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Authors: Taravati, Siavash, Glenn, Holly, and Mannion, Catharine

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DAILY FLIGHT ACTIVITY OF THE RUGOSE SPIRALING WHITEFLY (HEMIPTERA: ALEYRODIDAE)

Siavash Taravati[1*], Holly Glenn[1] and Catharine Mannion[1]
[1]University of Florida, Tropical Research and Education Center, 18905 SW 280th Street, Homestead, FL 33031

*Corresponding author; E-mail: siavashtaravati@ufl.edu

The rugose spiraling whitefly (RSW) (*Aleurodicus rugioperculatus* Martin; Hemiptera: Aleyrodidae) is an invasive pest in South Florida. RSW feeds on many plant species but especially gumbo limbo (*Bursera simaruba* (L.) Sarg,; Sapindales: Burseraceae), coconut (*Cocos nucifera* L; Arecales: Arecaceae), black olive (*Bucida buceras* L.; Myrtales: Combretaceae), avocado (*Persea Americana* Mill.; Laurales: Lauraceae), and *Calophyllum* spp.; Malpighiales: Calophyllaceae) (Stocks & Hodges 2012).

Understanding the behavior and movement of insects may help in their management (Foster & Harris 1997). For example, it is known that leaf hoppers in cotton and legume fields are hard to reach with insecticidal sprays because they reside on the underside of the lowest leaves of the plant. In the evening, however, they move to the tops of plants, which makes them vulnerable to spraying (van Emden & Service 2004). In this study, the daily flight behavior of RSW flight was characterized.

The experiment was done in a temperature controlled greenhouse at the University of Florida, Tropical Research and Education Center, Homestead, Florida. The temperature and RH in the greenhouse ranged between 16-27 °C and 32-99%, respectively. No artificial light was used in the greenhouse during the course of the experiment. Giant white bird of paradise (GWBP) (*Strelitzia nicolai* Regel & Körn.; Zingiberales: Strelitziaceae) liners were purchased from a local nursery and repotted into 12 cm (4.7 inch diam) pots and fertilized with a slow release fertilizer (Suncote 16-9-12). Three GWBP plants were infested with RSW by placing them into cages containing adult whiteflies until all of the leaves were infested with egg spirals. Each infested plant was then transferred individually into a 35.5 × 35.5 × 61 cm (14 × 14 × 24 inches) rearing and observational cage (BioQuip) and kept there until adult whiteflies emerged. Two yellow sticky cards (12.7 × 7.6 cm, BioQuip) were placed in each cage on the east and west side of the plant. Sticky cards were held upright with a wire holder inserted into a 16.5 cm (6.5 inch) diam soil-filled styrofoam cup. Each sticky card was labeled with the cage number, date, time, and direction (east or west). The top of the sticky cards were aligned with the top of the plant and were placed approximately 5-10 cm from the plant. The experiment was started on 21 Feb 2014 at 6:00 am, and observations were made through 7 Mar 2014. Sticky cards were removed and replaced with new cards each h for 24 h. Removed cards were wrapped in a plastic film (SARAN™-Premium wrap) for later evaluation. The dawn, sunrise, sunset and dusk time was retrieved from SunCalc (Agafonkin 2014) and observations on the greenhouse brightness and whitefly activity was recorded. The sticky cards were examined under a stereo-microscope and the numbers of male and female whiteflies were recorded. Males were distinguished from females by the presence of the clasper organ in males. Whenever the abdomen was not visible, the plastic film was cut and the wings were pulled up to expose the abdomen. This experiment was repeated on 6 and 7 Mar 2014. The data were analyzed using Mann-Whitney U test (R Version 3.0.2, R Development Core Team).

The average times for dawn, sunrise, sunset, and dusk were 06:24, 06:47, 18:27, and 18:50, respectively. Fig. 1 shows the average number of adult whiteflies trapped each h on sticky traps on east, west, and both sides of the plant combined. Adult flight peaked in the morning after dawn between 7:00-8:00 with a minor peak between 17:00-18:00. The flight activity in the cages after dusk and before dawn was very minor (0.32 whiteflies per hour on average). There was a highly significant difference between the number of trapped males (n = 132) and females (n = 822) (U = 392, P = 0.0002). This difference is believed to be due to the low number of males present in the cages. At least 70% of adults in the cages were female. There were significantly more whiteflies captured on the sticky traps located on the east side between 6:00-10:00 (U = 355, P = 0.001). There was no difference in whiteflies captured between trap locations between 15:00-19:00 (U = 148.5, P = 0.67). We observed that adults aggregated in large numbers on the top-east side of the cage after dawn. It is possible that the actual flight activity time is shifted slightly because of a delay in receiving direct sunlight in the morning and an early darkening of the greenhouse in the evening due to the greenhouse being located between a building on the east and a shadehouse on the west.

To conclude, our data suggested that RSW was most active in flight right after dawn and that flight activity was greatly reduced between 12:00-16:00. There was a smaller peak of activity near sunset. Our data from sticky traps along with our

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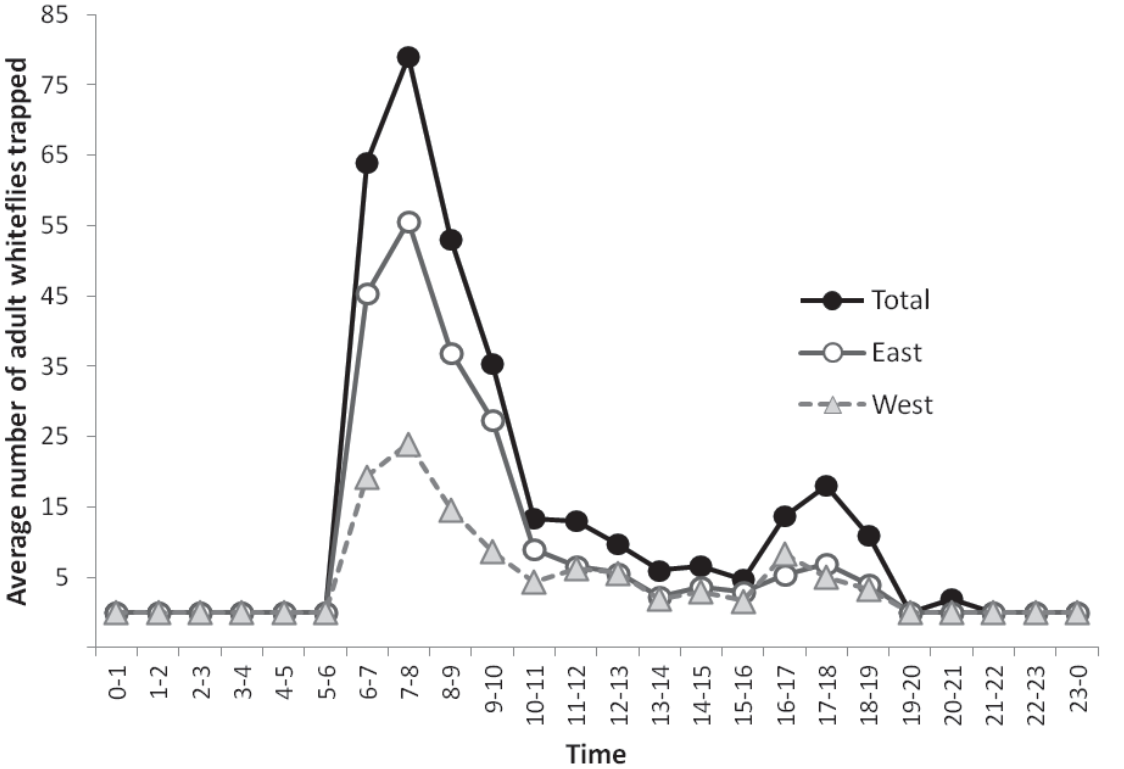

Fig. 1. The average numbers of adult rugose spiraling whiteflies (*Aleurodicus rugioperculatus*) caught hourly by sticky cards placed on the east and west sides of giant white bird of paradise (GWBP) (*Strelitzia nicolai*) plants within cages during experiments lasting 3 days. Observations were made between 21 Feb and 7 Mar 2014.

observations suggest a strong phototaxis of adult whiteflies toward sunlight in the morning. We recognize observations in a cage study may differ somewhat from field observations. Nevertheless, the results from this study are consistent with the findings of Han et al. (2009) that the congeneric spiraling whitefly (*Aleurodicus disperses* Russell) adults were most active in flight around dawn and dusk. A similar result was reported on the silverleaf whitefly [*Bemisia tabaci* (Gennadius)], which showed the longest flight duration between 06:00 and 10:00 (Blackmer & Byrne 1993). The findings from this study may help to improve the management of this whitefly by identifying the best time for scouting, sampling, and application of insecticides or other management strategies.

Summary

The flight activity of the rugose spiraling whitefly (*Aleurodicus rugioperculatus* Martin; Hemiptera: Aleyrodidae) peaked in the morning after dawn. There were significantly more whiteflies captured on sticky traps on the east side than on the west side of the plants between 6:00-10:00, which showed that this whitefly was strongly and positively phototactic during that time of the day. This whitefly displayed a second but smaller peak of flight activity in the evening near dusk.

Key Words: *Aleurodicus rugioperculatus*, dawn, dusk, phototaxis, sunset

Resumen

La actividad de vuelo de la mosca blanca espiral rugosa (*Aleurodicus rugioperculatus* Martin; Hemiptera: Aleyrodidae) alcanzó su punto máximo en la mañana después del amanecer. Hubo significativamente más moscas blancas capturadas en las trampas pegajosas en el lado este que en el lado oeste de las plantas de la ave blanco gigante del paraíso, *Strelitzia nicolai* (Zingiberales: Strelitziaceae), entre 06:00-10:00, lo que demuestra que esta especie de mosca blanca esta fuertemente y positivamente fototáctica durante esas horas del día. Esta mosca blanca presentó un segundo pero más pequeño pico de actividad de vuelo en la noche cerca de la aparición de la oscuridad.

Palabras Clave: *Aleurodicus rugioperculatus*, amanecer, atardecer, phototaxis, salida del sol, puesta del sol

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