

ECOLOGICAL STUDIES ON THE IMMATURE STAGES OF THE WHITEFLY *BEMISIA TABACI* ON CASSAVA

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Résumé

La mouche blanche *Bemisia tabaci* (Homoptera: Aleyrodidae) est le seul insecte connu vecteur de la mosaïque africaine du manioc. Des essais aux champs sont en cours en basse Côte d'Ivoire pour étudier l'écologie des populations aux stades immatures sur le manioc. Des données préliminaires sur la vitesse de développement et le taux de mortalité de chaque stade, la distribution à l'intérieur de la plante et l'évolution des populations dans le temps, sont présentées ici. Les mensurations morphométriques ont révélé qu'on peut distinguer entre les sexes au dernier stade larvaire.

Introduction

The whitefly *Bemisia tabaci* Genn. (Homoptera: Aleyrodidae) is the only known insect vector of African Cassava Mosaic Virus. This disease and the rôle played in its epidemiology by *B. tabaci* have been the subject of a series of studies in southern Côte d'Ivoire, West Africa (e. g. Fargette *et al* 1985, Fauquet *et al* 1988). Hitherto work on the vector has concentrated largely on the adult (Fargette 1985, Fishpool *et al* 1988): preliminary findings from a continuing field study of the population ecology of the immature stages are presented below.

The work is being carried out on an experimental farm at Adiopodoumé (05°19'N 04°08'W), 20km W of Abidjan in the forest zone of Côte d'Ivoire. The Kenyan cassava variety Kasimbidgi Green has been used, which is largely resistant to the disease, and is grown in plots of 1ha. Studies have concentrated on the first 4-5 months in the life of a cassava crop as it has been shown that infection with the disease after this period results in little yield loss (Fargette *et al.*, 1988).

Developmental Times

Direct observations in the field, at average mean temperatures of 26-28°C and average minimum relative humidities 63-65%, have shown that mean developmental times of the immature stages are as follows:

Immature stage	Mean duration in days
Egg	6.1
I instar	3.5
II instar	2.3
III instar	2.7
IV instar	3.5
'Pupa'	2.7
Total	20.8 (Range 18-23, n=46)

Population Curves

Population curves of nymphs within a cassava crop over the first five months after planting are shown in Figs. 1 & 2. It can be seen that once the crop has been colonised there is a rapid build up in numbers to a maximum at 7-10 weeks, whence there is a marked decline. Similar shaped population curves are seen for adult numbers in cassava of the same age (Fishpool *et al* 1988 and unpublished observations). While with a developmental time of about three weeks from egg to adult some four to five generations are possible during this period, the degree of overlap between generations is such that it is not possible to distinguish them.

Distribution within plant

Adult *B. tabaci* feed and oviposit preferentially on the youngest open five to seven



leaves of a cassava shoot (Fargette 1985). This, coupled with the rapid growth of cassava during this period (one leaf per 1,2 days) and the fact that *B. tabaci* nymphs are sessile, results in a stratification by age of instars down the cassava plant, as can be seen in Fig. 3. This has implications when devising sampling programmes for nymphs (Abisgold & Fishpool in prep.) and explains the choice of leaves sampled in Fig. 2.

Mortality

Preliminary estimates of mortalities of immature stages in the field have been obtained:

Developmental Stage	Mortality
Egg	negligible
I instar	35-50%
II instar	5-15%
III instar	5-15%
IV instar + 'Pupa'	30-40%
Survivorship to adult	2-10%

The main causes of mortality seem to be the failure of I instar nymphs to establish themselves after eclosion and death through parasitism and predation of the IV instar. The main predators recorded are mites of the genus *Euseius* (Acari: Phytoseiidae), while the parasitic wasp *Encarsia transvena* (Hymenoptera: Aphelinidae) is responsible for mortalities ranging from 10 to 60% of the IV instar and 'pupa' (Limberg & van Lingen 1988, and unpublished observations).

Morphometrics of IV instar nymphs

Morphometric measurement of the sizes of IV instar nymphs and 'pupae' revealed them to be bimodally distributed. The smaller size class, (length 0,55-0,63mm, width 0,35-0,43mm), gave rise uniquely to male adults while the larger class, (length 0,67-0,76mm, width 0,44-0,5mm) produced only females imagines. This is being used to investigate possible variations in the sex ratio of the population with time; *B. tabaci* is able to reproduce parthenogenetically with unfertilised eggs developing into males (Mound 1983).

Studies into the population ecology of immature *B. tabaci* continue and the results will be integrated with those from concurrent monitoring of adult populations in cassava, investigations of associated flight behaviour, and disease epidemiology.

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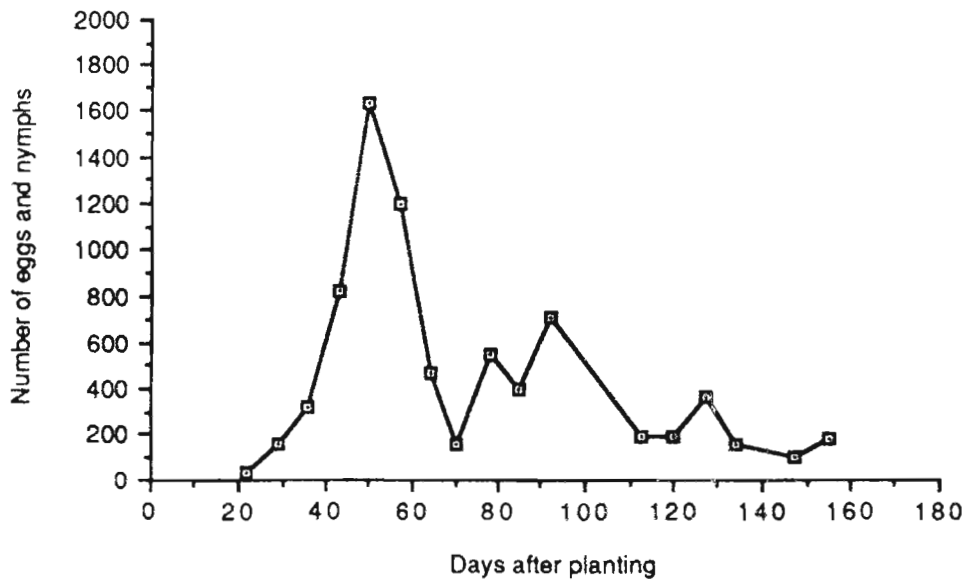


Fig. 1 Change with time in combined numbers of all living immature stages of *Bemisia tabaci* in a cassava crop over the first five months of growth (Dec. 88 - May 1989). Each data point represents the total recorded from one complete plant, except for the first three which are the means from five plants.

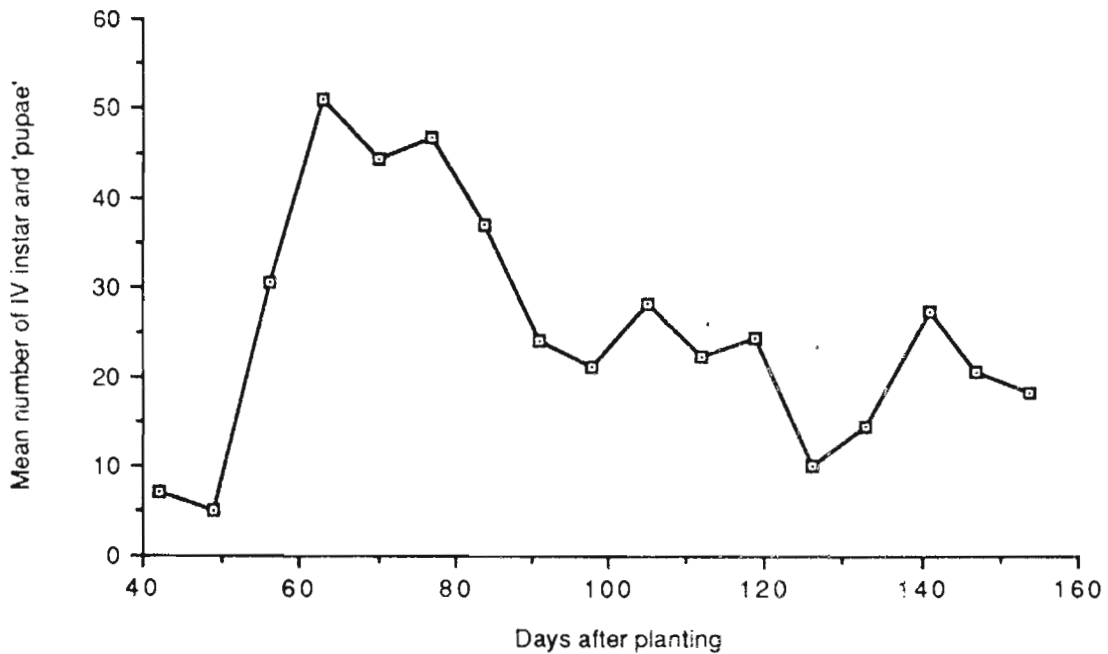


Fig. 2 Change with time in numbers of living IV instars and 'pupae' of *Bemisia tabaci* in a cassava crop over the first five months of growth (Dec. 88 - May 1989). Each data point is the mean number recorded from leaves 10 to 17 from a sample of 49 plants, where leaf 1 is the youngest (apical) open leaf of a stem.

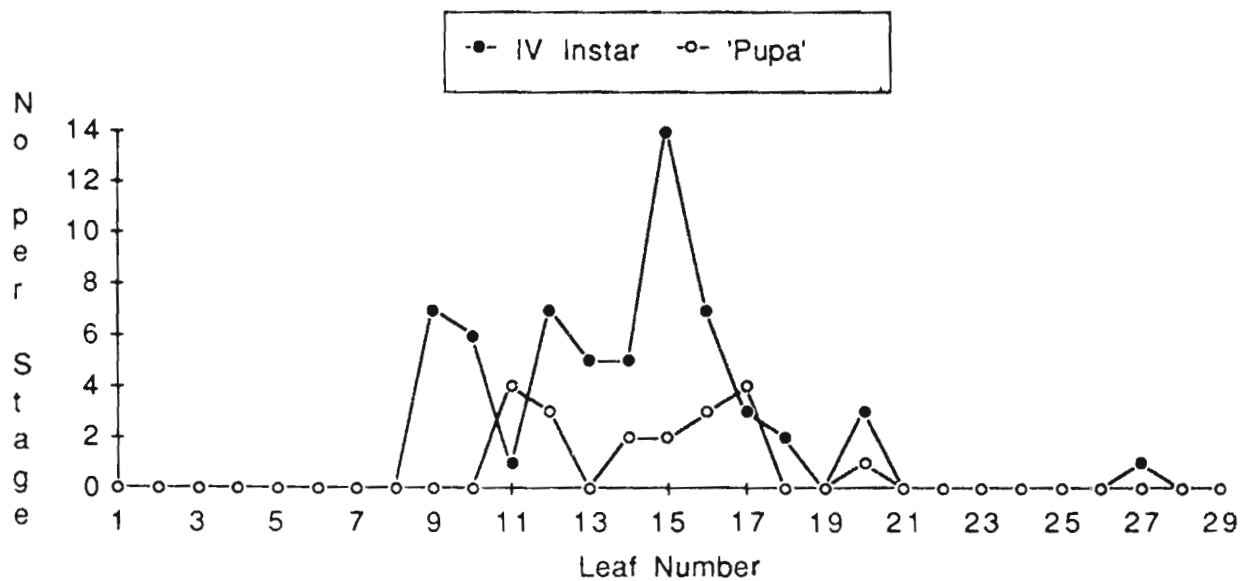
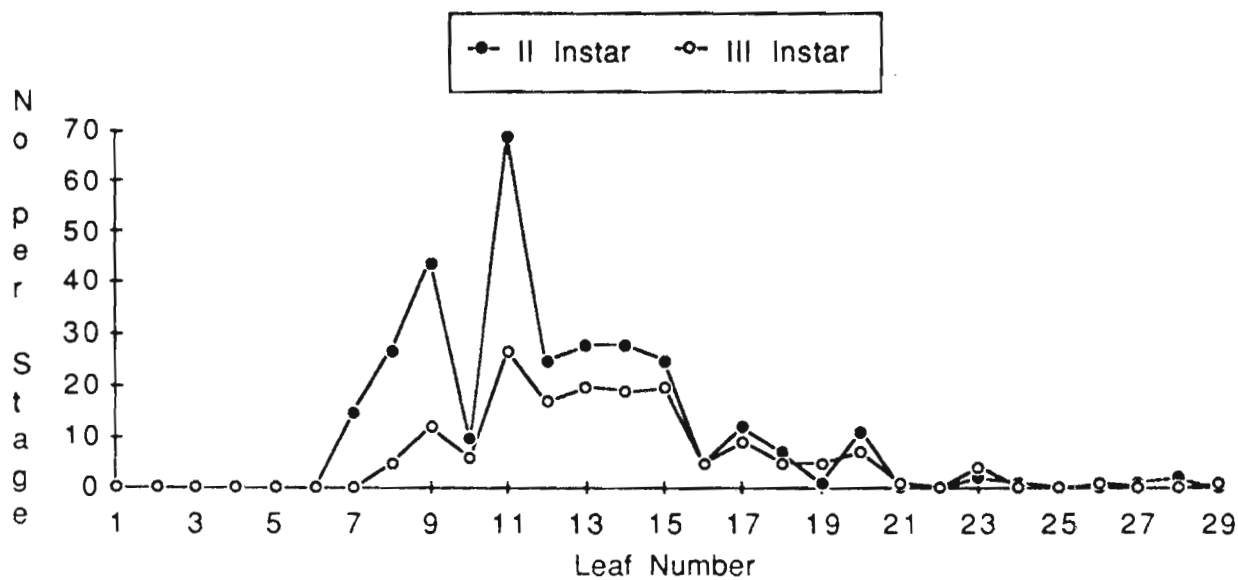
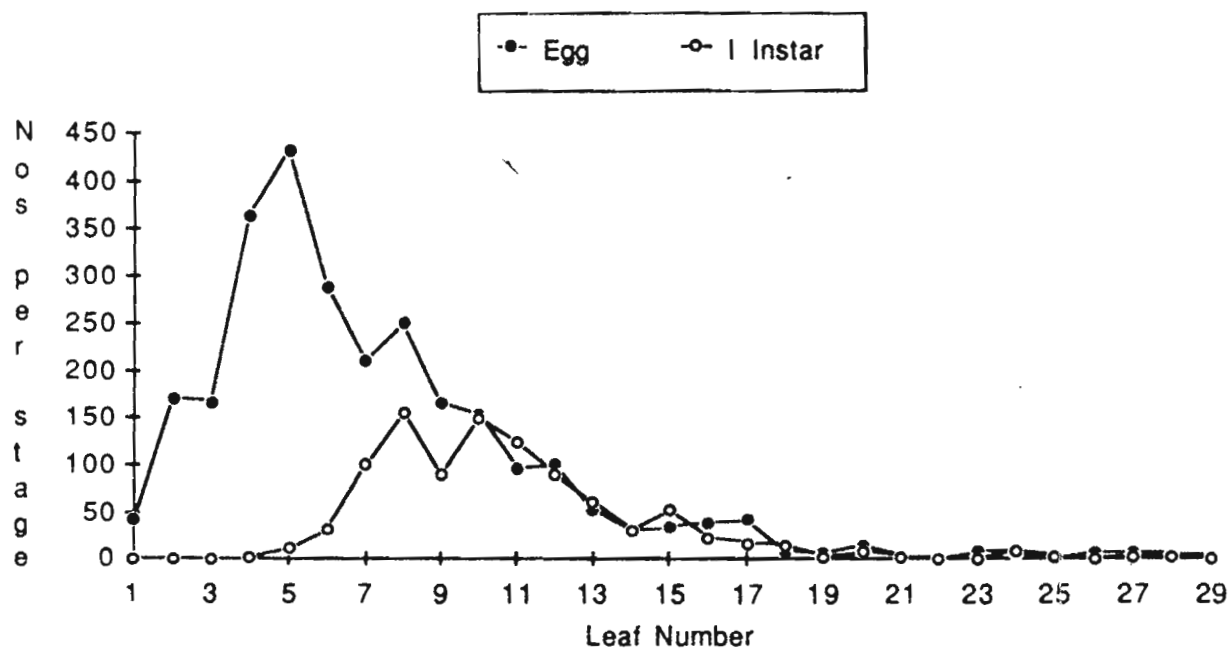


Fig. 3 Distribution in two month old cassava of all immature stages of *Bemisia tabaci* in relation to leaf age. Figures are combined totals from five complete plants counted in early Feb. 1989. Leaf 1 is the youngest (apical) open leaf of a stem.