

Short communication

Survey of the Infestation of *Rastrococcus invadens* Williams (Hemiptera: Pseudococcidae) and its Biological Control Agents at the University of Ibadan Campus, Oyo State, Nigeria

K.A. Kemabonta^{1*} and J.A. Odebiyi²

1. Nigerian Stored Products Research Institute, P.M.B. 12543, Lagos, Nigeria.

2. Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria.

*Corresponding Author (E-mail: kennykemabonta@yahoo.com)

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ABSTRACT: A survey of the infestation of mealybug *Rastrococcus invadens* Williams and its biological control agent was carried out at the University of Ibadan campus, Ibadan Oyo State Nigeria from 1989 to 1991. At each site, a census of host plants, which include Mango (*Mangifera indica*) and other horticultural plants was taken. An exotic parasitoid, *Gyranusoidea tebygi* was released into the ecosystem in 1990 to boost the biological control of the mealybug. The number of infested plants and the intensity of infestation were assessed. Eight sites were infested with *R. invadens* at the inception of the survey in 1989. This increased fourfold by the second year. *R. invadens* was found on mango, frangipani, guava and citrus trees at the survey area. Parasitoids that emerged from mummies collected were *Gyranusoidea tebygi* and *Anagyrus* sp. while the hyper-parasitoids were *Marieta leopadina* and *Chatocerus* spp. Predators of the mealybug include *Exochomus* spp and larvae of *Spalgis lemolea*.

Key words: Biological control, infestation, mealybug, parasitoids.

Introduction

The mango mealybug, *Rastrococcus invadens* Williams, originated from the oriental region (Williams, 1986) and was first observed on the African continent in Togo and Ghana. Since then, it has spread rapidly to other countries including Nigeria, Benin Republic and the Congo (Williams, 1986; Agounke *et al.*, 1988; Willink and Moore, 1988).

Rastrococcus invadens has assumed a prominent status among polyphagous pest of horticultural crops in West African countries since 1982. In Nigeria, it is rated the most potentially dangerous pest (Mamman, 1989) and the second new dreadful enemy of horticulture (Wudil, 1989). It has been recorded on at least 45 species from 32 different families of plants in the Republic of Benin and Togo (Willink and Moore, 1988).

Gyranusoidea tebygi, an exotic parasitoid of *R. invadens*, that was introduced in Nigeria in 1989 had been found to successfully parasitize *R. invadens*. It is now found in areas where it was not released (Odebiyi and Akinlosotu, 1990).

Little is known in Nigeria about *R. invadens* and its newly introduced parasitoid, *G. tebygi*. This experiment was designed to survey the distribution of *R. invadens*

and its biological control agent at the University of Ibadan campus, Oyo State, Nigeria.

Materials and Methods

A survey of *R. invadens* infestations on horticultural crops was conducted at the University of Ibadan Campus between October 1989 to October 1991 at four to six months interval. The study area is as shown in (Fig. 1).

At the study area, a census of host plant which included mango (*Mangifera indica*), the main host of *R. invadens*, and other horticultural plants such as citrus (*Citrus* spp.), frangipani (*Plumeria rubra*), ficus (*Ficus* spp.) and guava (*Psidium guajava*) was taken. The number of infested plants, and the intensity of infestation were noted. In areas where infestation of *R. invadens* was found, other associated crops such as pawpaw (*Carica papaya*), banana (*Musa* spp.) plants, ornamentals and weeds around the area were also examined for the presence of mealybug.

In January 1990 an exotic parasitoid, *Gyranusoidea tebygi* Noyes was released around Ijeoma Street in the South West West (Grid B4) region of the study area (Fig. 1).

The intensity of infestation was assessed thus: Five leaves were randomly selected along the four cardinal points (north, east, south and west) round the crown and the centre of a tree. A sickle mounted on a long pole was used to collect the leaves from the trees. All the five leaves from each tree were kept in "Ziploc"

The intensity of infestation was rated using the following scale modified from Akinlosotu (Personal communication):

- i. >100 mealybug/leaf - High density/heavy infestation
- ii. 50-100 mealybugs/leaf - Moderate density/moderate infestation
- iii. < 50 mealybugs/leaf - Low density/low infestation

The mummies were each kept in a gelatin capsule and watched daily for emergence of parasitoids. The emerged parasitoids were counted and identified. Predators were also collected from the site by the use of aspirators, kept in vials and taken to the laboratory for identification. Larval instars of predators taken to the laboratory were fed on life stages of *R. invadens*. The adults that emerged were identified.

Results

The result of the survey revealed that eight sites were infested within the first year in the study area (Fig. 1). However, by the end of the second year areas infested by natural spread had increased fourfold (Fig. 2). Generally, infestation by *R. invadens* was found localized in residential areas where there were ornamentals and horticultural plants. However, infestation on frangipani and mango were not restricted to residential areas as these plants were also found infested in the Faculties, sports centre and the University staff school.

R. invadens was found on frangipani, citrus, mango and guava trees. Ficus, banana/plantain and pawpaw trees were not infested even where these plants grew close to the infested hosts. In six sites where infestation was found on mango at the back of the building, it did not spread to other hosts such as frangipani and guava trees in front of the building, a distance of less than 10 metres until after 10 months.

Infestation on all host plants surveyed decreased from October 1989 to April 1990 (Fig. 3). In October 1989, out of the 897 mango trees encountered at the survey area, only five percent was infested with *R. invadens*. This was reduced to 4.3% in April 1990. Thereafter, infestation increased gradually from 7.1% in October 1990 to 15.8% in October 1991. Similarly, out of 863 other trees (frangipani, citrus, ficus and guava trees) present at the survey area, infestations by *R. invadens* decreased from 2.4% to 2.0% between October 1989 and April 1990. However, from October 1990 to October 1991, infestations increased from 5.1% to 12.2%.

bags, labeled and taken to the laboratory for further investigations.

In the laboratory, each leaf was examined under a stereomicroscope and the following data were collected:

- (i) Number of various life stages of the pest
- (ii) Number of mummified mealybugs

The intensity of infestation of *R. invadens* on mango varied over the two-year period of the survey (Fig. 4). The number of mango plants that were heavily infested decreased gradually through the years from 28% in October 1989 to 2% in October 1991 while those that were moderately infested decreased from 38% in October 1989 to 10% in October 1991. However, the number of mango plants with low level of infestation by *R. invadens* increased drastically through the years from 35% in October 1989 to 82% in October 1991. Though 15.8% of the 897 mango trees were infested with *R. invadens* by October 1991, only 2.1% were heavily infested.

Within one to two months of the release of *G. tehygi* the parasitoids were recovered from mummies collected at Abadina area in the North Central (Grid E2) region of the campus. Only *Anagrus spp.* and *G. tehygi* were the parasitoids that emerged from the mummies collected while the predators collected include *Exochomus spp.* and *Spalgies lemolea*. Hyperparasitoids collected and identified were *Chartocerus spp.* and *Marietta leopadina*.

Discussion

The initial localization of *R. invadens* for the first 18 months in residential areas where ornamentals and horticultural crops were mainly found probably suggests that *R. invadens* invaded the University of Ibadan campus through movement of ornamentals and horticultural crops in and out of the University campus. A similar observation was made by Akinlosotu, Fajuyigbe and Anno-Nyako (1988) who reported that the long distance spread of the pest resulted from the passive movement of infested plants, especially ornamentals, from one place to the other by urban dwellers. The slow movement of the pest across a distance of 10 meters within a period of 10 months further suggests that physical movement of materials may be more implicated than wind in the movement of the pest.

Initially, infestations of plants at the University of Ibadan campus was found only in eight sites but after two years, it had spread to more than 32 sites. The spread is probably due to the active movement of horticultural plants within the campus by ground-men who tended the University lawns and residential areas all the year round.

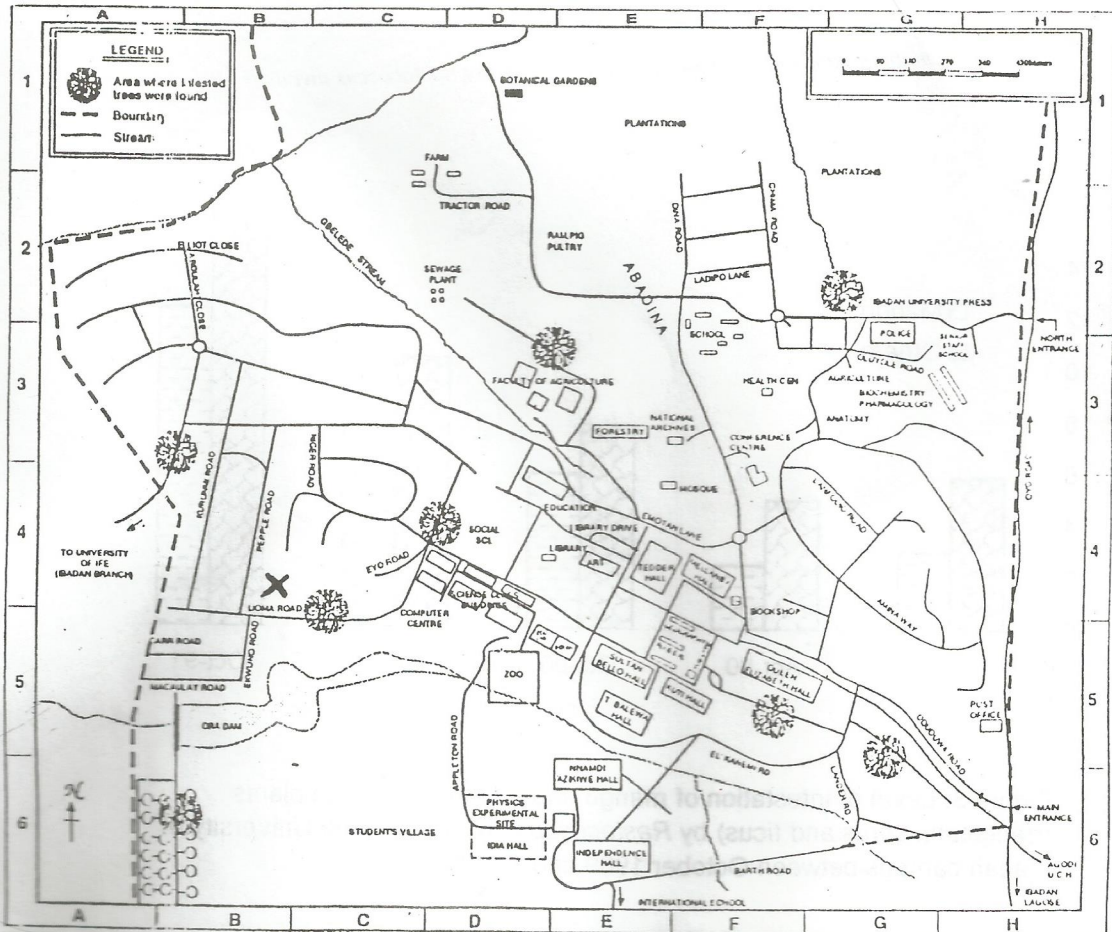


Figure 1. University of Ibadan campus showing initial level of infestation of *Rastococcus invadens* in October 1989. X - Point of release of parasitoid in January 1990.

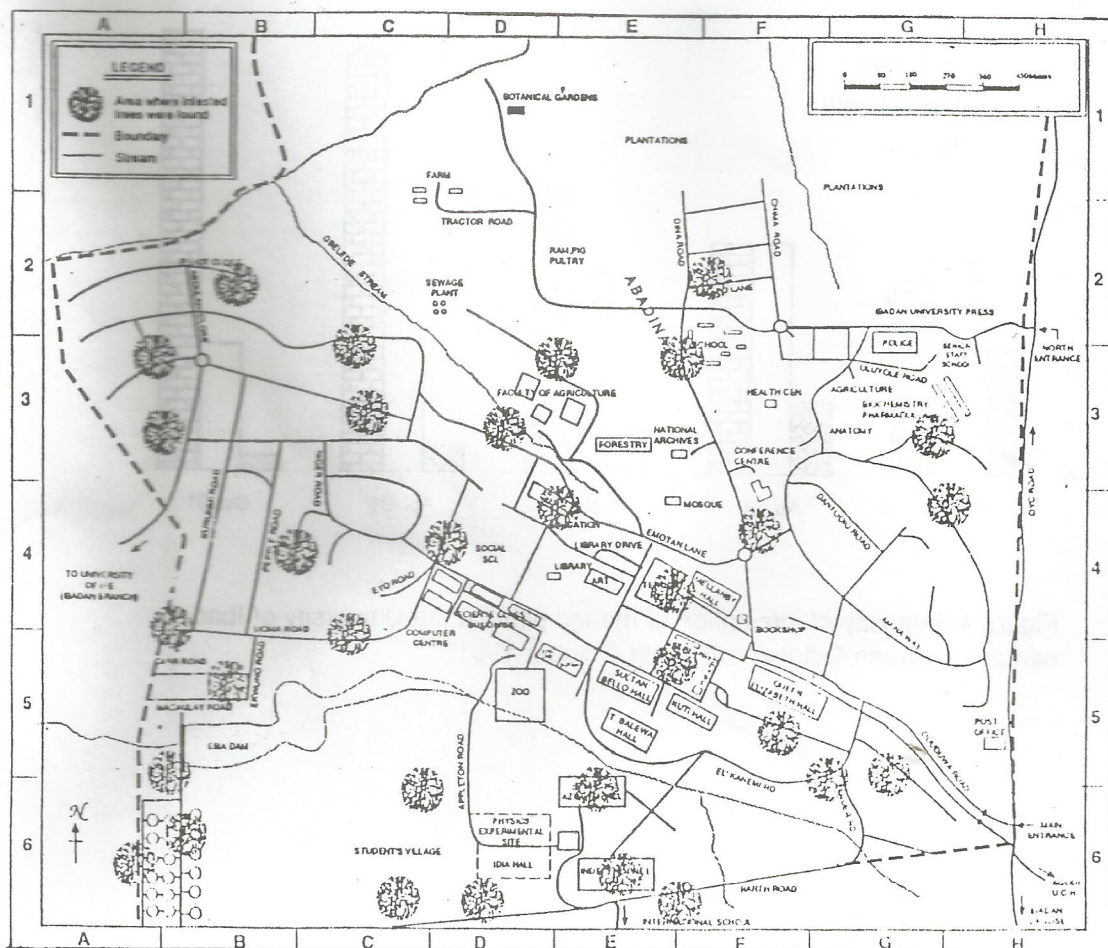


Figure 2. University of Ibadan campus showing initial level of infestation of *Rastococcus invadens* after two years in October 1991.

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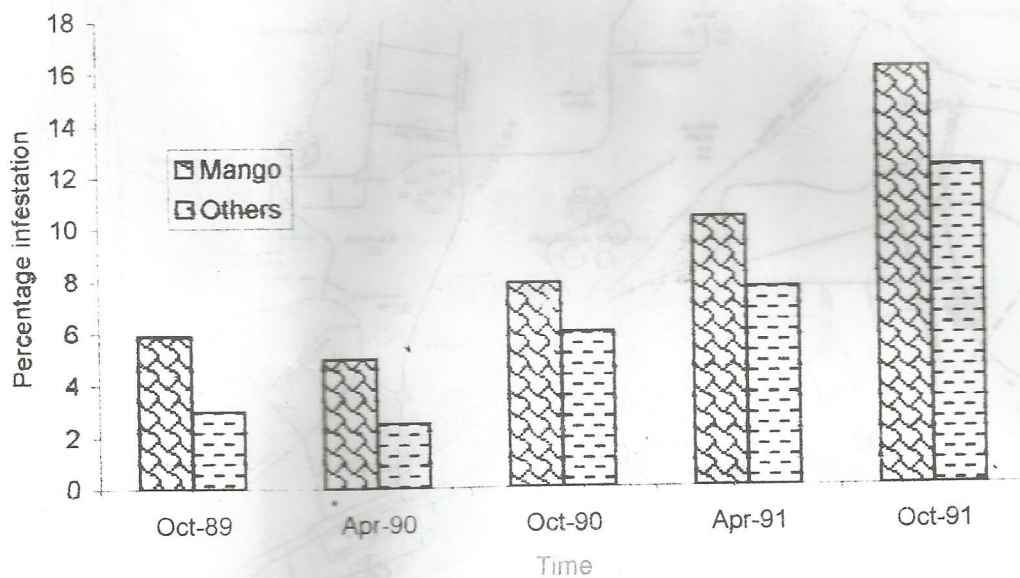


Figure 3. Level of infestation of mango and other horticultural plants (frangipani, citrus and ficus) by *Rastococcus invadens* at the University of Ibadan campus between October 1989 and October 1991.

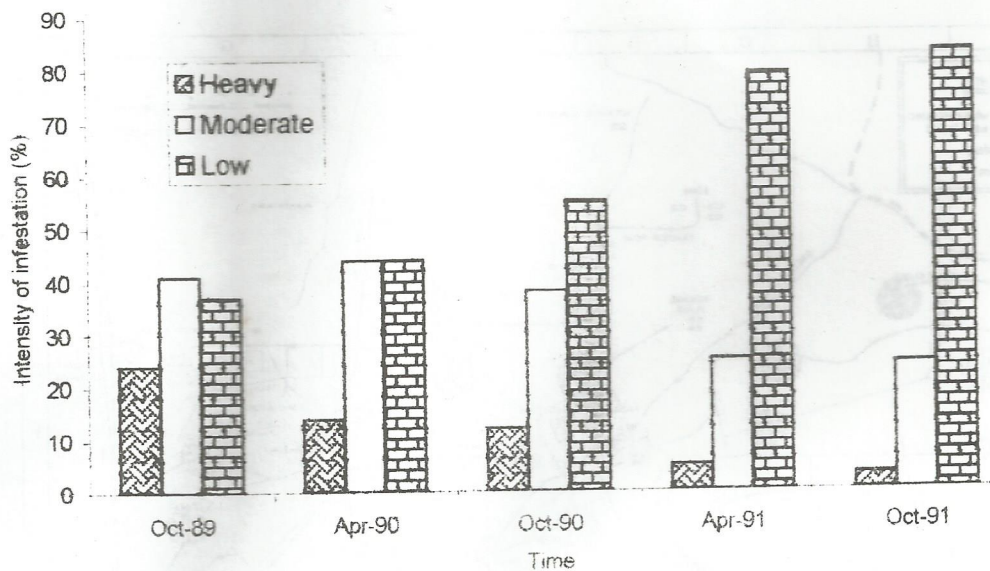


Figure 4. Intensity of infestation of mango plant at the University of Ibadan campus between October 1989 and October 1991.

The rapid decrease in the degree of infestation (Fig.4) in the second year of the survey was no doubt due to the activities of *G. tebygi*. Within one year of its release, *G. tebygi* was found to have established at the University of Ibadan campus

and had spread from the release site to the entire *R. invadens* infested areas. Though it was attacked by two hyperparasitoids, *G. tebygi* appears to have given a good control over *R. invadens*. Moore *et al.* (1988) observed similar results.

Prior to the release of *G. tebygi* in January 1990 and for a couple of months thereafter, pest population was relatively higher on all sites than at any other time during the study period, though some levels of mealybug parasitization, due mainly to the activity of *Anagrus sp.* (a local parasitoid), was recorded during the period. However, after the release of *G. tebygi* the latter was recovered on sites outside the release point and remained so for over two years that this survey lasted.

The constant presence of the parasitoids and the degree of synchronization in population fluctuation between it and its mealybug host is an indication that this exotic parasitoid had established a more or less stable relationship with its host. Furthermore, the reduction in the level and intensity of pest outbreaks is also a clear indication of the effectiveness of the parasitoid in controlling the mealybug. This indicated that the parasitoid has effectively established itself within the study environment. This agreed with Coppel and Martins (1977) who considered a natural enemy as established if it is recorded at one complete year after its release. Moreover, De Bach and Bertlett (1964) reported that a biological control agent could be considered as permanently established if it can be recovered in three successive years after its release. That *G. tebygi* was recovered in sites far away from the release site within two months of release may also indicate a good dispersal rate which according to Doutt and De Bach (1964) is one of the attributes of an effective natural enemy.

Similarly, impressive dispersal ability was reported by Moore *et al.* (1988), who found that *G. tebygi* has spread 15 to 20 kilometers away from the release site within six months of release.

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