were resistance to RSW with low infestation index 0.64 and 0.76, respectively. Alagar *et al.* (2020) concluded that tall coconut palms were resistance to RSW with low infestation index as compared to dwarf palms.

Mechanical control

In coconut farm, placing yellow sticky traps @ 10/acre smeared with castor oil/ horticultural mineral oil can be used for monitoring the population [15]. Jalali *et al.* (2018) observed that palms where yellow sticky traps were placed on tree trunks, there was low adult, pupae and spirals of rugose whitefly as compared to without sticky traps.

Biological control

Boughton *et al.* (2015) [16] studied biological control of RSW by *Encarsia noyesi* in cage trial and found that *E. noyesi* parasitized 2nd, 3rd and 4th instar nymphs of RSW. Parasitism reduced whitefly survival to adult less than 10% in high wasp treatment. High wasp treatment had reduced the RSW progeny per plant. Kumar *et al.* (2015) [17] concluded that combination of talus and PFR was found to be the most effective treatment for control of RSW eggs, early instar and late instar on white bird of paradise with 83-100 percent reduction during the 6 weeks period. Selvaraj *et al.* (2016) [18] recorded that 20–60% parasitism of *A. rugioperculatus* by *E. guadeloupeae* on coconut. Poorani and Thanigairaj (2017) [19] reported that *Encarsia dispersa* Polaszek and *E. guadeloupeae* parasitizing *A. rugioperculatus* and found that 40 to 70% parasitisation was recorded on banana alone by *E. guadeloupeae*. Natural enemies of RSW to were *E. guadeloupeae* Viggiani, *E. noyesi*, *Alueroctonus vittatus*, *Nephaspis oculata*. Among these, *E. guadeloupeae* was found potential biocontrol agent against RSW as it causes 50 to 60 % natural parasitisation. Elango *et al.* (2019) studied foraging potential of *Chrysoperla zastrowi* Sillemi on *A. rugioperculatus* of coconut and observed that third instar grub of *C. zastrowi* consumed maximum of 313.20 whiteflies followed by second and first instar grub. Elango and Nelson (2020) observed maximum mean mortality of 39.17% of RSW coconut after the application of *Lecanicillium lecanii*. Pradhan *et al.* (2020) [20] studied efficacy of bio-agent and insecticides against *A. rugioperculatus* under field conditions and concluded that *Isaria fumosorosea* caused cent percent mortality.

Botanical control

Elango and Nelson (2020) study toxicity of botanicals against nymphs and adults of *A. rugioperculatus* in coconut by direct spray and dry film method. They observed that maximum mean mortality of nymphs (56.67%) and adults (51.11%) of RSW coconut were recorded in Azadirachtin 5 percent treatment which was followed by Azadirachtin 1 percent.

Chemical control

Trunk injection treatment of imidacloprid was found effective in lowering whitefly population as compared to the drench and control treatments on gumbo limbo [21]. Pradhan *et al.* (2020) studied the efficacy of insecticides against early and late instar nymphs of *A. rugioperculatus* in vitro conditions and resulted that 3 day after treatment, all the treatments (azadirachtin 10000 ppm, thiomethoxam 25WG, dinotefuran, 20SG, pymetrozine 50WG, profenophos 50EC) were significantly effective except water and untreated control.

IPM

Rao and Rao (2019) concluded yellow sticky traps + water spray + azadirachtin 10000 ppm @ 1 ml along with detergent powder @ 10 g + release of aphelinidae parasitoid, *E. guadeloupeae* was found more effective against RSW infesting coconut palm.

Conclusion

The rugose spiraling whitefly (RSW) is a polyphagous insect pest that has caused significant damage. Installation of yellow sticky trap is important tool for monitoring and trapping the adult whitefly. Management through cultural, mechanical, biological and chemical methods have been found effective. *E. guadeloupeae*, *C. zastrowi* and *I. fumosorosea* are effective biocontrol agents

Application of research: Study of invasive insect pest. Neem based formulations are effective that minimizing the population build up. Trunk injection with systemic insecticide imidacloprid is effective against RSW in gumbo limbo.

Research Category: Agricultural Entomology

Abbreviations: RSW: rugose spiraling whitefly, WG: Water dispersible granules SG: Water soluble granules, EC: Emulsifiable concentrate

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Cultivar / Variety / Breed name: Sorghum, Groundnut

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