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STUDIES ON COCONUT VARIETAL PREFERENCE OF EXOTIC WHITE FLY-RUGOSE SPIRALLING WHITEFLY (RSW), *ALEURODICUS RUGIOPERCULATUS* MARTIN ON COCONUT

Mohitha Reddy J.[1]*, Chalapathi Rao N.B.V.[3], Viji C.P.[1], Anoosha V.[2], Narasimha Rao S.[1] and V. Govardhan Rao[2]

[1]College of Horticulture, Dr. YSR Horticultural University, Venkataramanagudem, West Godavari, Andhra Pradesh, 534101, India
[2]Dr. YSR Horticultural University, HRS-Ambajieta, Andhra Pradesh, 533221, India
[3]Chief Public Representative Officer and University Head Department of Entomology. Dr. YSR Horticultural University, Admin Building,Venkataramanagudem, West Godavari, Andhra Pradesh, 534101, India
*Corresponding author Email: mohithavarun@gmail.com
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ABSTRACT

Coconut breeding for biotic and abiotic stress is vital and screening of coconut varieties against whitefly complex is important to know the tolerance levels which could be helpful in breeding programs for developing resistant varieties against whitefly complex. The present study was conducted at HRS, Ambajipeta on ten different cultivars of coconut. Among them Gauthami Ganga (dwarf) recorded highest incidence (87.53%) and intensity (92.79%) while lowest incidence of (51.11%) and intensity (69.20%) was recorded in the variety Kera Bastar (Tall). The mean population count of different stages of RSW and BNW per leaflet was recorded maximum in Gautami Ganga (dwarf) with 15.24 spirals, 52.13 nymphs, 30.76 pupa, and 19.46 adults of RSW. Percent parasitazation by *E. guadeloupae* was observed more in Gauthami Ganga on pupa of RSW.
Keywords : Coconut, varieties, RSW, parasitazation

Introduction

Coconut (*Cocos nucifera* L.), a member of the family *Palmae* (Arecaceae), is widely recognized as a "Kalpavriksha" or the divine tree, owing to its versatile uses in nutrition, medicine, cosmetics, and industry. Every part of the coconut palm is utilized in daily life, especially in regions where it is cultivated extensively. Key by-products such as tender coconut water, copra, oil and coir pith contribute significantly to both rural livelihoods and the agro-economy.

India stands as the third-largest coconut producer in the world, with an annual output of over 21 billion nuts from 2.16 million hectares, averaging 2,1274 nuts per hectare (APCC, 2024). The cultivation is largely concentrated in the southern states, with Andhra Pradesh alone accounting for 1,07,370 hectares and a productivity of 10,894 nuts per hectare (CDB, 2024).

In the context of increasing global trade, the unintentional introduction of invasive pests has emerged as a major concern for coconut farming. One such pest is the Rugose spiralling whitefly (*Aleurodicus rugioperculatus* Martin), first reported in Tamil Nadu and Andhra Pradesh (Sundararaj & Selvaraj, 2016; Chalapathirao *et al.,* 2018). Since then, it has spread rapidly, causing significant yield and quality losses and other whitefly species like *Paraleyrodes* have also been reported in coconut plantations in Kerala and Karnataka (Josephrajkumar *et al.,* 2019; Vidya *et al.,* 2019).

Given the increasing incidence and threat of whitefly infestations, there is an urgent need to develop coconut varieties that can tolerate or resist such pests. Screening of existing varieties for resistance plays a crucial role in guiding breeding programs aimed at developing whitefly-tolerant cultivars to ensure sustainable coconut production in the future.

Material and Methods

The study on the incidence and damage intensity of the whitefly**,** along with associated natural enemies, was conducted at the AICRP (All India Coordinated Research Project) experimental block of the Horticultural Research Station (HRS), Ambajipeta. The investigation was aimed to assess varietal preference among coconut genotypes by evaluating a total of ten cultivars, which included one dwarf, three hybrids and six tall types**.** Among the tall cultivars, three were selected from the local germplasm**,** offering insights into region-specific responses to whitefly infestation. This structured varietal assessment provides a foundation for identifying tolerant genotypes that may be further utilized in whitefly-resistance breeding programs.

List of coconut cultivars included to study varietal preference by whitefly complex

1.	Gauthami Ganga	:	(A selection from Ganga Bondam GBGD) (Dwarf variety)
2.	Vasista Ganga	:	(Ganga Bondam GBGD X Philippines Ordinary Tall PHOT) (Hybrid)
3.	Abhaya Ganga	:	(Ganga Bondam GBGD X Laccadive Ordinary Tall LCOT) (Hybrid)
4.	Vynateya Ganga	:	(Philippines Ordinary Tall PHOT X Ganga Bondam GBGD) (Hybrid)
5.	Pillalakodi Green	:	(IC:610306) (Tall variety)
6.	Pillalakodi Brown	:	(IC: 610307) (Tall variety)
7.	Jonnalarasi Brown	:	(IC: 610309) (Tall variety)
8.	East Coast Tall	:	(Tall variety)
9.	Philippines Ordinary Tall	:	(Tall variety)
10.	Kera Bastar	:	(Tall variety)

Method of observation

From each cultivar a total number of three palms were selected randomly to record the incidence and intensity of whitefly. The observations of whitefly incidence and intensity were recorded at standard week interval and means were calculated. The population count of various whitefly stages (expect adults) along with natural enemies (except predators) were recorded with the help of Nikson SZ- 18 Microscope in laboratory at the stipulated time interval *i.e.,* at standard week interval.

Incidence (%)

To study the incidence percent of whitefly on palms the data pertaining to the pest was recorded using the following formula:

$$\text{Incidence (\%)} = \frac{\text{No. of leaves infested by whitefly per palm}}{\text{Total number of leaves}} \times 100$$

Intensity (%)

The percentage of intensity was worked out using the following formula:

$$\text{Palm Intensity (\%)} = \frac{\text{No. of leaflets infested with whitefly per leaf}}{\text{Total number .of leaflets per leaf}} \times 100$$

Whitefly population assessment

Three palms per cultivar were selected randomly and population assessment (spirals, nymphs, pupae and adults) was made from four randomly selected pest infested leaflets per leaf from four leaves of each palm (including top, middle and lower whorl) representing four directions (16 leaftets per palm) and expressed as mean of leaflet /leaf /palm.

Natural enemy population count

Similarly, data was collected from *Encarsia guadeloupae* paralized RSW pupae and emergence holes on pupae, predator *A. astur* and spiders from four randomly selected pest infested leaflets per leaf per palm from the top, middle and lower whorl representing four directions (four leaves per palm) and worked out and expressed as mean of leaflet / leaf / palm.

Results and Discussion

Incidence

Among the ten varieties screened for (RSW), results revealed that highest incidence of whitefly was observed in the dwarf variety Gauthami Ganga (87.53 %) followed by Vasista Ganga (GBGD X PHOT) with 72.14 % incidence, Abhaya Ganga (GBGD X LCOT) with 71.27 % incidence and Vynateya Ganga (PHOT X GBGD) with 70.22 % incidence .The local talls Pillalakodi Green (67.79%), Pillalakodi Brown (65.45 %) and Jonnalarasi Brown (64.86 %) were having comparatively high incidence among talls. The Phillippines Ordinary Tall with 58.47% incidence, East Coast Tall 55.64% incidence and Kera Bastar with 51.11% incidence were less preferred by whitefly complex (Table 1).

Intensity

Among the various coconut cultivars evaluated, dwarf variety Gauthami Ganga recorded the maximum intensity of whitefly complex with 92.79 % followed

by hybrids Vasista Ganga (GBGD X PHOT), Abhaya Ganga (GBGD X LCOT) and Vynateya Ganga (PHOT X GBGD) with intensity 85.12 %, 84.43 %, 81.78 % respectively. The local talls Pillalakodi Green, Pillalakodi Brown, Jonnalarasi Brown recorded intensity of 76.44 %, 75.96 % and 73.27 %, respectively and were followed by Phillippines Ordinary Tall, East Coast Tall and Kera Bastar with 72.33 %, 70.41 %, and 69.20 % intensity respectively.

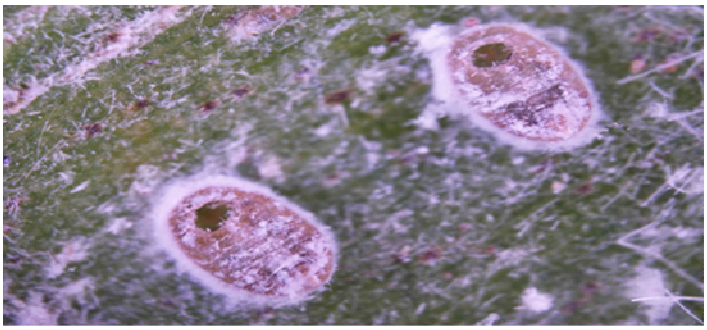
Eggs

Nymph

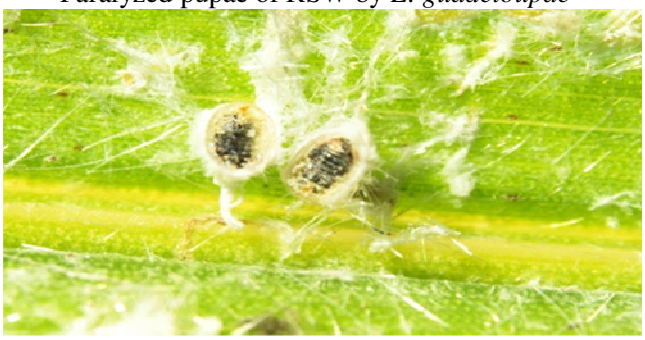
Spirals of RSW

Pupa

Adult



Paralyzed pupae of RSW by *E. guadeloupae*



Emergence holes of *E. guadeloupae* on RSW pupae.

Fig. 1: Life stages of Rugose Spiraling Whitefly, *Aleurodicus rugioperculatus*

Table 1: Incidence, Intensity and mean population of RSW on various coconut cultivars.

Cultivar	Incidence * (%)	Intensity* (%)	RSW (*A. rugioperculatus*)/ leaf let				% Parasitization (*E.guadeloupae*)
			Spirals*	Nymphs*	Pupa*	Adult*	
Gauthami Ganga	87.53	92.79	15.24± 3.18	52.13±10.73	30.76± 7.12	19.46±4.00	45.26
Vasista Ganga	72.14	85.12	12.12± 2.49	43.67± 8.99	21.12± 4.89	17.44±3.59	37.13
Abhaya Ganga	71.27	84.43	12.64± 2.60	41.49± 8.54	21.63± 5.00	17.19±3.54	35.79
Vynateya Ganga	70.22	81.78	11.42± 2.35	41.27± 8.49	19.46± 4.50	16.63±3.42	32.67
Pillalakodi Green	67.79	76.44	8.54± 1.78	30.88± 6.35	15.63± 3.61	13.21±2.71	21.54
Pillalakodi Brown	65.45	75.96	8.31± 1.71	29.71± 6.11	14.87± 3.44	12.76±2.62	19.74
Jonnalarasi Brown	64.86	73.27	7.77± 1.59	29.63± 6.10	14.34± 3.31	12.98±2.67	18.19
East Coast Tall	55.64	70.41	2.46± 0.50	15.09± 3.10	8.51± 1.97	10.34±2.12	12.47
Philippines Ordinary Tall	58.47	72.33	3.12± 0.64	17.16± 3.53	10.29± 2.38	11.42±2.35	7.69
Kera Bastar	51.11	69.20	2.02± 0.41	11.63± 2.39	7.14± 1.65	8.14±1.67	3.21

*Mean of 3 replicates; Values in the table are represented as mean ± standard error for population count

Table 2: Parasitisation of *E. guadeloupae* (%) and predator population observed during various months in varietal block while screening of coconut cultivars.

S. No.	Month	Natural enemies/ leaflet*		
		E. guadeloupae parasitisation (%) on RSW pupa	Number of Predators	
			Spiders	*A. astur* grub
1	December	21.98	0.47	0.79
2	January	29.14	0.65	1.22
3	February	33.63	0.79	1.41
4	March	25.12	1.02	1.77
5	April	23.47	1.11	1.94

*Data based on the average of 16 observations.

Pest Population on different coconut cultivars

Egg spirals of RSW

As per the data presented in the (Table 1) the population count of spirals was highest in the dwarf variety Gauthami Ganga with 15.24 spirals/ leaflet, followed by Vasista Ganga (GBGD X PHOT) with 12.12 spirals/ leaflet, Abhaya Ganga (GBGD X LCOT) with spiral count of 12.64 spirals/ leaflet and Vynateya Ganga (PHOT X GBGD) with 11.42 spirals/ leaflet and among talls, Kera Bastar recorded lowest of 2.02 spirals/ leaflet.

Nymphs, Pupae and adults

The nymphal, pupal and adult population of RSW was highest in dwarf variety Gauthami Ganga followed by hybrids, local talls and Kera Bastar being less preferred. The various life stages observed are presented here under (Table 1).

Gauthami Ganga is with highest nymphs, pupa and adult population of RSW with 52.13 nymphs/ leaflet, 30.76 pupae/ leaflet, 19.46 adults/ leaflet respectively and lowest nymphs, pupa and adult population/ leaflet of RSW with 11.63, 7.14, 8.14, respectively in tall variety Kera Bastar.

Among the various coconut cultivars it was earlier reported that compared to tall varieties, dwarf palms were more prefered by RSW (Sundaraj and Selvaraj, 2017; Chandrika *et al.,* 2017 and Fousiya *et al.,* 2019). Selvaraj *et al.* (2016) also reported that high incidence of RSW was observed more on hybrid and dwarf varieties *viz.,* Chowghat orange dwarf (COD), Malayan orange dwarf (MOD) and Gauthami Ganga. Srinivasan *et al.* (2016) observed that dwarf coconut palms such as Chowghat Orange Dwarf (COD), Malayan Yellow Dwarf (MYD), Malayan Green Dwarf and Dwarf x tall hybrids (COD X WCT) recorded an Infestation Grade Index (IGI) of 2.55, 2.35, 2.53 and 2.45 which is high as compared to that of West Coast Tall (0.55) and Arasampatti Tall (0.60) in Tamil Nadu.

Jethva *et al.* (2020) reported that in coconut plantations of Gujarat, RSW infestation was severe on dwarf and hybrid palms. Similarly, Rajesh *et al.* (2020) recorded highest RSW population in dwarf Gauthami Ganga (30.6/ cm^2) followed by hybrids *viz.,* Konkan

Bhatye Coconut Hybrid-1 (20.2/ cm^2) and Kahikuchi Hybrid-1 (18.2/ cm^2) in Chattisgarh. In the present study also high incidence, intensity and all life stages of white fly complex comprising RSW and BNW were recorded more in dwarf Gauthami Ganga followed by various hybrids Vasista Ganga, Abhaya Ganga and Vynateya Ganga as compared to ECT and Kera Bastar. Severino (2003) reported that in general leaf nutrient levels of dwarfs are slightly higher than talls but lower than hybrid coconuts and this can be a probable reason for high incidence, intensity and all life stages of white fly complex in the present study on dwarfs and hybrids.

Natural Enemies

During the screening of coconut cultivars for resistance to whitefly infestation, the presence of natural enemies such as *Encarsia guadeloupae*, spiders, and *Apertochrysa astur* were recorded on infested palms. The highest parasitization rate by *E. guadeloupae* on rugose spiralling whitefly (RSW) was observed in February (33.63%), while the lowest was noted in April (23.47%) (Table 2). Interestingly, the predatory populations of spiders and *A. astur* were more abundant during April. Among the evaluated cultivars, parasitization by *E. guadeloupae* ranged from a minimum of 3.21% in Kera Bastar to a maximum of 45.26% in Gauthami Ganga (Table 2). In the present investigation, higher parasitization of RSW pupae by *Encarsia guadeloupae* was recorded in the dwarf cultivar Gauthami Ganga, which also recorded the highest incidence, intensity, and abundance of RSW life stages. Conversely, the lowest parasitization was observed in the cultivar Kera Bastar, which harbored a comparatively lower RSW population. (Table 1)

E. guadeloupae and other species of *Encarsia* have been documented as effective parasitoids of several whitefly species, including RSW (Evans, 2008; Taravati *et al.,* 2013; Francis *et al.,* 2016) and similar findings were corroborated in the current study. In the context of biological control, host–parasitoid interactions play a crucial role (Berhow *et al.,* 2013). The density of both host and parasitoid populations has been shown to significantly influence parasitism rates, with parasitization increasing proportionally to the abundance of hosts and parasitoids (Bilal Rasool, 2021).

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