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BIOLOGICAL EFFECTIVENESS OF *BEAUVERIA BASSIANA* AND *PAECILOMYCES FUMOSOROSEUS* IN CONTROL OF *BEMISIA TABACI* IN TOMATO CROP

Graciano Obeso Adalid
Tecnológico Nacional de México. Campus Guasave
Guasave, Sinaloa
https://orcid.org/0000-0002-0849-0054

García Gutiérrez Cipriano
Instituto Politécnico Nacional. Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional. Unidad Sinaloa
Guasave, Sinaloa
https://orcid.org/0000-0002-8967-3679

Rodríguez Apodaca Jesús Ramón
Universidad Autónoma Indígena de México
Los Mochis, Sinaloa
https://orcid.org/0000-0002-3609-1958

Abstract: The white fly: *Bemisia tabaco* is a pest that causes significant losses in field and greenhouse crops worldwide. Infestations of: *B. tabaci* in horticultural crops they can cause up to 100 % yield losses when begomovirus transmission occurs during the first phase of crop growth. The objective of the present investigation was to evaluate the biological effectiveness of: *beauveria bassiana* and *paecilomyces fumosoroseus* combined with neem plant extracts in the control of *bemisia tabaci* in tomato cultivation in Guasave, Sinaloa. To achieve the objective, a completely randomized design was established with three repetitions, as a response variable was the insecticidal effect on the population density of adults of *B. Tabaci* in each of the treatments of the experiment, which were established based on the alternative for the control of the white fly. Regarding the results, at 48 and 72 hours after the applications, the counts of white fly adults show that the most efficient treatment for the control of white fly adults is where a combination of *Beauveria bassiana* and neem plant extract, with a total of 32.12±3.01 and 23.98±1.33 on average for each count, respectively. Therefore, it can be concluded that entomopathogenic fungi combined with neem plant extracts are a viable option for white fly control.
Keywords: Control, entomopathogenic fungi, white fly, tomato.

INTRODUCTION

Production systems in vegetable crops vary in terms of varieties, growth substrates, nutrient doses and pest control techniques, among other factors (García & Gonzalez, 2010; Luna et al., 2016). These crops are regularly affected by pest insects, among which the white fly stands out (Pacheco et al., 2016). The white fly: *Bemisia tabaci* is a pest that causes significant losses in field and greenhouse crops worldwide (Perring et al., 2017). infestations of *B. tabaci* in horticultural crops they can cause up to 100 % yield losses when begomovirus transmission occurs during the first phase of crop growth (Ruiz et al., 2019).

In the present project, different doses of entomopathogenic fungi combined with neem plant extracts were evaluated, which produce diseases and cause the death of insects and other arthropods. About 750 species of these fungi are known, most of them included in the groups: *Hypocreales* (Ascomycota) and *Entomophthorales* (Zygomycota), The life cycle of these fungi is divided into a parasitic phase, which goes from infection to the death of the host, and a saprophytic phase, which takes place after the death of the insect. This aspect of their biology allows entomopathogenic fungi to act as facultative pathogens, that is, they are capable of surviving at the expense of organic matter in the soil or other substrate, while there are no insects available to infect, in order to avoid, combat, and eliminate like the white fly.

MATERIALS AND METHODS

STUDY AREA

The present investigation was developed in the municipality of Guasave, Sinaloa, Mexico (Fig. 1). In Guasave, the wet season is sweltering, oppressive, and mostly cloudy and the dry season is hot and mostly clear. During the course of the year, the temperature generally ranges from 12°C to 37°C and rarely drops below 9°C or rises above 39°C. The municipality of Guasave is located in the northwest area of the state of Sinaloa, it has an area of 2,935.60 square kilometers, which represents 5.1 percent of the state area and 0.15 percent of the national area of this area, more than 50 % is used for agricultural activities.

The trials were established in the experimental field of the ''Instituto

Tecnológico Superior de Guasave", which has an extension of 8 hectares and is located in the ejido Burrioncito, Guasave, Sinaloa, between the coordinates 25° to 26° N, and 108° to 109° W (Figure 2).

EXPERIMENTAL DESIGN

In the present investigation, a randomized complete block design (DBCA) was established with three repetitions, as a response variable was the insecticidal effect on the population density of adults of *B. tabaci* in each of the treatments of the experiment, which were established based on the alternative for the control of the white fly (Table 1).

TREATMENT MANAGEMENT

The treatments were applied with the help of a previously calibrated manual pump, in a single application and a daily monitoring was carried out and on day four the total count was carried out.

VARIABLE OF POPULATION DENSITY OF *B. TABACI.*

Samples were taken from the population densities of *B. tabaco,* prior to the application, at 24, 48 and 72 hours after the application of the different treatments, for which ten plants per treatment will be randomly selected, for a total of 60 plants of the six established treatments. They were chosen from the central rows of each treatment for the different evaluations. Samples were taken by randomly selecting three leaves: one from the top, one from the center, and one from the bottom third of the plant. Adults were counted by carefully turning the leaf and observing the abaxial side. Data were reported as number of individuals per cm^{-2} (Reddy y Miller, 2014).

RESULTS AND DISCUSSION

Table 2 shows the values of the effect of different doses of entomopathogenic fungi combined with extract of neem plants on the population density of white fly adults, where it is found that in the count prior to application, the treatment with fewer adults white fly was where it was applied: *Beauveria bassiana* with 40.67 ± 1.22 white fly adults on average per tomato plant, while the treatment with the highest number of white fly adults was where a combination of: *Beauveria bassiana* and neem plant extract with 43.21 ± 1.33 white flies on average per tomato plant.

It can be observed in the trend of figure 3, that in the control treatment, where products were not applied to control white fly, the number of adults increases as the hours pass. For 24 hours after the application, the treatment with neem plant extract was the most efficient in the control of white fly. At 48 and 72 hours after the applications, the white fly adult counts show that the most efficient treatment for the control of white fly adults is where a combination of the entomopathogenic fungus Beauveria bassiana and neem plant extract was applied. with a total of 32.12 ± 3.01 and 23.98 ± 1.33 on average for each count, respectively.

CONCLUSIONS

- At 72 hours after the application of the bioinsecticides, the treatment where Beauveria bassiana combined with extracts of neem plants was applied was statistically different compared to the other treatments.
- The best treatment for the control of white fly adults was where the entomopathogenic fungus Beauveria bassiana was applied combined with extracts from the neem tree, where there was a 55.49% decrease in white fly density, this treatment being where the density decreased the most. adult density.
- The use of bioinsecticides in agriculture is an action that contributes to the

Figure 1. Geographic location of the municipality of Guasave, Sinaloa, Mexico.

Figure 2: Experimental field of: Instituto Tecnológico Superior de Guasave.

Treatment	Alternative for white fly control
T1	Witness (no application)
T2	*Paecilomyses Fumosoroseus*
T3	*Beauveria bassiana*
T4	Neem plant extracts
T5	*Beauveria bassiana + Neem plant extracts*
T6	*Paecilomyses Fumosoroseus* + Neem plant extracts

Table 1. Treatments evaluated in the present investigation.

TREATMENTS	PREVIOUS	24 h	48 h	72 h
Witness	42.23±2.01	45.32±1.87	48.52±2.11a	49.97±1.98a
Paecilomyses Fumosoroseus	41.37±2.65	39.21±1.92	38.64±3.01	35.89±2.92b
Beauveria bassiana	40.67±1.22	37.34±2.31	33.56±2.62	29.23±1.22c
Neem extract	42.32±1.43	34.23±1.71	33.01±1.53	34.45±2.04b
Beauveria bassiana + Neem extract	43.21±1.33	41.42±2.04	32.12±3.01	23.98±1.33d
Paecilomyses Fumosoroseus + Neem extract	42.74±1.86	39.12±2.21	38.04±2.54	27.23±1.52c

Table 2. Average values of adults white fly in different counts.

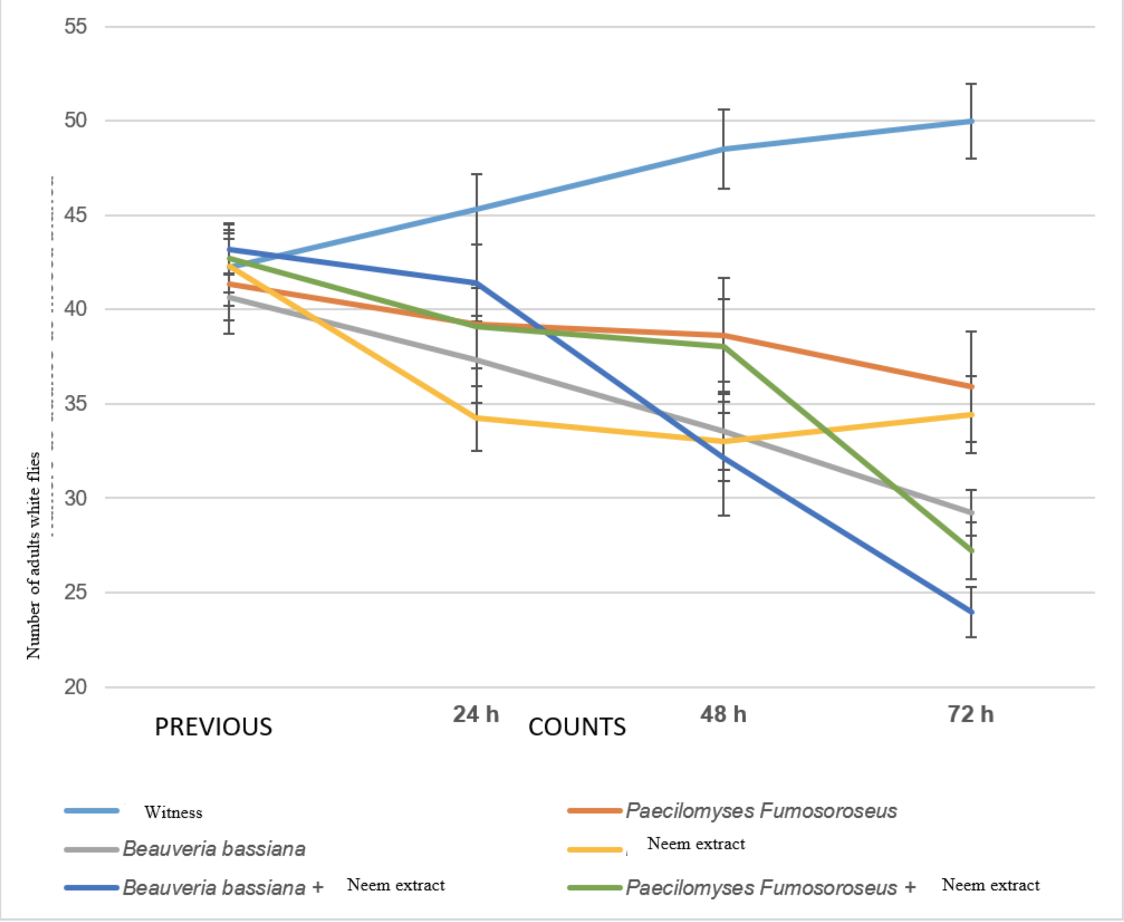

Figure 3. Graph of the effect of bioinsecticides on the population density of white fly adults in tomato crops.

sustainability of food production systems, in addition, they are resilient agricultural practices that increase production, being of natural origin they improve the quality of soil, water and air.

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