THE BASIC REPRODUCTIVE BIOLOGY OF THE GREEN PLANT BUG INFESTING SOUTH TEXAS COTTON

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Abstract

Understanding the reproductive development of any insect pest is one essential aspect of formulating pest management strategies. We reared the green plant bug *Creontiades signatus* (Stahl) (Heteroptera: Miridae), a relatively new pest of cotton, under conditions to induce reproductive development. Males and females were then dissected every 2 d where observations were made and documented through imagery on the temporal development of the reproductive morphology. This preliminary ground-work will be used to aid in preparing for more detailed studies on the life cycle, development and host plant utilization of this pest of cotton.

Introduction

The green plant bug, *Creontiades signatus* Distant, has established itself as a perennial cotton pest from the Upper Coastal Bend to the Lower Rio Grande Valley of Texas. This south Texas region represents roughly 600,000 ha of cotton production. The plant bug causes economic damage to cotton fruit as a result of direct feeding similar to other hemipteran species (Armstrong et al. 2010); damage and yield loss is compounded by the secondary effects of boll rot (Armstrong et al. 2009). Very little technical information is available regarding the basic biology and ecology of this pest, including reproduction, host plant utilization, population development or migration from non-crop hosts to crop hosts.

Materials and Methods

Green plant bugs eggs were aged from the time of eclosion after being oviposited in green bean pods from a colony maintained at the USDA-ARS, BIRU Weslaco, TX and reared according to the procedures published by Armstrong et al. (2010). Within 24 h of egg-hatch, groups of 1st instar males and females were maintained in 6-L ventilated Tupperware containers held in a walk-in environmental chamber maintained at 28.5 ºC, 65% RH and a 14:10 (L:D) h to induce reproduction. Adult males and females were dissected at 2 d intervals for 14 d. Adults were pinned in dissection plates and dissected in 7.4 % phosphate buffered saline to assess and document temporal development of reproductive systems. A digital camera (Canon A590 IS, Malaysia) capable of 4x magnification mounted on an SZ-PT Olympus camera mount, and a stereoscope (Olympus SZ60, Olympus America Inc. Center Valley, PA) was used to record images of gonadal development.

Results and Discussion

For general reference, the green plant bug adult is larger (>2 mm in length) than the tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), and the western tarnished plant bug, *Lygus hesperus* Knight, taking on a longer, more slender body length (Figure 1b). Nymphs and adults have antenna that are longer than the length of body and generally bright red eye color pigmentation (Figure 1a & 1b). Males can easily be distinguished from females by observing the ventral aspect of the last abdominal segment. Males have a narrow abdomen with the genital opening on the last segment (Figure 1c), while the female has a prominent ovipositor that transects the last 4-5 segments from a ventral aspect (Figure 1d).

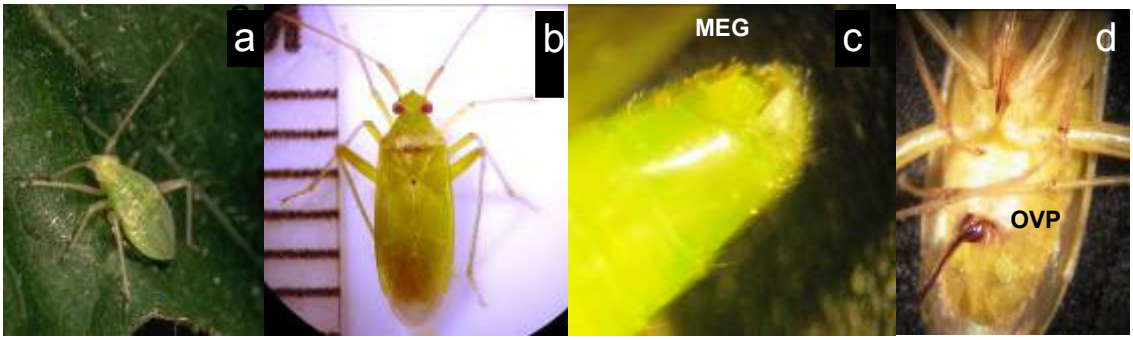

Fig. 1. Green plant bug, *C. signatus:* a) nymph; b) adult slightly over 5 mm in length; c) ventro-lateral view of male external genitalia; and, d) ventral view of female with ovipositor extended. MEG, male external genital opening; OVP, ovipositor.

Adult males that are 2 d of age have green colored testes (Figure 2a) for almost all their life-span, but the color tends to fade with age. Mature eggs of reproductive females can be seen as early as 2 d (Figure 2b), but generally 3 d are required for complete chorionation and for the operculum to turn to a medium brown color. Eggs are fully mature and may be oviposited following chorionation and operculum development. At 4 d of adult development, male testes are broadened and mature, but may remain green in color (Figure 2c). This may be an artifact of feeding on green beans, but our observations of dissected field-collected individuals from other host plants indicated field-collected males also possessed green testes. Females will have a full complement of mature eggs at 4 d of age (Figure 2d), but on average, and based on our experience of rearing green plant bugs, the pre-oviposition period is 4.5 d.

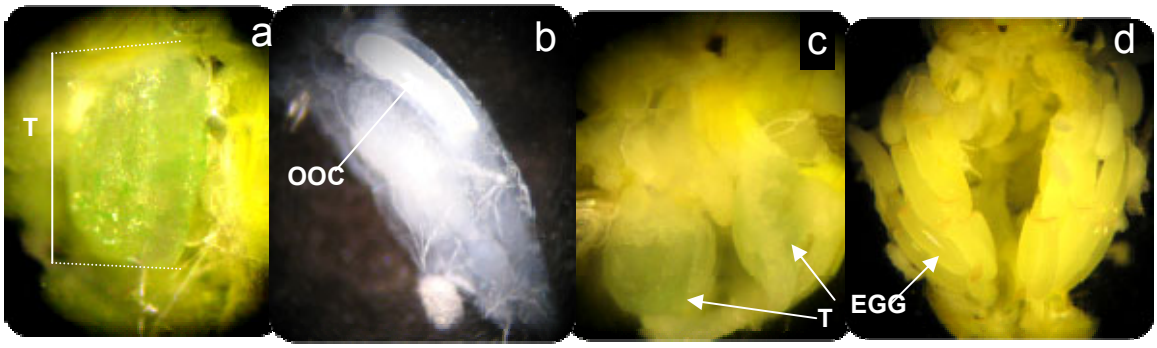

Figure 2. Green plant bug, *C. signatus*: a) testis from a 2 d old adult; b) oocyte development from a 2 d old female; c) testis from a 6 d old male; and, d) a full egg complement from a 4 d old female. T, testis or testes; OOC, oocyte; EGG, mature chorionated egg.

At 6 d of age, adult males will have the medial accessory glands full and distended with sperm, while the lateral accessory gland remains opaque, and seminal vesicle is well developed and full of sperm (Figure 3a). Males that have been successful in actively mating with females will show sperm in both the lateral and medial accessory glands by the age of 10 d (Figure 3c). The copulatory pouch of a 10 d old female will expand with sperm much like a shiny balloon, making the determination of mating success quite obvious (Figure 3d). Sperm is quite visible

through the wall of the copulatory pouch. Both medial and lateral accessory glands are full of sperm in 12 d old males (Figure 4a); the copulatory pouch of the 12 d old females seems to be deteriorating, but a full complement of mature eggs remains ready for oviposition (Figure 4b). Mature testes from males that are 14 d of age tend to turn white from the distal end, which appears to be a sign of maturity (Figure 4c). Finally, our observations for eggs deposited in plants are that as they mature, the center portion of the operculum darkens significantly, turning dark black by 8-9 d before the will hatch (Figure 4d). Eggs that remain clear or opaque do not appear to be fertilized and will never develop.

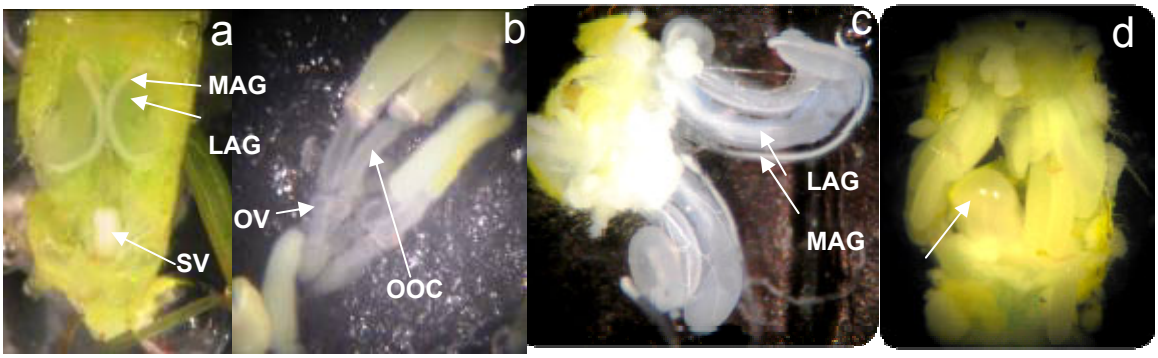

Figure 3. Green plant bug, *C. signatus*: a) lateral and medial accessory glands in a 6 d old male; b) ovary development from a 6 d old female; c) lateral and medial accessory glands from a 10 d old male; and, d) copulatory pouch and egg complement of fully mature and chorionated eggs in a 10 d old female. MAG, medial accessory glands; LAG, lateral accessory glands; SV, seminal vesicle; OV, ovary; OOC, oocyte; EGG, operculum of oviposited egg; CP, copulatory pouch.

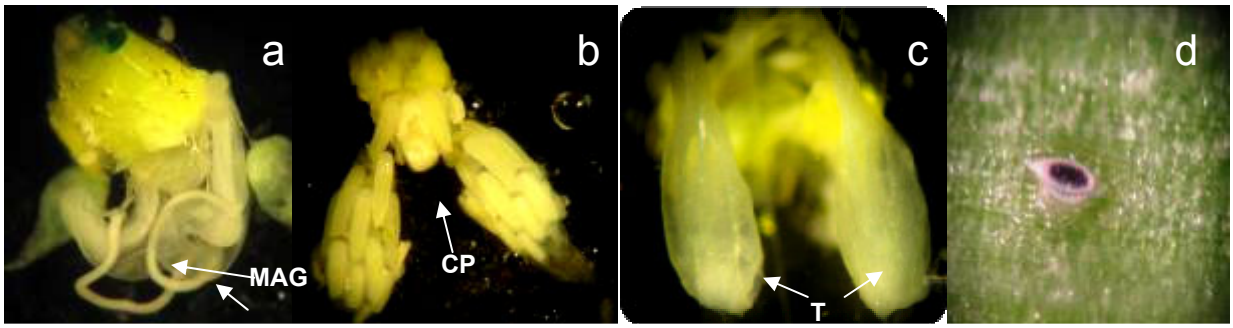

Figure 4. Green plant bug, *C. signatus:* a) lateral and medial accessory glands from a 12 d old male adult; b) egg development from a 12 d old female; c) testes from a 14 d old male; and, d) operculum or "egg cap" from a mature egg oviposited in a cotton leaf petiole. MAG, medial accessory glands; LAG, lateral accessory glands; CP, copulatory pouch, T, testes; EGG, operculum of mature egg oviposited in plant.

Acknowledgement

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References

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