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Research Article

Bio-morphometry of invasive rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin on three tropical fruit crops: A host suitability assessment

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Abstract
The rugose spiralling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae), is an invasive insect pest in Bangladesh, first reported in 2019 on coconut, and is characterized by a wide host range and high damage potential. Coconut (*Cocos nucifera* L.) is an economically important tropical fruit crop in Bangladesh, providing substantial income and livelihood support for growers; however, its production has declined sharply following the invasion of RSW. To investigate the developmental performance of RSW, the present study evaluated its developmental biology and morphometry on three major fruit crops, native coconut, banana, and guava as well as three dwarf coconut cultivars (Siam Blue, Siam Green, and DJ Sompurna). Incubation period, oviposition period, total life cycle duration, and morphometric traits were assessed on selected host plants under laboratory conditions. Results showed that the RSW life cycle duration was shorter on all coconut cultivars (37.6 ± 0.92 to 38.4 ± 0.67 days) and differed significantly from that on banana (41.8 ± 0.80 days) and guava (45.4 ± 0.60 days). Egg and nymphal length and width were greater in coconut cultivars than in banana and guava, indicating greater host suitability of coconut for RSW. Morphometric parameters differed significantly among coconut cultivars, banana, and guava. These host-dependent differences in developmental duration and morphometric traits provide important insights into the biology and host suitability of RSW and can support improved monitoring, risk assessment, and timing of control measures within integrated pest management (IPM) programs.

Keywords: Fruit crops, Host suitability, Life cycle, Morphometry, Rugose spiralling whitefly

INTRODUCTION

The globalization of agricultural trade has facilitated both deliberate and accidental introductions of quarantine pests, diseases, and weeds, posing significant threats to agriculture, natural resources, and food security. This is a core focus of current USDA Plant Protection and Quarantine efforts to safeguard crops and ecosystems while enabling safe international trade (APHIS, USDA, 2025). Among these invasive species, the rugose spiralling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae), is a recently introduced pest in Bangladesh, first reported in 2019 in the southwestern region on coconut plants and subsequently spreading throughout the country (Dutta *et al.*, 2019). Described initially in Belize in 2004 (Martin, 2004), RSW was later identified in Florida, USA, on *Gumbo limbo* in 2009 (Stocks and Hodges, 2012), and has since emerged as a serious threat to the coconut industry in southern India, including Kerala and Tamil Nadu (Shanas *et al*., 2016; Selvaraj *et al.,* 2017; Sundararaj *et al*., 2017).

The rugose spiralling whitefly (RSW) is a highly polyphagous pest, attacking over 118 host plants across 43 families (Francis *et al.,* 2016; Kumar *et al*., 2013). In Bangladesh, baseline surveys have identified 61 host plants, with coconut experiencing the most severe infestations (Das *et al*., 2023). Coconut (*Cocos nucifera* L.) is cultivated in more than 93 countries, with India, Indonesia, the Philippines, Sri Lanka, and Bangladesh together contributing 78% of global production (Kumara *et al*., 2015). Bangladesh ranks 12th globally in coconut production, producing 442,708 metric tons from 25,334 hectares (FAOSTAT, 2022; BBS, 2021). Coconut farming represents a significant livelihood source, providing consistent income and supporting numerous coconut-based industries, particularly in the southern regions of the country. To enhance production and improve growers' socio-economic conditions, the government has imported dwarf coconut varieties in recent years, including DJ Sompurna from India and Siam Blue and Siam Green from Vietnam. However, coconut production has declined sharply since the introduction of RSW, a major contributor to this decline. Surveys indicate that 85.72% of native and 81.23% of dwarf coconut plants are infested (Das *et al*., 2023), with yield losses ranging from 6.69% to 30.38% (Puvvala *et al.,* 2023). Beyond coconut, RSW has also been reported on banana and guava, both of which are important for meeting nutritional needs and supporting the socio-economic status of growers in Bangladesh.

As a hemipteran insect, both nymphs and adults of RSW feed by sucking cell sap from leaves, causing physiological stress through the depletion of nutrients and water, which results in direct damage to the host plant. In addition, *A. rugioperculatus* excretes honeydew, which serves as an ideal substrate for the growth of sooty mold fungus (Taravati and Mannion, 2016). The resulting sooty mould forms dense layers on leaves and other surfaces, severely inhibiting photosynthesis and causing significant physiological disorders. Consequently, RSW represents a major threat to the production of economically important fruit crops, particularly coconut. Efforts to control infestations with chemical pesticides have often been ineffective, and indiscriminate pesticide application has, in some cases, exacerbated the problem, further compromising plant health and productivity.

Therefore, the present study aimed to evaluate the suitability of three major fruit crops viz. coconut, banana, and guava to *A. rugioperculatus* under net-cage condition by assessing its life cycle duration, growth, and development. Understanding host–pest interactions will provide a foundation for future research on population dynamics, ecological impacts, and the development of targeted, actionable, sustainable integrated pest management (IPM) strategies in Bangladesh.

MATERIALS AND METHODS

Host plants and their management

Saplings of coconut (*Cocos nucifera* L.; DJ Sompurna, Siam Blue, Siam Green, and Native), banana (*Musa acuminata*), and guava (*Psidium guajava*) were collected from the Horticulture Center, Kewatkhali, Mymensingh. The saplings were initially kept outdoors for at least one month to recover from transport-related stress, then brought to the laboratory and maintained for two weeks to acclimate to laboratory conditions. Subsequently, they were transplanted into plastic pots filled with a prepared mixture of soil, cow dung, and appropriate amounts of triple super phosphate (TSP), muriate of potash (MP) and oil cake (Fig. 1).

To ensure uniformity across treatments, saplings were selected based on age, leaf number, and height. Coconut and banana saplings were one year old, with coconut having 4–5 fully expanded leaves and a height of approximately 90 cm, and banana having 5–6 fully expanded leaves and a height of approximately 120 cm. Guava saplings were also one year old, with 14–15 fully expanded leaves and a height of approximately 60 cm.

Mass rearing of *Aleurodicus rugioperculatus*

Initially, RSW-infested coconut (*Cocos nucifera* L.) leaflets were collected from the Bangladesh Agricultural University campus (24°43′26″ N, 90°25′48″ E) and transported to the Entomology Laboratory. Adult whiteflies were sexed to confirm males and females and then gently released onto mud-potted coconut plants (40 cm × 40 cm), which were subsequently placed inside a mini net cage (150 cm × 150 cm × 120 cm). RSW colonies were maintained in the insectary of the Department of Entomology, Bangladesh Agricultural University, at 28.5 ± 0.21°C and 78.3 ± 1.4% relative humidity. Several generations were produced under these conditions to ensure sufficient insects for experimental use.

Life cycle assessment of RSW

To assess the life-cycle parameters of RSW, three plants per host species were maintained individually in net-cages serving as independent experimental replicates. Fifteen pairs of adult whiteflies, sexed to confirm males and females, were gently released on each plant using a soft camel-hair brush. Adults began oviposition on day one, continuing for three to four days. Host plants were inspected daily to monitor egg-laying, and the oviposition period was recorded. Three spirals from

Fig.1. *Different host plants used in experiments*

each host plant were selected, tagged, and the date of egg-laying noted (Fig. 2) (total egg spirals, n = 9). Egg spirals were examined every 24 hours under a zoom-stereomicroscope (SM-1TSZZ-144S-10M, AmScope) to determine hatching. The incubation period was calculated as the interval between egg-laying and hatching. First-instar nymphs were identified based on crawling behavior, and subsequent nymphal instars were monitored according to body size, wax layer morphology, filament development, and molted exuviae (Boughton *et al.,* 2015). Observations were continued daily until adult emergence, and adult longevity was recorded from emergence to death for both sexes. The same protocol was applied consistently across all host plants. Environmental conditions, including temperature and relative humidity, were recorded daily to contextualize developmental data.

Morphometry of *Aleurodicus rugioperculatus* on different host plants

From each host plant, three egg spirals were randomly selected, and from each spiral three eggs were also randomly chosen and measured their length and width (mm). This resulted in 9 eggs per plant (3 spirals × 3 eggs) and a total of 27 eggs per host species (3 plants × 9 eggs, n = 27). A similar sampling approach was followed for nymphal instars and adults**,** ensuring consistent data collection across all developmental stages and host plants. Morphometric measurements were obtained from photographs of eggs, nymphs, and adults captured under a 40× zoom stereomicroscope (Fig. 2 and 3), and the images were calibrated using a reference scale in ImageJ software**.**

Statistical analysis

All data were first checked for normality of residuals using the Shapiro–Wilk test and for homogeneity of variances using Levene's test. Data meeting these assumptions were analyzed using a one-way analysis of variance (ANOVA) to compare the mean values of the measured traits of *A. rugioperculatus* on different host plants**.** Where ANOVA indicated significant differences, mean values were separated using Tukey's Honestly Significant Difference (HSD) test at P ≤ 0.05. All statistical analyses were performed using R software version 4.3.1.

RESULTS AND DISCUSSION

Life cycle parameters

The oviposition, incubation, nymphal, and adult durations of *A. rugioperculatus* are summarized in Table 1 and Fig. 4, and illustrated in Fig. 3, whereas the mor-

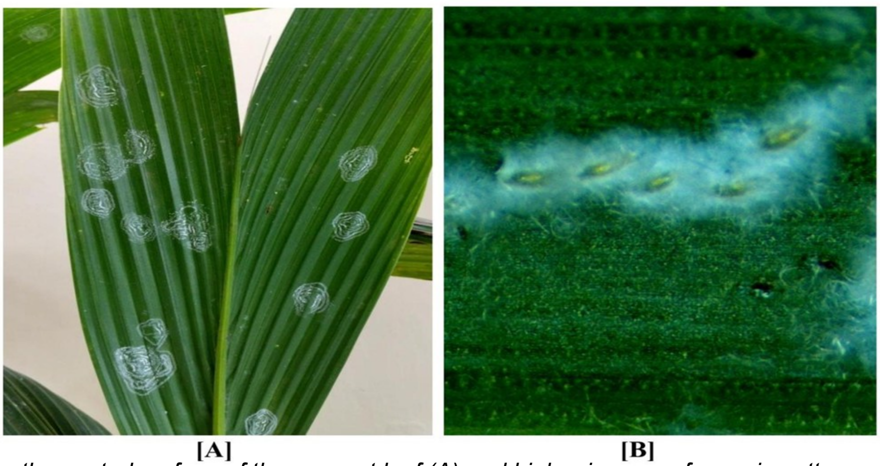

Fig. 2. *Egg spirals on the ventral surface of the coconut leaf (A) and higher images of eggs in cottony masses (B).*

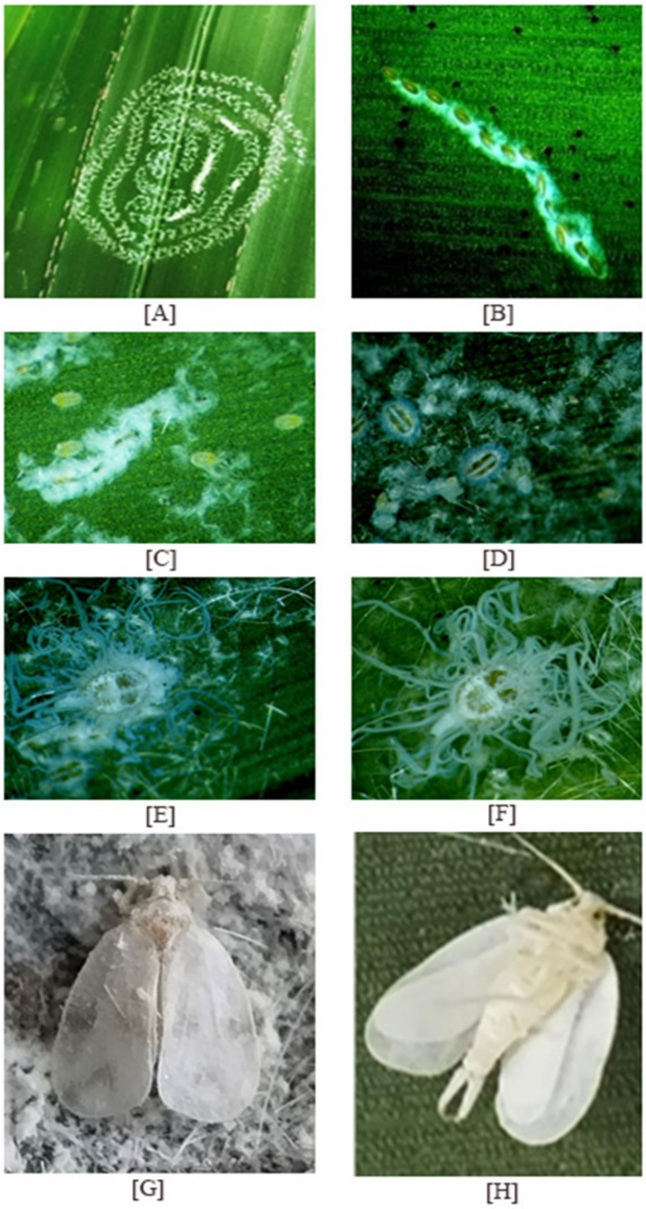

Fig. 3. *Different stages of life cycle of rugose spiralling whitefly. A-Egg spiral, B-Eggs in cottony masses, C-1st instar, D-2nd instar, E-3rd instar, F-4th instar, G- Female adult, H-Male adult*

phometric measurements, including the length and width of eggs, nymphs, and adults, are presented in Table 2.

Oviposition period

The oviposition period of RSW did not differ significantly among the four coconut varieties, banana, and guava (Fig. 4). However, the longest period was observed on native coconut (2.60 ± 0.24 days), compared to other coconut varieties, banana and guava.

Incubation period

The incubation period of *A. rugioperculatus* differed significantly among hosts (One-way ANOVA: $F_{5,12}$ = 3.84; P = 0.026, Table 1), being longest on guava (8.60 ± 0.24 days), followed by banana and coconut. Among the coconut varieties, DJ Sompurna showed the longest incubation period (7.60 ± 0.24 days), although this difference was not statistically significant compared with the other coconut varieties.

Nymphal instars

RSW has four nymphal instars, and their developmental periods varied among host plants (Table 1). On guava, the first instar lasted 6.60 ± 0.22 days, followed by banana and coconut varieties (One-way ANOVA: $F_{5,12}$ = 4.04, P = 0.022; Table 1). Similarly, the second, third, and fourth instars spent longer on guava than on banana or coconut. Among the three host species, the shortest developmental period occurred in the coconut, which differed significantly from that in banana and guava. The total developmental duration for all instars was the highest on guava (31.0 ± 0.23 days), followed by banana (28.0 ± 0.20 days), and shortest on coconut varieties (24.0 ± 0.10 to 25.0 ± 0.50 days) (One-way ANOVA: $F_{5,12}$ = 4.52; P = 0.034, Table 1).

Adults

Male and female longevity of RSW did not differ significantly among coconut varieties, banana, and guava (Table 1). Females consistently lived longer than males on all hosts. Male longevity was slightly shorter on banana (3.60 ± 0.24 days) compared to coconut and guava, while female longevity tended to be higher on coconut varieties, although these differences were not statistically significant.

Total life cycle duration

The total life-cycle duration differed significantly among host plants (One-way ANOVA: $F_{5,12}$ = 10.67, P = 0.012; Table 1). Among coconut varieties, total life-cycle duration did not differ significantly, although the shortest duration (37.6 ± 0.92 days) was recorded on the dwarf variety DJ Sompurna (Kerala, India). The life cycle duration on the native, Siam Blue, and Siam Green varieties was 38.4 ± 0.67, 38.2 ± 0.48, and 38.3 ± 0.50 days, respectively. In contrast, the longest life cycle duration was observed on guava saplings (45.4 ± 0.60 days), followed by banana (41.8 ± 0.80 days), with a significant difference between guava and banana (P<0.05). Overall, the total life cycle was significantly shorter across all coconut varieties than in banana and guava indicating that coconut serves as a more suitable host, supporting faster development of RSW.

Morphometric parameters

The morphometric measurements of RSW eggs, nymphs, and adults on different coconut varieties, banana, and guava are presented in Table 2. Some morphometric parameters differed significantly among coconut cultivars, banana, and guava. Significant differ-

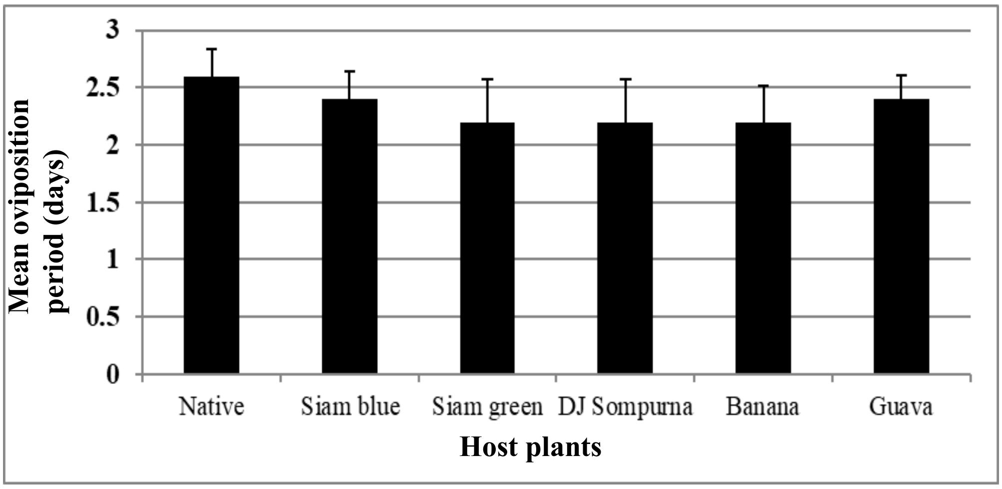

Fig. 4. *Oviposition periods of rugose spiralling whitefly on different host plants*

ences in egg length and width were observed among the host species (Egg length: One-way ANOVA: $F_{5,12}$ = 4.06, P = 0.022; Egg width: One-way ANOVA: $F_{5,12}$ = 4.56, P = 0.015). Nymphal length and width also varied significantly among the host species. The mean length and width of all nymphal instars (1st to 4th) were highest on DJ Sompurna (Length: 0.72±0.22; width: 0.43±0.15) and differed significantly from those on other host species (Length: One-way ANOVA: $F_{5,12}$ = 31.2, P< 0.001; Width: One-way ANOVA: $F_{5,12}$ = 23.2, P<0.001). Body length (2.45 ± 0.12 mm) and width (0.84 ± 0.01 mm) of adult male RSW were highest on DJ Sompurna and differed significantly from the other host species (Length: $F_{5,12}$ = 23.2, P < 0.001; Width: $F_{5,12}$ = 7.75, P = 0.0015). Similarly, the body length (2.45±0.12) and width (0.84±0.01) of female RSW were the highest on DJ Sompurna and differed significantly from the other host species. The consistently greater length and width of eggs, nymphs, and adults on DJ Sompurna suggest that this variety may provide more favourable conditions for RSW growth and development than the other tested hosts.

Invasive insect species pose a major threat to agriculture worldwide, affecting both developing and developed countries. In Bangladesh, several exotic insect pests have been reported over the past decade, raising serious concerns due to their rapid outbreaks. One such pest is the *A. rugioperculatus,* a polyphagous insect that has recently invaded the country. Although coconut is its primary host, RSW has been recorded on 61 plant species in Bangladesh (Das *et al.,* 2023). The pest has emerged as a significant threat to coconut production (Ullah *et al*., 2021), and infestations have also been observed on various fruit and field crops. The

Table 1. Life cycle duration of rugose spiralling whitefly on different host plants under room temperature conditions (Temperature: 28.5 ± 0.21°C, Relative Humidity: 78.3 ± 1.4%, Photoperiod (L:D): 16:8 hours)

Parameters	Duration: Days (Mean ± SEM)					
	Coconut native	Coconut siam blue	Coconut siam green	Coconut DJ sompurna	Banana	Guava
Incubation period	7.40 ± 0.24^{a}	7.00 ± 0.31^{a}	7.00 ± 0.31^{a}	7.60 ± 0.24^{a}	8.00 ± 0.31^{ab}	8.60 ± 0.24^{b}
1st nymphal instar	5.40 ± 0.24^{a}	5.20 ± 0.20^{a}	5.40 ± 0.24^{a}	5.40 ± 0.24^{a}	5.60 ± 0.21^{a}	6.60 ± 0.22^{b}
2nd nymphal instar	5.20 ± 0.20^{a}	6.00 ± 0.31^{ab}	5.40 ± 0.24^{a}	5.60 ± 0.24^{a}	6.40 ± 0.24^{ab}	7.20 ± 0.37^{b}
3rd nymphal instar	5.80 ± 0.20^{a}	6.20 ± 0.48^{a}	6.00 ± 0.31^{a}	5.60 ± 0.24^{a}	7.20 ± 0.20^{ab}	7.80 ± 0.20^{b}
4th nymphal instar	6.80 ± 0.37^{a}	7.00 ± 0.31^{a}	7.20 ± 0.37^{ab}	6.80 ± 0.20^{a}	7.80 ± 0.37^{ab}	8.60 ± 0.24^{b}
Total nymphal duration	24.0 ± 0.10^{a}	25.0 ± 0.50^{a}	25.0 ± 0.16^{a}	24.0 ± 0.32^{a}	28.0 ± 0.20^{b}	31.0 ± 0.23^{c}
Male longevity	4.80 ± 0.37^{a}	4.00 ± 0.31^{a}	4.00 ± 0.31^{a}	4.00 ± 0.31^{a}	3.60 ± 0.24^{a}	4.00 ± 0.31^{a}
Female longevity	7.80 ± 0.37^{a}	6.80 ± 0.37^{a}	7.30 ± 0.20^{a}	6.60 ± 0.40^{a}	6.60 ± 0.20^{a}	6.60 ± 0.24^{a}
Total life cycle duration (Female)	38.4 ± 0.67^{a}	38.2 ± 0.48^{a}	38.3 ± 0.50^{a}	37.6 ± 0.92^{a}	41.8 ± 0.80^{b}	45.4 ± 0.60^{c}

Mean ± SEM within a row followed by the same letter is not significantly different (P < 0.05)

Table 2. Morphometric measurement (mm) (Mean ± SEM) of eggs, nymphal instars and adults of rugose spiralling whitefly (Temperature: 28.5 ± 0.21°C, Relative Humidity: 78.3 ± 1.4%, Photoperiod (L:D): 16:8 hours).

Different stages		Coconut native	Coconut siam blue	Coconut siam green	Coconut DJ sompurna	Banana	Guava
Egg	L	0.29±0.02[a]	0.33±0.02 [b]	0.30±0.02 [a]	0.35±0.01 [b]	0.30±0.05 [a]	0.28±0.01 [a]
	W	0.10±0.03 [a]	0.12±0.09 [a]	0.11±0.09 [a]	0.13±0.01 [b]	0.12±0.06 [ab]	0.10±0.04 [a]
1st nymphal instar	L	0.39±0.02 [a]	0.37±0.01 [a]	0.38±0.04 [a]	0.37±0.08 [a]	0.35±0.02 [b]	0.31±0.02 [c]
	W	0.20±0.01 [a]	0.17±0.06 [b]	0.17±0.03 [b]	0.16±0.09 [b]	0.15±0.08 [b]	0.14±0.01 [bc]
2nd nymphal instar	L	0.39±0.01 [a]	0.39±0.09 [a]	0.40±0.07 [a]	0.41±0.01 [a]	0.40±0.02 [a]	0.45±0.02 [b]
	W	0.22±0.02 [a]	0.19±0.05 [a]	0.19±0.04 [a]	0.21±0.01 [a]	0.19±0.01 [a]	0.18±0.06 [b]
3rd nymphal instar	L	0.85±0.09 [a]	0.74±0.03 [b]	0.79±0.07 [c]	0.78±0.05 [c]	0.77±0.02 [c]	0.75±0.02 [b]
	W	0.51±0.05 [a]	0.47±0.01 [b]	0.47±0.02 [b]	0.52±0.01 [a]	0.45±0.01 [b]	0.38±0.08 [c]
4th nymphal instar	L	1.05±0.12 [a]	1.18±0.05 [b]	1.15±0.07 [b]	1.33±0.08 [c]	1.22±0.03 [b]	1.10±0.03 [d]
	W	0.70±0.04 [a]	0.72±0.02 [a]	0.71±0.01 [a]	0.83±0.02 [b]	0.68±0.02 [c]	0.61±0.02 [d]
Means of all nymphal instars	L	0.67±0.16 [a]	0.68±0.19 [a]	0.67±0.18 [a]	0.72±0.22 [b]	0.66±0.20 [a]	0.62±0.17 [c]
	W	0.37±0.12 [a]	0.39±0.13 [a]	0.38±0.10 [a]	0.43±0.15 [b]	0.36±0.12 [a]	0.32±0.10 [c]
Adult male	L	2.39±0.09 [a]	2.17±0.03 [b]	2.17±0.04 [b]	2.45±0.12 [c]	2.17±0.04 [b]	2.11±0.06 [d]
	W	0.81±0.03 [a]	0.72±0.02 [b]	0.71±0.01 [b]	0.84±0.01 [a]	0.77±0.01 [c]	0.68±0.04 [d]
Adult female	L	2.39±0.09 [c]	2.17±0.03 [b]	2.17±0.04 [b]	2.45±0.12 [a]	2.17±0.04 [b]	2.15±0.06 [b]
	W	0.81±0.03 [a]	0.72±0.02 [b]	0.71±0.01 [b]	0.84±0.01 [ab]	0.77±0.02 [c]	0.68±0.04 [d]

Means ± SEM within a row followed by the same letter(s) are not significantly different (P < 0.05). L-length; W-Width

present study provides clear evidence that coconut is the most favourable host among the crops tested for *A. rugioperculatus*. In the present study, we investigated the life cycle parameters and morphometric characteristics of *A. rugioperculatus* on coconut, banana, and guava under laboratory conditions using net cages. Our results revealed that RSW completed its life cycle more rapidly on coconut than on banana or guava, and nymphal instars and adult growth were also faster on coconut, indicating high host suitability. It should be noted that data on developmental biology and morphometry were collected from the third generation of whiteflies, while the first two generations were not included. This approach allowed whiteflies to acclimate to all host types more evenly before data collection. Nevertheless, since the population originated from coconut, a potential pre-adaptation bias may exist, favoring coconut and influencing the observed performance. Future studies using multi-generation rearing on alternative hosts or reciprocal host-transfer experiments could help separate inherent host suitability from prior host adaptation.

The mean oviposition period of *A. rugioperculatus* ranged from 2.2 to 2.6 days across coconut varieties, banana, and guava, with no significant differences among hosts. Oviposition in whiteflies is known to be influenced by leaf surface characteristics, particularly the presence of trichomes (Mound, 1965). Since the upper leaf surfaces of coconut, banana, and guava are smooth and lack trichomes, the similarity in egg-laying duration across these hosts is expected. In contrast, the incubation period was significantly shorter in the four coconut varieties than in banana and guava, supporting earlier studies (Taravati *et al*., 2021; Pradhan *et al*., 2020; Fousiya *et al*., 2019). These studies also reported relatively shorter incubation durations on coconut (3–5 days) than on banana (5–8 days) at 28.0 ± 0.2 °C and a 12:12 h (L:D) photoperiod, with differences likely attributable to variations in temperature, leaf moisture, and photoperiod across experimental setups (Byrne *et al*., 2011). However, the underlying mechanisms responsible for similar oviposition periods but differing incubation durations across host plants remain unclear and warrant targeted investigation in future studies.

The total nymphal duration of RSW ranged from 24.0 ± 0.32 to 25.0 ± 0.50 days on dwarf coconut varieties, which did not differ significantly from that on native coconut (24.0 ± 0.10 days). However, nymphal development was significantly prolonged on banana (28.0 ± 0.20 days) and guava (31.0 ± 0.23 days). These findings are in close agreement with earlier studies, where Pradhan *et al*. (2020) reported a nymphal duration of 23.2 ± 1.38 days on coconut and 29.6 ± 1.67 days on banana, while Saranya *et al*. (2021) and Alagar *et al*.

(2020) recorded an average of 27 days on coconut. Adult longevity was consistently shorter in males compared with females across all host plants, a pattern commonly observed in whiteflies. The total life cycle duration of RSW ranged from 37.6 ± 0.92 to 38.04 ± 0.67 days on coconut, with the shortest (37.6 ± 0.92 days) recorded on DJ Sompurna. In contrast, life cycle duration was significantly longer on guava, followed by banana and coconut. Comparable trends were reported by Pradhan *et al.* (2020), whereas longer developmental durations were documented by Saranya *et al*. (2021), Alagar *et al*. (2020), and Elango *et al*. (2019). The variation among studies may be attributed to differences in experimental conditions, particularly photoperiod, relative humidity, and temperature, as the latter studies were conducted under field environments where climatic fluctuations are more pronounced.

In terms of morphometric traits, *A. rugioperculatus* exhibited comparatively smaller egg, nymphal, and adult measurements on guava, followed by banana and coconut varieties. In contrast, significantly greater lengths and widths of eggs, means of all nymphal instars, and adults (male and female) were recorded on the dwarf coconut variety DJ Sompurna, suggesting higher host suitability than other hosts. This might be attributed to the relatively higher levels of soluble sugars and nitrogen in the phloem sap, which can enhance whitefly survival, growth, and fecundity (Byrne and Miller, 1990; Liu *et al.,* 2012). In addition, the physical traits of coconut leaves such as softer tissue, reduced trichome density, and smoother wax layers are likely to facilitate oviposition, feeding, and nymphal movement, thereby promoting successful development (Avery *et al.,* 2015). Coconut leaves may also contain comparatively lower concentrations of defensive phenolic compounds and alkaloids in young tissues, which could reduce antibiosis effects on whiteflies relative to hosts such as guava or banana (Karban and Baldwin, 1997). Furthermore, the large leaf surface area and higher moisture retention of coconut create a favourable microclimate for egg viability and nymphal development, supporting faster life-cycle completion and increased morphometric traits (Boughton *et al.,* 2015). Collectively, these nutritional, physical, and microclimatic factors likely contribute to the enhanced growth and development of *A. rugioperculatus* on DJ Sompurna, explaining its higher suitability compared with other host plants.

The shorter life cycle of RSW on coconut compared to banana and guava, combined with larger egg and nymph sizes, suggests that coconut plants provide a more favourable environment for development and growth. Biologically**,** a reduced developmental duration allows more generations per season, accelerating population buildup. Ecologically**,** larger eggs and faster-growing nymphs may increase survival rates and competitive advantage, potentially leading to higher infestation levels on coconut plantations. These host-dependent differences suggest that coconut plantations act as primary reservoirs, potentially facilitating spillover to other crops. Understanding these variations is critical for targeted monitoring and management, including timing control measures to vulnerable life stages and prioritizing coconut in integrated pest management programs. Overall, the morphometric and developmental differences reflect host suitability that drives RSW population growth and infestation severity in the field.

In the present study, the biology and morphometry of *A. rugioperculatus* were examined under laboratory-controlled conditions using saplings. Such conditions differ substantially from shed, net house, or field environments, where light, temperature, and humidity fluctuate. Additionally, mature plants may differ in physiological status, nutrient composition, and physical leaf characteristics, all of which could influence *A. rugioperculatus* development, morphometry and host suitability. These findings provide a baseline for understanding *A. rugioperculatus* biology and morphometry under controlled conditions, and future studies on mature, field-grown plants will help validate and extend these observations to natural agricultural settings.

Conclusion

In conclusion, understanding the biology, life cycle, and morphometry of *A. rugioperculatus* is crucial for assessing host suitability and informing targeted management strategies. This study provides valuable bio-morphometric information, demonstrating that coconut, particularly the dwarf variety DJ Sompurna, is the most favourable host, with a shorter life-cycle and larger developmental traits. These findings can guide hypothesis-driven future research, such as evaluating the efficacy of specific biological control agents or implementing targeted cultural practices (e.g., nutrient management, intercropping) tailored to the most susceptible host and key developmental stages of RSW. In addition, strict quarantine measures, early detection, and regular surveillance of both commercial plantations and backyard gardens are essential to prevent further spread of this invasive pest. Coordinated monitoring programs, timely interventions, and farmer awareness campaigns will be vital for sustainable management and for minimizing the economic and ecological impacts of RSW in Bangladesh.

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Conflict of interest

The authors declare that they have no conflict of interest.

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