Jurnal Lahan Suboptimal : Journal of Suboptimal Lands
ISSN: 2252-6188 (Print), ISSN: 2302-3015 (Online, www.jlsuboptimal.unsri.ac.id)
Vol. 11, No.2: 216-222 Oktober 2022
DOI: 10.36706/JLSO.11.2.2022.579

Study The Integrated Pest Management on Chili Cultivation to Control *Aphis gossypii* and *Bemisia tabaci*

Kajian Pengelolaan Hama Terpadu pada Budidaya Cabai untuk Mengendalikan Aphis gossypii and *Bemisia tabaci*

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(Received: 13 December 2021, Accepted: 8 August 2022)

Citation: Wilyus W, Novalina N, Nurdiansyah F. 2022. Study the integrated pest management on chili cultivation to control *Aphis gossypii* and *Bemisia tabaci*. *Jurnal Lahan Suboptimal : Journal of Suboptimal Lands.* 11 (2): 216-222. DOI: 10.36706/JLSO.11.2.2022.579.

ABSTRAK

Penelitian ini bertujuan untuk membangun model PHT pada tanaman cabai untuk mengendalikan *A. gossypii* dan *B. tabaci.* Penelitian dilakukan di Kebun Percobaan Fakultas Pertanian Universitas Jambi dari bulan Mei sampai September 2018. Penelitian dirancang dengan dua perlakuan yaitu; Penerpan model PHT cabai untuk mengendalikan *A. gossypii* dan *B. tabaci* dan budidaya tanaman cabai secara konvesional (praktek budidaya cabai oleh petani), masing-masing pada lahan seluas 0,25 ha. Parameter pengamatan adalah: populasi *A. gossypii*, populasi *B. tabaci*, serangan *A. gossypii* dan *B. tabaci* serta serangan virus. Data yang diperoleh ditabulasi dan dihitung persentase serangan *A. gossypii* dan *B. tabaci*, serangan virus, dan dianalisis secaran deskriptif. Hasil penelitian imenunjukan bahwa: 1) investasi awal *A. gossypii* dan *B. tabaci* pada tanaman cabai baik pada lahan PHT maupun konvensional terlihat pada tanaman cabai 4 minggu setelah tanam (mst); 2) Populasi *A. gossypii* dan populasi *B. tabaci* pada tanamn cabai dengan penerapan model PHT sampai 7 mst cenderung meningkat, namun setelah 7 mst populasi hama tersebut tertekan dan cendrung menurun dengan cepat. Dapat disimpulakan bahwa model PHT dengan komponen seleksi bibit cabai dari lapang, penanaman jagung sebagai tanaman pagar dan penanaman refugia dapat menekan perkembangan *A. gossypii*, *B. tabaci* dan serangan virus pada tanaman cabai.

Kata kunci: serangan, populasi, menekan

ABSTRACT

This study was carried out to build an IPM model on chili plants to control *Aphis gossypii* and *Bemisia tabaci*. The study was conducted at the Experimental Garden of the Faculty of Agriculture, Jambi University from May to September 2018. The study was designed with two treatments, namely; The application of the chili IPM model to control *A. gossypii* and *B. tabaci* and conventional chili cultivation (chili cultivation practice by farmers), each on an area of 0.25 ha. Observation parameters were: population of *A. gossypii*, population of *B. tabaci*, attack of *A. gossypii* and *B. tabaci* and attack of virus . The data obtained were tabulated and calculated the percentage of *A. gossypii* and *B. tabaci* attacks, virus attacks on chili and analyzed descriptively. The results of the study showed that: 1) the initial investment of *A. gossypii* and *B. tabaci* in chili plants both on IPM and conventional land was seen in chili plants 4 weeks after planting (WAP); 2) Populations of *A. gossypii* and populations of *B. tabaci* on chili plants with the application of the IPM model up to 7 WAP end to increase, but after 7 WAP the pest population is depressed and tends to decrease rapidly. It can be concluded that the IPM model with components of chili seed selection from the field, planting corn as hedges and planting refugia can suppress the development of *A. gossypii, B. tabaci* and virus attacks on chili plants.

Keywords: attack, population, suppress

INTRODUCTION

Productivity of Indonesian chili in 2015 was 7.49 tons/ha (Nuryati et al., 2016). This is still very low when compared to the potential production of various chili varieties of around 20 tons/ha. There were many factors that influence the lack of chili productivity, among others were attack of *Aphis gossypii* (Indriyanti et al., 2015) and *Bemisia tabaci* (Indriyanti et al., 2015); Gangwar & Gangwar, 2018; Padhi et al., 2017). Besides causing direct damage, these pests also play an important role as virus vectors (Ghosh & Ghanim, 2021; De Marchi et al., 2017; Hilje & Stansly, 2018; Hernández-Espinal et al., 2018; Polston et al., 2014; Singarimbun et al., 2017).

Aphis belongs to the phylum Athropoda, class Insects, order Hemiptera, family Aphididae (Maharani & Hidayat, 2021). Aphids can reproduce sexually and parthenogenically (Simon & Peccoud, 2018). In the tropics, aphids usually reproduce parthenogenesis so that the population grows faster (Zein & Arifin, 2016). Meilin (2014) stated that aphids attack on shoots and young leaves. Attacked leaves will shrivel, curl and curl, causing plant growth is stunted and the plant becomes dwarf. Duque-Gamboa et al. (2018) reported there was association between Aphis and 19 ant species that may affect of biological control.

B. tabaci is an important pest in horticultural crops (Subagyo & Hidayat, 2014). *B. tabaci* fecundity varied from 34-69 eggs per female (Kedar et al., 2014). The nymph consists of three instars. Imago of *B. tabaci* are small, ranging from 1-1.5 mm with white color, and wings cover the wax layer (Marwoto, 2012 in Kasno et al., 2014). Imago usually clusters on the underside of the leaves, if disturbed they will fly like fog or white clouds. The average life cycle of *B. tabaci* in healthy plants is 24 days, while in virus-infected plants it is 21 days (Marwoto, 2012 in Kasno et al., 2014). Hidayat et al. (2017) reported that *B. tabaci* life cycle varied from 30,86 – 33,27 days. The symptoms of chili plants attacked by *B. tabaci* are necrosis of the stems, curling leaves, curly shoots followed by narrow or concave leaf blades (Nurtjahyani &Murtini, 2015).

Farmers often use synthetic insecticides to control *A. gossypii* and *B. tabaci*. The use of synthetic insecticides can cause pest resistance and resurgence, as weel as it also causes environmental damage. Therefore, it is necessary to study the implementation of integrated pest management (IPM) in controlling these pests. In IPM implemenatation all stages of plant cultivation techniques must be directed to: increase plant vigor, increase the role of natural enemies, and reduce the presence of plant-disturbing organisms. In this case, the use of biological control agents becomes very important (Sharma et al., 2014). Based on the description above, the researcher conducted an applied research entitled “A Study on the Application of Integrated Pest Management Models on Chili Plants to Control *Aphis gossypii* and *Bemisia tabaci*. This study was carried out to build an IPM model on chili plants to control *Aphis gossypii* and *Bemisia tabaci.*

MATERIALS AND METHODS

Place and Time

The research was conducted at the Experimental Garden of the Faculty of

Agriculture, Jambi University from May to September 2018.

Research Design

The study was designed with two treatments, namely; The application of the chili IPM model to control *A. gossypii* and *B. tabaci* and the conventional cultivation of chili plants (the practice of chili cultivation by farmers), each on an area of 0.25 ha. The description of the IPM model treatment and conventional chili cultivation is presented in Table 1.

Plant Preparation

Seeding, tillage, fertilizing, watering and weeding were carried out in accordance with the technical standards of chili cultivation (Swastika et al., 2017) while the treatment input as a component of cultivation technology refers to the description of the treatment according to the treatment that has been determined in Table 1.

Observation

The observed parameters were; population of *A. gossypii*, population of *B. tabaci*; attack percentage of *A. gossypii/B. tabaci*; percentage of virus attacks. The population of *A. gossypii*, population of *B. tabaci* were observed in 5 sample plots that were systematically determined with a diagonal pattern. Each sample plot consisted of 4 plants. Observation of the population of *A. gossypii* and population of *B. tabaci* were carried out by examining each leaf and shoot of the plant directly, and using a loupe, camera and counter. In the observation of the population of *A. gossypii*, the population of *B. tabaci* was recorded.

Observations of virus attack were carried out on 100 sample plants which were determined systematically with a U pattern. At 6 week after planting (WAP) all virus-infected plants were removed and destroyed so that the observation on the 7th week of the sample plants was moved to plants afterward. On observation the number of plants showed symptoms of virus attack was recorded. Symptoms of virus attack on chili plants are showed by symptoms, yellow, chlorosis and mozoic which can be caused by various types of viruses such as CMV (Cucumber Mosaic Virus), ChiVMV (Chilli Veinal Mottle Virus) and TMV (Tobacco Mosaic Virus) (Nyana, 2012). The percentage of plants affected by the virus is the number of plants infected by the virus divided by the number of sample plants multiplied by 100%.

Table 1. Description of the chili IPM model treatment to control *A. gossypii* and *B. tabaci* and conventional chili cultivation

Treatment	Description
Chili IPM Model	• Chili seeds are selected from the field, physically free from virus attack. • Planting corn plants around chili fields that act as repellents for *B. tabaci* (Tyasningsiwi et al., 2019) and as weel as fences and trapping aphids and at the same time conserving natural enemies of aphids. Corn plants are planted in 4 rows with a spacing of 20 x 20 cm • Planting refugia, 2 weeks before planting chili around and at several locations on IPM land, to conserve natural enemies of pests, • No insecticide application.
Conventional Control	• Seeds are purchased from a farm shop that is often used by farmers (Labek Variety) • Insecticide application once a week

Data Analysis

Populations of *A. gossipii, B. tabaci* and the percentage of plants infected by virus are presented in graphical form and discussed descriptively.

RESULTS

The Effect of the Application of the IPM Model on the Population Development of *A. gossypii* and *B. tabaci*

The effect of the application of the IPM model on chili cultivation on the population development of *Aphis gossypii* and *Bemisia tabaci* could be seen in Figure 1 and Figure 2.

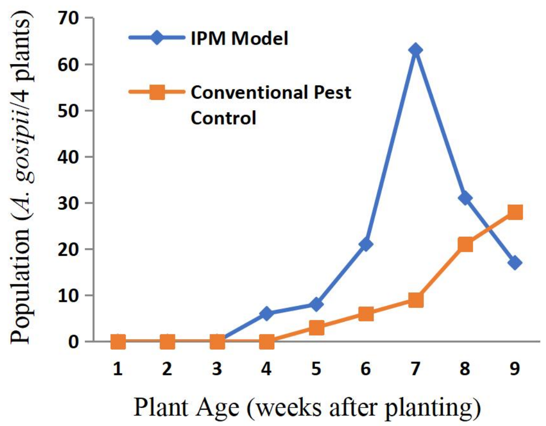

Figure 1. Population development of *A. gossypii* on chili plants treated with the application of the IPM model and conventional pest control

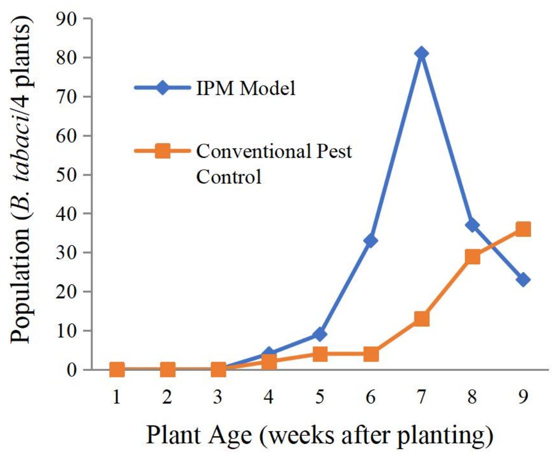

Figure 2. Population development of *B. tabaci* on chili plants treated with the application of the IPM model and conventional pest control

The population development of *A. gossypii* and *B. tabaci* in chili plants in IPM plots showed a different trend from conventional plots. Infestation of *A. gossypii* and *B. tabaci* in IPM plots began to be seen when the plants were 4 WAP old, while in conventional plots they began to be seen when the chili plants were 5 WAP. In chili plants using the IPM model, the development of *A. gossypii* and *B. tabaci* increased to 7 WAP, then decreased rapidly the following week. Populations of *A. gossypii* and *B. tabaci* on chili plants in conventional plots were up to 8 WAP lower than IPM plots, but when chili plants were 9 WAP old *A. gossypii* and *B. tabaci* populations in conventional plots were higher than IPM plots.

The Effect of Applying the IPM Model on Chili Cultivation on Virus Attacks

The effect of the application of the IPM model on chili cultivation on the development of virus attacks can be seen in Figure 3.

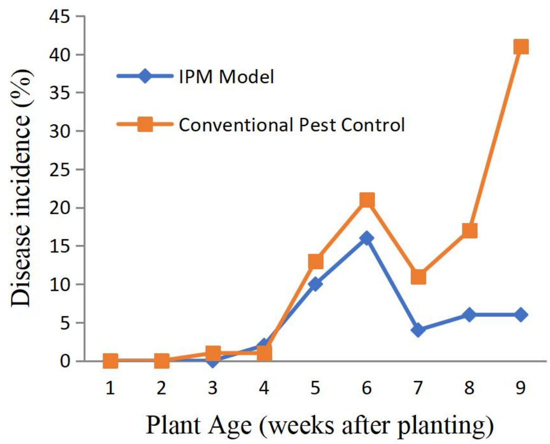

Figure 3. The development of virus attacks on chili plants treated with the aplication of the IPM model and conventional pest control

The proportion of plants infected with the virus in chili plots with the application of the IPM model was generally lower than that of conventionally cultivated chili plants. At 9 mst the proportion of chili plants infected with the virus in the IPM model plot was much lower than the conventional control plot, where in the IPM model plot it was 6% while in the conventional plot it was 41%.

DISCUSSION

The population development of *A. gossypii* and *B. tabaci* in chili plantations with IPM model treatment increased up to 7 WAP, then decreased rapidly the following week. This phenomenon occurs because in the initial investment phase of *A gossypii* and *B tabaci*, their natural enemies (predators, parasitoids and pathogens) have not worked yet effectively. The effectiveness of natural enemies starts to show at 8 WAP. Planting refugia plants and not using synthetic insecticides in controlling pests in IPM plots is estimated to have succeeded in increasing the presence and effectiveness of natural enemies. This was confirmed by Kurniawati (2015) and Karenina et al. (2019) the presence of flowering plants in agroecosystems can significantly increase the diversity of natural enemies.

In conventional chili cultivation, although insecticides have been sprayed every week, the population growth of *A. gossypii* and *B. tabaci* from the beginning was detected (4 WAP) to 8 WAP continued to increase. In the beginning the population development was a bit slow but at 6 WAP, 7 WAP and 8 WAP it grew faster. At 8 WAP the population of *A. gossypii* and *B. tabaci* in conventional plots was higher than that of *A. gossypii* and *B. tabaci* in IPM plots. This phenomenon could be caused by the ineffectiveness of the insecticide used, the large number of pest migration from the surrounding host plants and the lack of natural enemies available in conventional plots due to exposure to insecticides.

The percentage of virus attack on chili plantations with the application of IPM models and conventional cultivation is interesting to observe. In IPM plots, virus symptoms were detected at 4 WAP, while in conventional cultivated chilies virus symptoms were detected earlier at 3 WAP. At 7 WAP there was a decrease in virus attack in both IPM plots and conventional plots due to the removal of all plants showing symptoms of virus attack in both treatments as control activities carried out at 6 WAP after observations were made. In IPM plots, virus attacks were more depressed than in conventional plots. At 5 – 9 WAP the virus attack on IPM plots was lower than conventional plots, even at 9 WAP there was a very clear difference where in IPM plots the proportion of plants infected with viruses was 6% while in conventional plots it was 41%.

The difference in virus development in IPM plots and conventional plots was thought to be due to the resistance of different plant varieties. In the IPM plot, the plant seeds used were curly chili, local variety of Medan, while in the conventional plot, the plant seed used was curly chili, the Labek variety, which was purchased from an agricultural shop. It is strongly suspected that local varieties of Medan curly chili have high resistance to virus attacks. The local Medan variety chili has been cultivated by a small number of farmers in Jambi City and its surroundings. From the results of observations in the field, it was shown that the local varieties of chili plants in Medan were less susceptible to viruses so that they were used as one of the components in the preparation of the IPM model.

CONCLUSSION

The IPM model with components of chili seed selection from the field, planting corn as hedges and planting refugia can suppress the development of *A. gossypii, B. tabaci* and virus attacks on chili plants.

ACKNOWLEDGEMENTS

We would like to thank Faculty of Agriculture, University of Jambi for funding the research based on the Research Contract Agreement Letter Number: 1348/ UN21.17/LT/2018 April 16, 2018.

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