

## Vertical distribution of *Aphis gossypii* Glover (Hemiptera: Aphididae) within cotton cultivars with colored fibers.

Francisco Sales Fernandes (UCB/EMBRAPA, salimfernandes@hotmail.com), Francisco de Sousa Ramalho (UCB/EMBRAPA, ramalhohvv@globo.com), José Bruno Malaquias (PPG ENTOMOLOGIA ESALQ/USP, jbmalaquias@ig.com.br), José Luís Nascimento Junior (UCB/EMBRAPA, jlnjunioragro@hotmail.com), Ezequias Teófilo Correia (UCB/EMBRAPA, ezequiaslca@gmail.com), Antonio Rogério Bezerra do Nascimento (UCB/EMBRAPA, nascimento\_arb@yahoo.com.br) and José Cola Zanuncio (DBA/UFV, zanuncio@ufv.br)

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### 1 - Introduction

The cotton plant (*Gossypium hirsutum* Linnaeus) is one of the most important crops for the agribusiness Brazilian, because presents major environmental and economic benefits. Naturally colored cottons are unique because they do not require dyeing in the fabric manufacturing process. Accordingly, the use of cotton with naturally-colored fiber could be an interesting strategy to help reinvigorate the cotton industry in the Northeast region of Brazil. But this crop's can be affected for cotton aphid *Aphis gossypii* Glover (Hemiptera: Aphididae) that is found during the development phase of cotton plants.

Colonies of *A. gossypii* are generally located on ventral parts of leaves; however, nymphs and adults can also be found on the dorsal parts of leaves (Gonzaga et al. 1991). Apterous and alate individuals may be found on a single leaf; however, the alate individuals occurs more frequently in high-density infestations, where competition for food is greater (O'Brien et al. 1993). Its reproduction is parthenogenetic, with a reproductive period from five to 10 days, in which a female can produce up to 40 nymphs (Van Steenis 1992).

A lot of research has been conducted on the distribution of arthropods in cotton plants (Kuehl and Fye 1972; Wilson et al. 1983; Wilson et al. 1984; Fernandes et al. 2003); there is, however, little information about the vertical distribution of *A. gossypii* according to the age of colored-fiber cotton. Knowledge of the vertical distribution of *A. gossypii* in naturally-colored cotton plants according to age may help improve decision making in integrated management programs for this pest. Accordingly, the aim of this study was to describe the vertical distribution of the cotton aphid, *A. gossypii* within a cotton plant in two cotton cultivars (BRS Safira and BRS Rubi) with colored fiber, over the time.

### 2 - Material and Methods

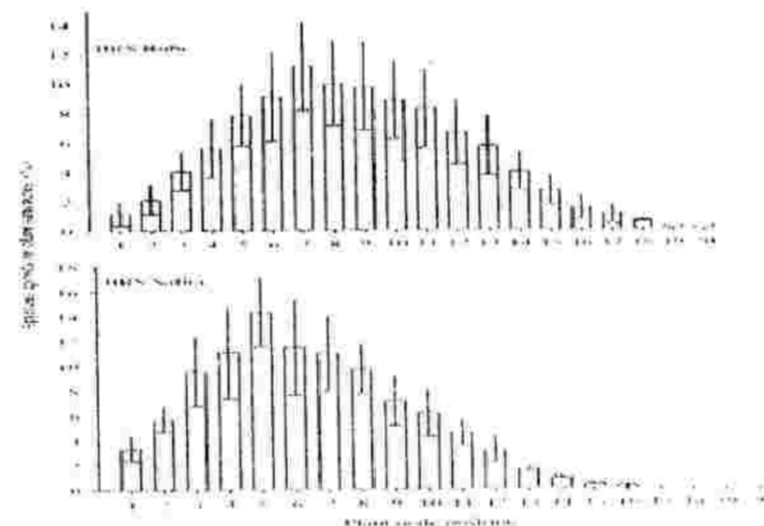
The study was carried out at Experimental Station of the Embrapa Algodão, Campina Grande, Paraíba State, Brazil. A randomized block experimental design was used, with two treatments composed of colored-fiber cotton cultivars (*G. hirsutum* L.) BRS Safira and BRS Rubi, distributed in five replications, with each experimental unit composed of 25 plants. Measurements of aphid population distribution in the cotton plants were taken in intervals of seven days, from the moment of plant emergence until the

appearance of the first open bolls. The percentages of apterous and alate aphids were recorded in relation to the nodes' vertical position on the plant (the lowest node = 1 and the highest = 20) or the leaf's position on the branches, using PROC REG (Sas Institute 2006). Furthermore, to test the hypothesis that the behavior of the aphid's vertical distribution on the plant varies according to the cultivar, the linear portion of fitted models was compared. Thus, the linear slopes of fitted models (i.e., first- or second-order models) of percentage of aphids per vertical (node on mainstem or leaf on branches) were compared between cotton cultivars using PROC MIXED to test the equality of linear slopes (Sas Institute 2006).

### 3 - Results and Discussion

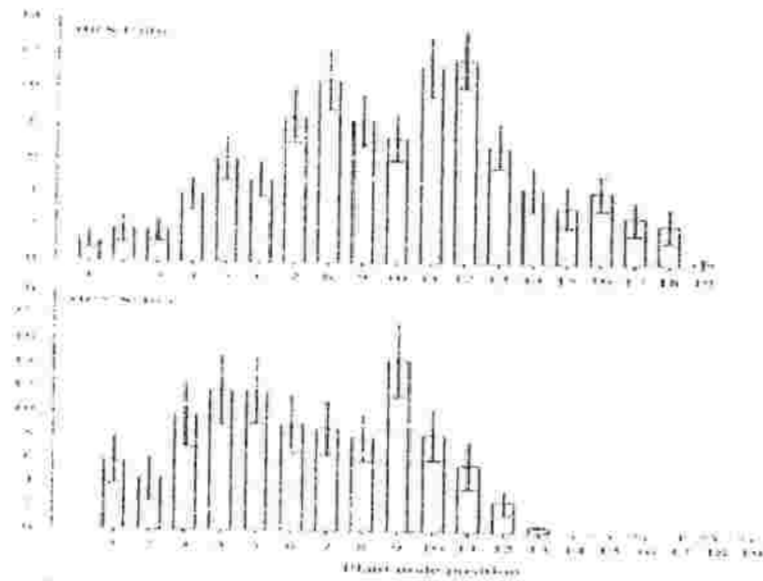
The results of this study show that the number of apterous aphids found on the cultivar BRS Safira (56,515 aphids) was significantly greater than that found on BRS Rubi (50,537 aphids) ( $F_{(1, 332)} = 183.83, P < 0.0001$ ). However, there was no significant difference between the number of alate aphids between the cultivars BRS Safira (365 aphids) and BRS Rubi (477 aphids) ( $F_{(1, 332)} = 2.55, P > 0.1114$ ).

Considering the highest percentages of apterous aphids were found on nodes 1 to 10 of the BRS Safira (89.1%) and BRS Rubi (69.4%) cultivars (Fig. 1).



**Figure 1.** Vertical distribution (%) of apterous aphids on nodes within BRS Safira and BRS Rubi cotton plants based on plant node position from bottom (node 1) to plant apex (node 20). <sup>1</sup>All plant structures (leaves, squares, flowers and bolls).

In BRS Safira, 99.5% of alate aphids were found on nodes 1 to 12, while in BRS Rubi, 86.1% of alate aphids were found on nodes 5 to 16 (Fig. 2).



**Figure 2.** Vertical distribution (%) of alate aphids on nodes within BRS Safira and BRS Rubi cotton plants based on plant node position from bottom (node 1) to plant apex (node 20). <sup>1</sup>All plant structures (leaves, squares, flowers and bolls).

Cividanes (2002) believes that the appearance of alate aphids in crops in their initial development phase may be influenced by factors such as the host plant's odor, the quality of the light spectrum reflected by the crop and local temperature. It is probable that differences in such factors in the cotton crops studied were not great enough to establish significant differences for colonization by alate aphids of *A. gossypii*.

Given that the apterous and alate aphids were found to concentrate in the bottom and middle nodes, quadratic models were the best fit to represent decrease in percentage of apterous (BRS Safira:  $y = 7.73 + 0.47x - 0.05x^2$ ,  $R^2 = 0.69$ ,  $F_{(2,15)} = 16.89$ ,  $P < 0.0007$  and BRS Rubi:  $y = 0.66 + 1.70x - 0.10x^2$ ,  $F_{(2,17)} = 32.57$ ,  $R^2 = 0.79$ ,  $P < 0.0001$ ) (Fig. 4) or alate (BRS Safira:  $y = 7.65 + 0.50x - 0.06x^2$ ,  $F_{(2,15)} = 12.81$ ,  $R^2 = 0.63$ ,  $P < 0.0006$  and BRS Rubi:  $y = -1.89 + 1.94x - 0.10x^2$ ,  $F_{(2,17)} = 19.82$ ,  $R^2 = 0.70$ ,  $P < 0.0001$ ) aphids per node from bottom to top of plants (Fig. 5). The pattern for apterous (PROC MIXED of Sas for equality of linear coefficient:  $t_{(1, 32)} = 10.08$ ,  $P < 0.0018$ ) or alate (PROC MIXED of Sas for equality of linear coefficient:  $t_{(1, 32)} = 15.12$ ,  $P < 0.0006$ ) aphids was different comparing the linear coefficients of the models between BRS Safira and BRS Rubi cultivars.

The interaction between cultivars and plant age and also between plant region and plant age reflects variation in leaf area, the number of leaves, the age of the leaves, the level of nutrients, amino acid concentration, levels of secondary metabolites, and the number of nodes per main stem. These factors consequently affect patterns of vertical distribution of apterous and alate aphids in the plants. The effects of these physiological factors on aphids depend on the plant's age, with different behavior over the course of the plant's development (Cividanes and Santos 2003). In terms of levels of amino acids, studies carried out by Auclair (1976) revealed that the performance of *Acyrtosiphon pisum* (Harris) is not only affected by the total concentration of amino acids, but also by the relative concentration of different amino acids that may contribute

to a possible nutritional balance and/or reduced phagostimulation.

The results of this study are of great importance in improving control strategies for *A. gossypii* in the naturally-colored cotton cultivars BRS Safira and BRS Rubi.

#### 4 - Acknowledgments

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