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STUDIES ON BIOLOGY OF RUGOSE SPIRALLING WHITEFLY (RSW), *ALEURODICUS RUGIOPERCULATUS* MARTIN (HEMIPTERA: STERNORRHYNCHA: ALEYRODIDAE) ON OIL PALM

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ABSTRACT

The biology of the Rugose Spiralling Whitefly infesting oil palm was studied in Tripuraram mandal, Nalgonda district, Telangana. Eggs laid in loose waxy spirals on leaf upper surfaces, hatched in 6.33±0.3 days. Four nymphal instars totaled 25±0.5 days (24–26 days), followed by 3.3±0.3-day pupation, yielding egg-to-adult development of 34.6±0.3 days (32–38 days). Females lived 10±0.5 days, males 6.6±0.3 days, for full cycles of 44.6 and 41.3 days, respectively.
Keywords **:** Oil Palm, Rugose Spiralling whitefly (*Aleurodicus rugioperculatus*), Biology, Life cycle.

Introduction

Oil palm (*Elaeis guineensis* Jacq.), a perennial monocot belonging to the Arecaceae family, stands as a cornerstone of global vegetable oil production, often hailed as the "liquid gold of the tropics" for its high oil yield. Native to West Africa, it has become a vital crop in India's humid tropical belts, driven by the urgent need to bridge the widening edible oil deficit through sustainable yields of up to 4–5 tonnes of crude palm oil per hectare annually. The fruit bunches yield palm oil rich in carotenoids, vitamin E (tocopherols and tocotrienols) and palmitic acid, contributing significantly to nutritional security and industrial uses (Singh and Ghosh, 2022).

In India, oil palm occupies around 3.72 lakh hectares, yielding approximately 3.32 lakh metric tonnes of palm oil in 2022–23, marking a steady rise from prior years amid government-backed expansion under the National Mission on Edible Oils – Oil Palm (NMEO-OP). Production is concentrated in Andhra Pradesh (over 2.5 lakh ha, ~80% share), Telangana, Karnataka, Tamil Nadu, Kerala and emerging fronts like Odisha and Mizoram. However, despite this growth, India's output remains modest at under 1% of global supply, hampered by biotic stresses including erratic monsoons and escalating pest pressures that curtail bunch yields and spike management costs.

The rugose spiralling whitefly (*Aleurodicus rugioperculatus*) is an invasive pest first reported in Florida in 2009 on gumbo limbo (*Bursera simaruba*). In India, its initial detection occurred on coconut palm in Pollachi, Tamil Nadu, during August–September 2016 (Selvaraj *et al*. 2016). Subsequently, it has been found infesting a range of economically important plants in Southern India, including *Musa sp.*, *Mangifera indica*, *Terminalia catappa* and various ornamentals. This pest exhibits extreme polyphagy with 118 recorded host species across 43 plant families, notably affecting coconut, oil palm, and banana crops (Francis *et al*., 2016; Karthick *et al*., 2018). In its native range, *A. rugioperculatus* primarily targets coconut palms and other broad-leaved hosts. Infestations can lead to severe damage characterized by heavy sooty mold accumulation and complete leaf withering.

The pest's feeding behavior stresses host plants by extracting water and nutrients and producing honeydew, which promotes sooty mold formation on leaf surfaces, thereby impairing photosynthesis. Although superficially similar to the spiralling whitefly (*Aleurodicus disperses* Russell), another invasive species established in India since the mid-1990s, the rugose spiralling whitefly poses a distinct and growing threat. Given the increasing impact of this invasive pest

in India, comprehensive information on its biology is critical. This study aims to address this knowledge gap by investigating the biological characteristics of *A. rugioperculatus*. Sparse data exist on the pest's bionomics under Indian oil palm agro-ecosystems, particularly regarding regional variations in development amid diverse microclimates and host nutrition. The present study addresses this void by elucidating the detailed biology of the rogue Spiralling whitefly on oil palm, laying groundwork for targeted interventions.

Materials and Methods

The study on the biology of the rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin was conducted from heavily infested plantations in Tripuraram mandal, Nalgonda district, Telangana. Ten leaves from different palm plants were tagged and prepared for egg laying using small leaf clip cages. Females were released onto these leaves and egg laying dates were recorded before removing the cages. Leaves with egg spirals were collected and monitored every 24 hours to record egg incubation and nymphal emergence. Nymphal development was observed on ten leaves with first instar nymphs, marked by emergence date. Leaves were examined daily with a 15X hand magnifier to record the duration of each instar and total nymphal development time.

For pupal duration, ten leaves with fourth instar nymphs were tagged and pupation dates recorded. These were checked every 24 hours to observe adult emergence and calculate average pupal duration. Ten leaves containing pupae were covered with clip cages to trap emerging adults, inspected every 12 hours. Five freshly emerged males and females were separately released on host plants within clip cages to record adult longevity, monitored daily until death and average longevity calculated. The total developmental period from egg laying to adult emergence was calculated using data from all stages of *A. rugioperculatus*.

Results and Discussion

The developmental biology of the Rugose Spiralling Whitefly was investigated under with key life stage durations summarized in Table 1. Females deposited eggs primarily on the upper leaf surface in characteristic loose spirals, often coated with a thin layer of waxy secretion for protection. Eggs were elongated, smooth and initially pale yellow, turning slightly darker before hatching. Hatching occurred after an average of 6.33 ± 0.3 days. The current findings align with those of Saranya *et al*. (2020), who identified the incubation period of RSW as 6.4 days on sapota. Similarly, Elango *et al*. (2019) reported a 6.9-day incubation period on coconut, while Alagar *et al*. (2020) found it to be 6.7 days on coconut.

The initial instar, often referred to as the crawlers, is a stage characterized by mobility and functional legs. After hatching, these mobile crawlers, marked by a yellow band, move a few millimeters to begin feeding by extracting sap using their needle-like mouthparts, as shown in Figure 1. They have an oval shape. Initially, the crawlers are white at hatching but gradually change to a yellowish hue, previously noted as ranging from light green to yellow (Gill, 1990). Their eyes are small yet noticeable, featuring red spots. The absence of compound wax pores in the first instar nymph means there is no wax secretion on their bodies. The first instar (crawler) was mobile, flattened and pale yellow with functional legs for initial dispersal, lasting 5.3 ± 0.3 days on average. Subsequent instars (II–IV) became progressively more sessile and convex, feeding by inserting stylets into leaf tissues and secreting honeydew. Nymph II endured 5.6 ± 0.8 days, Nymph III 6.67 ± 0.3 days and the final instar (pseudo-pupa) 7.33 ± 0.8 days. The cumulative nymphal phase totaled 25.00 ± 0.5 days (24–26 days' range), reflecting stable development with minimal variation.

Pupation followed, averaging 3.3 ± 0.3 days (3–5 days), marked by a non-feeding stage encased in a waxy shell. Total immature development from egg to adult emergence spanned 34.6 ± 0.3 days (32–38 days). Emerged adults were covered in white powdery wax, with reddish-brown eyes and distinctive wing markings; females slightly outlived males, surviving 10.0 ± 0.5 days (7–11 days) versus 6.6 ± 0.3 days (6–8 days). The complete life cycle, from oviposition to adult death, averaged 44.6 days for females and 41.3 days for males.

These observations align closely with prior reports of Saranya *et al*. (2020), who identified the total incubation period of RSW on sapota. Similarly, Elango *et al*. (2019) reported total incubation period on coconut, while Alagar *et al*. (2020) found on coconut.

Table 1: Biology of Rugose Spiraling Whitefly *A. rugioperculatus*

Life Stage	(days, mean ± SE)
Egg	6.33 ± 0.3
Nymph I (crawler)	5.3 ± 0.3
Nymph II	5.6 ± 0.8
Nymph III	6.67 ± 0.3
Nymph IV (pseudo-pupa)	7.33 ± 0.8
Nymph Total	25.00 ± 0.5 (24-26)
Pupa	3.3 ± 0.3 (3-5)
Total Dev.	34.6 ± 0.3 (32-38)
Adult Female	10.0 ± 0.5 (7-11)
Adult Male	6.6 ± 0.3 (6-8)
Full Cycle	♀44.6, ♂41.3

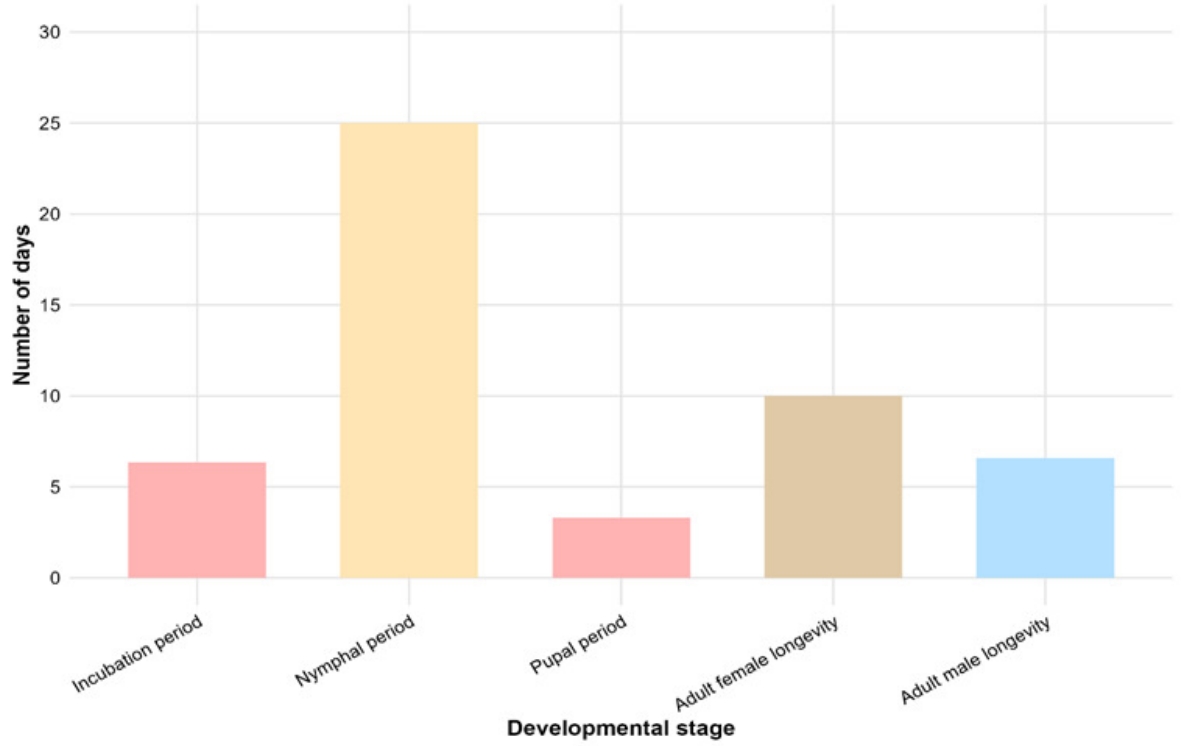

Fig. 1: Different Development stages of *A. rugioperculatus*

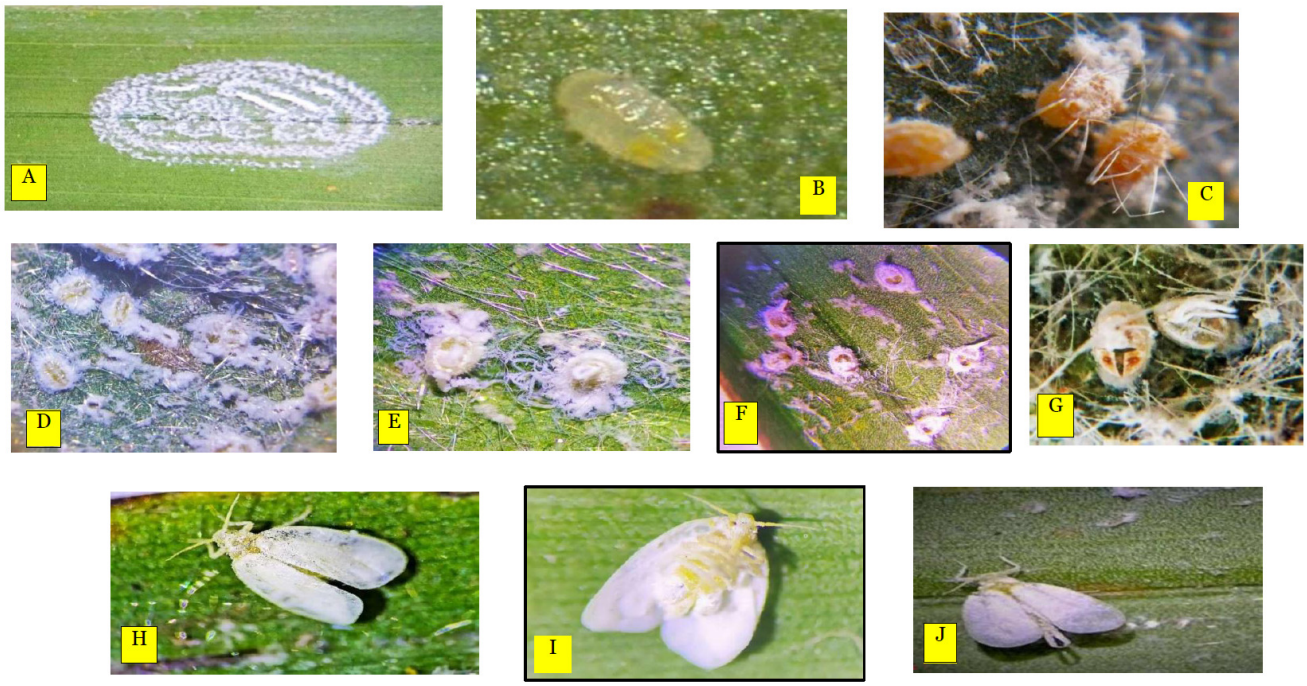

Fig. 2 : Life stages of A. rugioperculatus, A) Eggs, B) First instar nymph, C) Second instar nymph, D) Third instar nymph, E) Fourth instar nymph, F) Pupae, G) T opening of adult emergence, H) Adult female, I) Adult female without pincers at the tip of the abdomen, J) Adult male with pincers at the abdominal tip

Conclusion

The present investigation establishes that the rogue whitefly completes its development from egg to adult in 34.6 ± 0.3 days (32–38 days), with a full generational cycle averaging 44.6 days for females and 41.3 days for males under laboratory conditions mimicking tropical field scenarios on oil palm. This rapid progression in eggs (6.33 days), four nymphal instars totaling 25 days and brief pupation (3.3 days) positions the pest for explosive outbreaks, compounded by female longevity supporting sustained oviposition in waxy spirals on leaf undersides.

These metrics resonate with earlier accounts, such as average instar durations of 5–7 days and life cycles around 42–47 days, alongside high egg viability nearing 96% and female-biased ratios favouring proliferation. The findings affirm the whitefly's adaptability across hosts, validating standardized rearing for bioassays. Practically, this timeline informs precise IPM timing: targeting crawlers and early nymphs disrupts cycles, while adult monitoring curbs public nuisance from waxy fallout in oil palm groves. Enhanced biological insights promise resilient strategies to safeguard India's burgeoning oil palm sector against this insidious sap-feeder

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