Spatial Distribution of Preimaginal *Bemesia tabaci* (Homoptera: Aleyrodidae) in Cotton

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ABSTRACT

Studies were conducted to examine the distribution of preimaginal Bemesia tabaci (Gennadius) in cotton, Gossypium hirsutum L. at various locations in 1996 and 1997. The number of eggs and nymphs were counted on the underside of leaves from the top, middle and bottom thirds of the plants. Fifty to one hundred leaf samples were taken from each field at weekly intervals. Fields were selected from commercial crops with conventional spray programmes and from research fields with controlled conditions. The number of eggs and nymphs per leaf increased considerably towards the end of the season in all three strata in each field but the proportion of eggs was consistently higher in the upper stratum. The nymphs took higher proportions of the populations on leaves in the middle and bottom strata. This became more evident late in the season. The proportion of nymphs was always higher in the middle than the bottom stratum.

Introduction

The Çukurova low plain comprising the provinces Hatay, Içel and Adana, is the largest cotton growing area of Turkey. About 3-400 000 ha land are devoted to irrigated and non-irrigated cotton cultivation. Cotton is one of the main cash crops in Turkey, providing raw material for textile and cottonseed processing industries and providing many labour opportunities in agriculture and industry. Cotton and value added cotton products are major exports.

Since 1974, *Bemisia tabaci* (Gennadius) has become the most important pest in cotton under irrigated conditions (Sengonca, 1975). Although its population densities change from year to year, it is the key pest in Çukurova. If no control measure is taken, it causes 40 % yield reduction in irrigated and 15 % in non-irrigated areas (Anon., 1974-1987). Although some chemicals are available, the ability of *B. tabaci* to develop resistance rapidly and inefficient aerial applications prevent satisfactory whitefly control.

Management of *B. tabaci* presents a significant challenge because of its intercrop movement, high reproductive potential, broad host range, resistance to insecticides and its habitation on the underside of foliage. An efficient IPM program has to be based on a solid sampling plan that depends on an understanding of the underlying spatial distribution of the target insect (Morris, 1960; Southwood, 1978). A number of sampling methods have been developed to estimate population densities of immature *B. tabaci* in cotton (Gerling *et al.*, 1980; Butler *et al.*, 1986; Ohnesorge and Rapp, 1986; Rao *et al.*, 1991; Naranjo and Flint, 1994).

This report discusses the spatial distribution of eggs, nymphs and pupae of *B. tabaci* on cotton plants in Çukurova, Turkey.

Materials and Methods

Within-plant distributions of *B. tabaci* eggs, nymphs and pupae were examined from mid-June to late-August on upland cotton, *Gossypium hirsutum* L., at the 0.2 ha grower field in Akdam 1996, an 0.5 ha grower field in Dikili and 0.5 ha experiment field in Balcalı in 1997. Grower fields received regular chemical treatments for cotton pests while experiment field were untreated. Fifty to hundred randomly selected plants were sampled from each field weekly. Three leaves from the top, middle and bottom strata of the plants were taken randomly on side branches from each plant in 1996. In 1997, two extra leaves from third and fifth node were also sampled in addition to three strata. Leaves were brought to the laboratory and the number of eggs, nymphs and pupae were counted separately on the whole leaf under the stereomicroscope. Analysis of variance (ANOVA) was used to test for differences in abundance among the stages for each stratum. Whole-leaf counts were transformed by $\ln(x + 1)$.

Results

Statistical analysis indicated that the numbers of each immature stage were significantly different among the leaves taken from each stratum. The differences among mean density of egg, nymph and pupal stages were also different for each leaf at different strata. Only percent distribution of immature stages within plants from three different fields are presented.

Although the mean density of each stage varied between two fields within-plant distribution showed similar trends in 1997. The number of eggs and nymphs per leaf increased considerably towards the end of season in all three strata in each field but the proportion of eggs was consistently higher in upper strata. The proportion of nymphs was higher on leaves in the middle and bottom strata. This became more

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evident late in the season. The proportion of nymphs was always higher in the middle than the bottom stratum (Figures 1-3). Although the mean density of eggs was lower on bottom strata, their proportion was higher or similar to those of nymph and pupal stages in Akdam (Figure 1) and Dikili (Figure 2). The proportion of pupal stage was consistently lower regardless to the position of leaves in all fields. This might be due to the emergence of adults from the pupae and/or high mortality rates of nymphal stages. Within-plant distribution of stages showed slight differences in untreated field. The proportion of nymphs was higher than that of eggs and pupae on fifth nodal leaf and on leaves at bottom strata (Fig. 3). The population density of immature stages might effect the within-plant distribution of the stages, since population densities of whiteflies were much lower in this field compared to the others. The increase in proportion of nymphs by time was observed in Dikili and Balcalý on leaves taken from the lower strata until the end of July in 1997 (Figs. 2, 3). Similar trend was not detected in Akdam in 1996; the proportion of nymphs fluctuated over time (Fig. 1). Disregard to population densities, the proportion of pupal stage was always very low in both years even on leaves from lower strata.

Discussion

Data indicated that leaves from the top strata had the greatest number of eggs, and leaves from middle and bottom strata contained the most nymphs. Other workers (Melamed-Madjar *et al.*, 1982; Ohnesorge and Rapp, 1986; Naranjo and Flint, 1994) reported similar results. As a common practice, a field manager collects a leaf randomly from the cotton plants and counts the pupae for decision making. Since the leaves from bottom strata and from mainstem node 5 showed similar trends in proportions of egg and nymph stages, it could ease and speed the sampling by taking a leaf randomly from lower strata. However, making decision with these samples might be misleading because of high variation in leaf ages on side branches. Most studies have focused on defining the position of the most infested leaf, but from a sampling perspective, the leaf showing the least variation might be more important as reported by Naranjo and Flint (1994). Before drawing any further conclusions, our data require a through statistical analysis.

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Figure 1. Percent distribution of preimaginal stages of *B. tabaci* on leaves taken from different strata of cotton plants in Akdam.

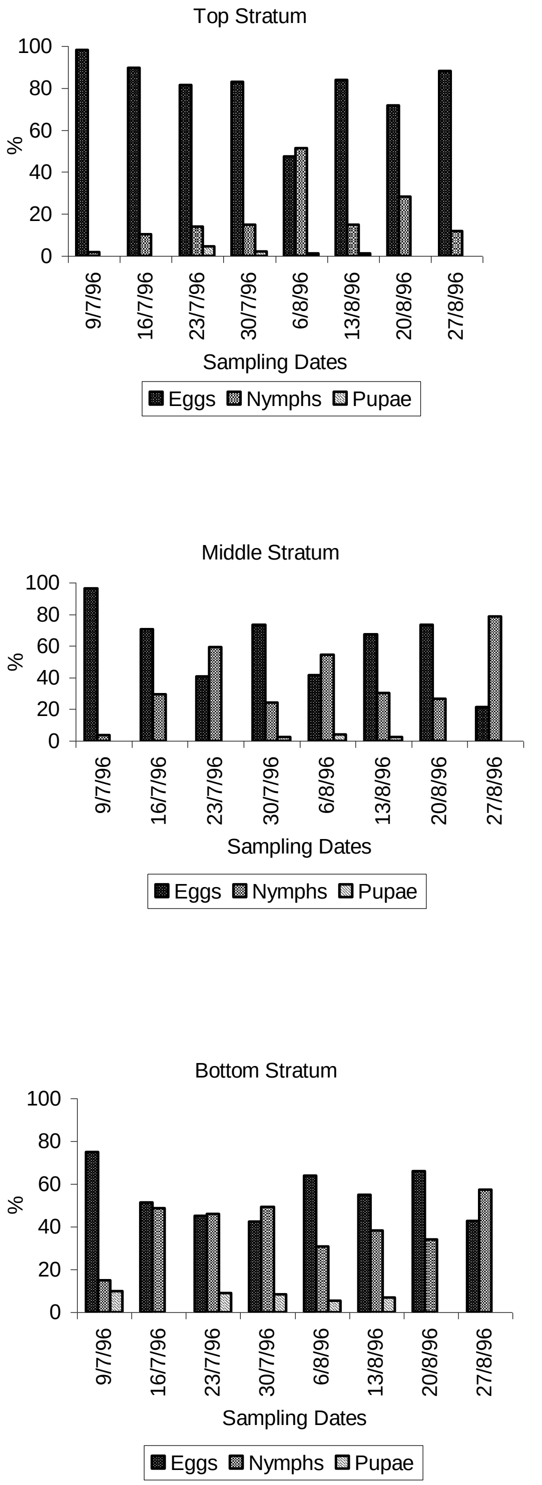

Figure 2. Percent distribution of preimaginal stages of *B. tabaci* on leaves from different strata of cotton plants from commubal firlds in Dikili (Legend as for Figure 1).

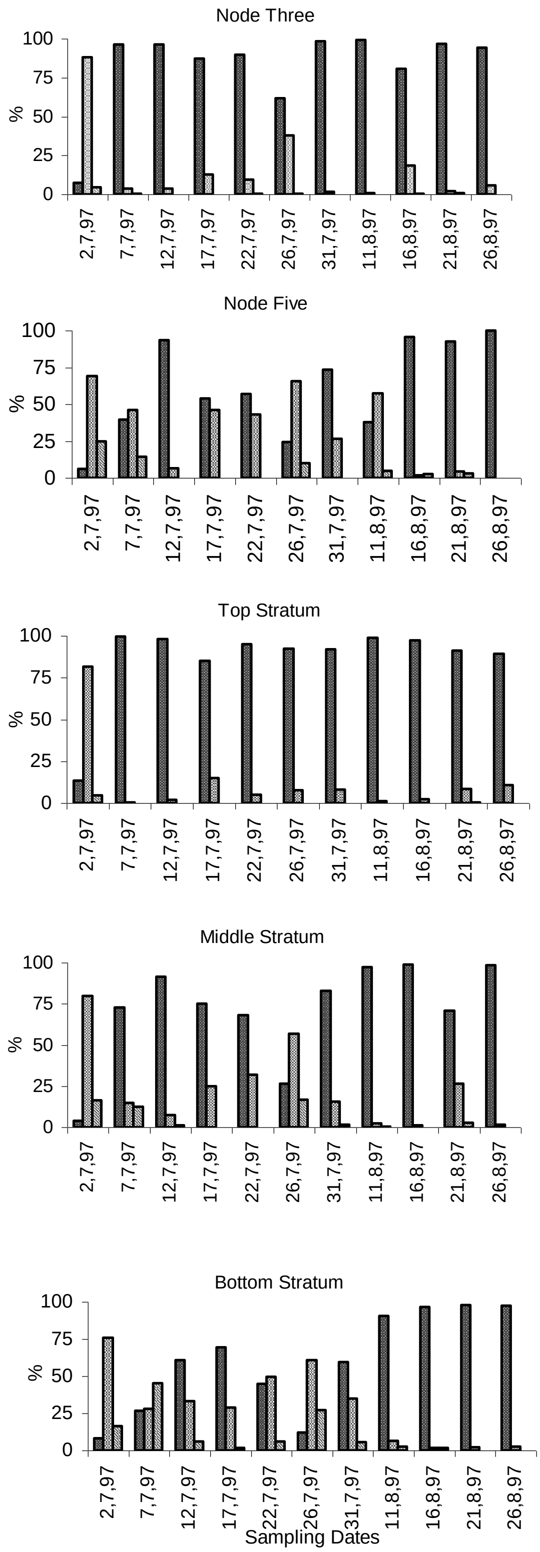

Figure 3. Percent distribution of preaginal stages of B.tabaci on leaves taken from different srata off cotton plants untreated from an experimental field in Balcali in 1997 (Legend as for Figure 1).