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Efficacy of the entomopathogenic fungus, *Beauveria bassiana* and certain insecticides on some cabbage insects in field

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ABSTRACT

Cabbage is one of the most widely grown winter vegetables worldwide. A wide range of insect pests attacks it, resulting in yield losses. Farmers used to use synthetic insecticides to produce damage-free cabbage heads. The present study aimed to evaluate the potential of entomopathogenic fungus, *Beauveria bassiana* on the management control of economic insect pests of cabbage and compare it with effect of traditional insecticides at two locations cultivated with cabbage in Egypt. Four insect species were surveyed; the most common pests of cabbage are; onion thrips, *Thrips tabaci*, cabbage white butterfly, *Pieris rapae,* diamondback moth, *Plutella xylostella* and cabbage aphid, *Brevicoryne brassicae*. The results showed that *T. tabaci* was the most dominant pest. By the end of the season, the mean population of *T. tabaci* reached 39.72±6.2 and 7.68±1.2 larvae, adults/plant in the Giza, 45.44±8.27 and 2.68±2.8 larvae, adults/plant in the El-Menoufia on plants treated with insecticides and *B. bassiana*, respectively. After applying *B. bassiana*, the populations of *P. rapae* and *P. xylostella* became less than the threshold. But in insecticides plots, the population of *P. rapae* reached 3.52±1.23 and 2.36±1.35 larvae/plant and *P. xylostella* reached 1.72±1.28 and 2.64±1.03 larvae, pupae/plant in Giza and El-Menoufia, respectively. The results showed that *B. bassiana* effectively controlled the major insect pests of cabbage, *T. tabaci*, *P. rapae*, *P. xylostella*, and *B. brassicae* at both study sites.

Beauveria bassiana as a biological control agent can be recommended as a good pest management practice against some of the economic cabbage pests in the field.

Keywords: Entomopathogenic fungi, insecticides, insect pests, Cabbage.

INTRODUCTION

Cabbage, *Brassica oleracea capitata* L. (Brassicaceae), is a leafy vegetable crop that originated in the Mediterranean Region, Southern England, Wales and Northern France (Norman 1992). However, it is now widely grown year-round throughout the world, including in African countries (FAO/WHO 1995; Obeng- Ofori 1998; Ngosong 2017). It is a high-protein, carbohydrate, vitamin, and mineral vegetable that plays an important role in a nutritionally balanced diet (Hadi et al., 2017).

The wide spectrum of pests significantly reduces yields by damaging cabbage stems, leaves, growth points, inflorescence, and heads (CPC 2001). Amongst these insect pests, onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) (Shelton et al., 2008 and Voorrips et al., 2008), the cabbage white butterfly, *Pieris rapae* (L.) (Lepidoptera: Pieridae) (Ikeura *et al.*, 2010; Embaby and Lotfy 2015; Rahouma 2018 and El-Sheikh 2020), the diamondback moth, *Plutella xylostella* L. (Lepidoptera: Plutellidae) (Embaby and Lotfy 2015; Robin *et al.*, 2017 and Rahouma 2018), and the cabbage aphid, *Brevicoryne brassicae* L. (Homoptera: Aphididae) (Anwar and Shafique 1999; Mohamed et al., 2006; Abdel-Samad 2010; Embaby and Lotfy 2015 and Nasab et al., 2018).

The widespread use of synthetic insecticides in controlling insect pests has led to the development of resistance to different types of chemical insecticides and has undoubtedly had adverse impacts on humans and the environment (Agboyia et al., 2020).Bio-pesticides are one of the promising solutions to control insect pests (Sarfraz et al., 2005 and Sow et al., 2013). In recent years, many fungus-based bio-pesticides have been developed for the biological control of insect pests, and therefore, entomopathogenic fungi (EPF) have received a lot of attention (De Groote et al., 2001; De Faria and Wraight 2007 and Ain et al., 2021). EPF is host-specific, acts through contact, and its use is regarded as an environmentally friendly control method (Shahid et al., 2012). *Metarhizium anisopliae* (Metchnikoff) Sorokin (Hypocreales: Clavicipitaceae) and *Beauveria bassiana* (Balsamo) Vuillemin (Hypocreales: Ophiocordycipitaceae) are the most common commercial bio-pesticides (fungus-based) (Feng et al., 1994; De Faria and Wraight 2007 and Agboyia et al., 2020). *Beauveria bassiana* has been reported to be able to infect over 100 species of insects from a wide range of orders. Isolates of this fungus vary in host range and also exhibit a high host specificity (Fargues 1976; McCoy et al., 1988).

The objective of this study was to evaluate the potential of *B. bassiana* on the management of economic insect pests of cabbage and compare it with traditional insecticides (Pluto and Comite) in two different cabbage farms located at Giza and El-Menoufia Governorates in Egypt.

MATERIAL AND METHODS

Study sites:

Two field trials were conducted in a farmer's field located in Giza and El-Menoufia Governorates, Egypt. The Central Laboratory for Agriculture Climate (CLAC), Dokki, Giza, Egypt, provided daily weather data (minimum, maximum, and relative humidity). Trials started with seedlings on November 24th, 2020 until harvested on March 25th, 2021 in the Giza plot and on December 25th, 2020 until harvested on April 26th, 2021 in the El-Menoufia plot. The two locations planted the cabbage periodically. Onion thrips, *T. tabaci*, cabbage white butterfly, *P. rapae*, diamondback moths, *P. xylostella* and cabbage aphid, *B. brassicae* were the most common and economic insect pests found on cabbage on two farms.

Treatments:

The study was carried out on the cabbage *B. oleracea capitata*. Three treatments (Table 1) were evaluated against the four pests (*T. tabaci*, *P. rapae*, *P. xylostella* and *B. brassicae*). Commercial formulations of EPF (*B. bassiana*), insecticides (Pluto and Comite) and water (control) were experimentally used in the field.

Entomopathogenic fungi (EPF)

The formulation of *B. bassiana* was manufactured by T. Stanes and Company Limited, Tamil Nadu, India. The viability of *B. bassiana* was checked before its application in the field. By culturing it on Potato Dextrose Agar (PDA) media and incubating it at 25± 2°C for 7 days following the technique of Youssef (2015). Before field applications, the *B. bassiana* was observed under light microscopy (x 40 magnification) to ensure that more than 95% of the spores had germinated.

Experimental design:

A randomised complete block design with five replications was used to set up the experiment. 25 plants were placed in each experimental unit (plot), which was 5 m long and 2 m wide (0.5 m X 0.5 m). To prevent the effects of the treatments drifting, a 1.5 m wide walkway was used to separate the plots. Transplanting was carried out using 30 day old seedlings of B. oleracea capitata var. Lomana in the Giza plot and var. Bolsta in the El-Menoufia plot.

Application of treatments:

Applications of the treatments started on the 7th day after transplantation and continued weekly for 11 weeks after transplantation. The application was done at sunset to prevent UV damage, following the technique of Gulzar et al., (2021a). For each treatment, using a Pomsan sprayer (model: K-93), the spray volume was 1000L ha^{-1}. The dosages used were 3kg ha (recommended by the manufacturer) for *B. bassiana*, 400g/ 200L of water for insecticide Pluto and 620g/ 200L of water for insecticide Comite (Table 1).

All treatments were performed using manually operated, calibrated for very fine droplets. It is important to note that droplet size and spore distribution were strongly associated with the effectiveness of microbial pesticide applications rather than a high volume application (Chapple et al., 2007).

Table 1 Field treatments used in the field experiment to control *T. tabaci*, *P. rapae*, *P. xylostella* and *B. brassicae*

Designation	Treatment description	Dose	Type of treatment
T1	BioPower @ 1.15% WP (*B. bassiana*, contains spore and mycelia fragment 1 X 108 CFU's/gm),	3 kg/hectare in 500 liters of water, i.e., 6 gm per liter of water.	Entomopathogenic fungi
T2	*Pluto (Thiamethoxam 1%) **Comite (Sulfurous acid, 2-[4-(1,1-dimethyl-ethyl) phenoxy] cyclohexyl-2propynyl ester)	*400g/ 200L (Pluto) **620g/200L (Comite)	Insecticides
T3	Water	-	-

CFU: colony forming units

Data collection:

Data were collected by field inspections of five plants in the middle of each plot. All economic cabbage insect pests per 5 plants were counted weekly until the harvest. The total number of larvae and adults of onion thrips, *T. tabaci* were counted using the aid of a (10x) hand lens according to Gulzar et al., (2021b). The number of cabbage white butterfly *P. rapae* larvae was directly recorded. The number of diamondback moth *P. xylostella* larvae and pupae was recorded according to Agboyia et al., (2020). In one square inch, the population of the cabbage aphid, *B. brassicae* was counted directly on the inspected plants with the aid of a (10x) hand lens.

Statistical analysis:

Data were coded and entered using the statistical package SPSS version 22. Data was statistically described in terms of mean, standard deviation for quantitative variables. Analysis of variance (ANOVA) was applied using the Holm-sidak method to reject null hypnosis and confirm the presence of significant variance between differences at P<0.05.

The analysis becomes available using SigmaPlot V12.5 and MiniTab V18.1 software.

The dominance percentage of all the studied insect species inhabiting cabbage was determined by the Balogh formula (Harde et al. 1984) as follows: D = $\frac{a_1}{\sum a_i}$ x 100

Where: D = Dominance percentage; a1= number of identified specimens of one species; ∑ai = the total number of all collected specimens.

RESULTS

During the field applications, the weather data was recorded as 37.53-11.76 °C maximum temperature, 19.9-4.1 °C minimum temperature, and 82.81-53.83% RH in Giza Governorate, and 42.72-15.14 °C maximum temperature, 19.78-8 °C minimum temperature, and 81.62-57.92% RH in El-Menoufia Governorate.

Insect pests infested cabbage during the season at the two study sites

The cabbage plants attracted a variety of insect pests at different stages of the plant's growth because of their luxuriant and nutritive nature. The pest complex included *T. tabaci*, *P. rapae*, *P. xylostella* and *B. brassicae*. *Thrips tabaci* was the most dominant pest, causing a great damage to the leaf plants. Its dominance percentage was recorded as 71.8 and 75.1%, followed by *B. brassicae* (21.15 and 15.92%), *P. rapae* (5.99 and 6.14%) and *P. xylostella* (1.05 and 2.87%) in Giza and the El-Menoufia plots, respectively.

Effects of applied *Beauveria bassiana* and insecticides applications on cabbage economic insect pests

1. **Onion thrips, *Thrips tabaci* :**

In Giza plot, thrips numbers started rising from the 21st day after transplanting with 4.12±3.5, 3.76±2.6 and 4.28±1.8 larvae, adults/ plant in control, insecticides and *B. bassiana* plots, respectively (Fig. 1A). Infestations on plots treated with *B. bassiana* were generally lower than in insecticides plots. The highest population number was in control plots. On the 77th day after transplanting, *T. tabaci* population reached 58.52±8.5 and 39.72±6.2 and 7.68±1.2 larvae, adults/plant, in control, insecticides and *B. bassiana* plots, respectively. The population of *T. tabaci* decreased significantly (P<0.001) in the plots treated with *B. bassiana*.

Treatments interacted significantly (F = 757.3, df = 2, p < 0.001). There was also significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F = 19.3) and (F = 8.9) between control and insecticides treatments.

Also, in El-Menoufia plot, thrips numbers started rising on the 21st day after transplanting with 7.72±3.2, 7.08±4.7 and 7.92±3.1 larvae, adults/ plant in the plots of control, insecticides and *B. bassiana*, respectively (Fig. 1B). In the control plots, the population of *T. tabaci* gradually increased, reaching 72.28±24.1 larvae, adults/ plant on the 77th day after transplanting. At the end of the season, the population of *T. tabaci* reached 45.44±8.27 and 2.68±2.8 larvae, adults/ plant, in insecticides and *B. bassiana* plots, respectively (Fig. 1B).

The population of *T. tabaci* decreased significantly (P<0.001) in *B. bassiana* plots and increased significantly (P<0.001) in the insecticide plots. There was significant interaction among treatments (F =742.5, df = 2, p <0.001). There was also significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F =22.4) and (F = 22.95) between control and insecticides treatments.

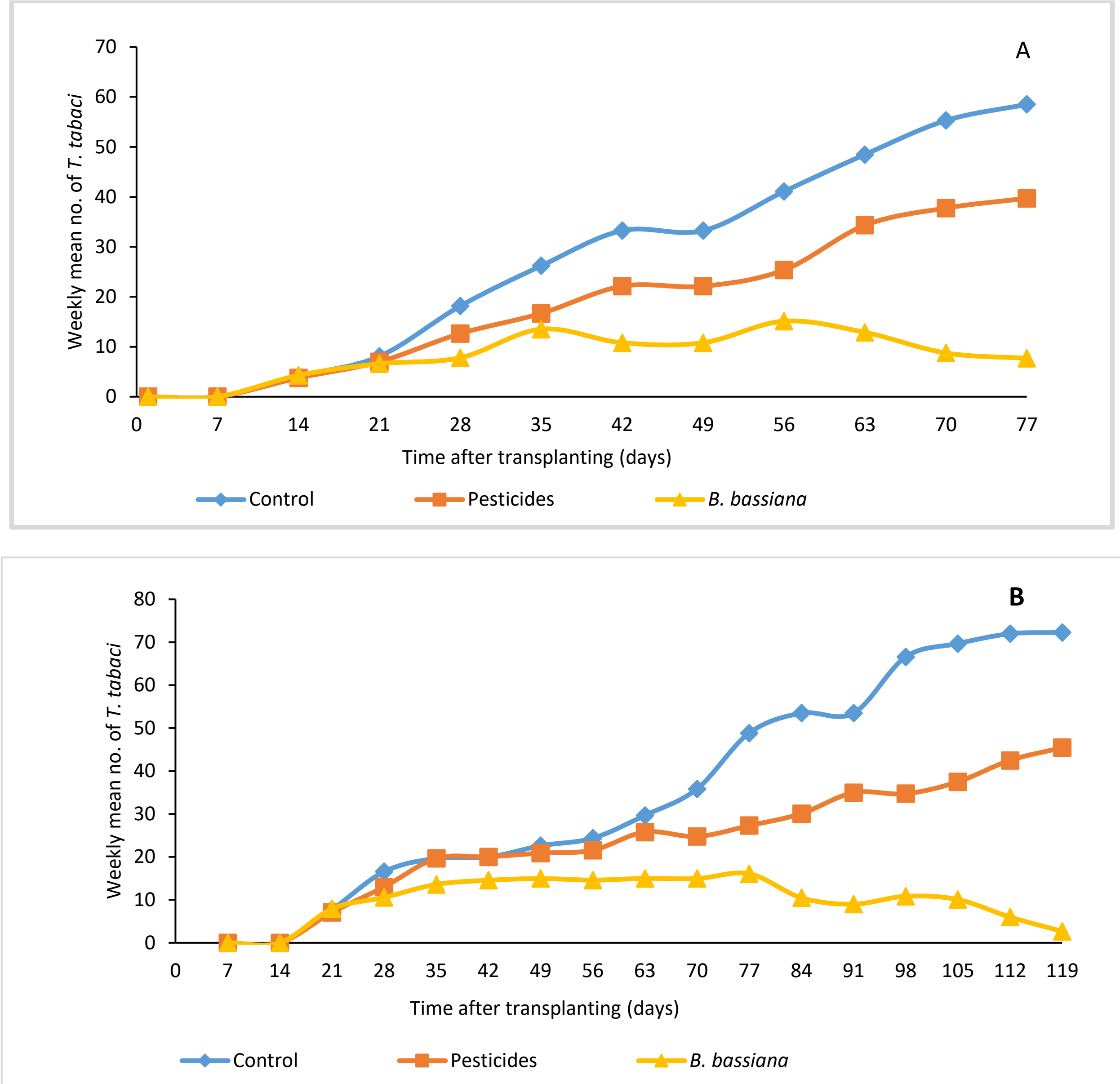


Fig 1 A, B. Effects of treatments on weekly mean number of *T. tabaci* per plant during the cabbage season in Giza plot (A) and El-Menoufia plot (B).

2. Cabbage white butterfly *Pieris rapae* :

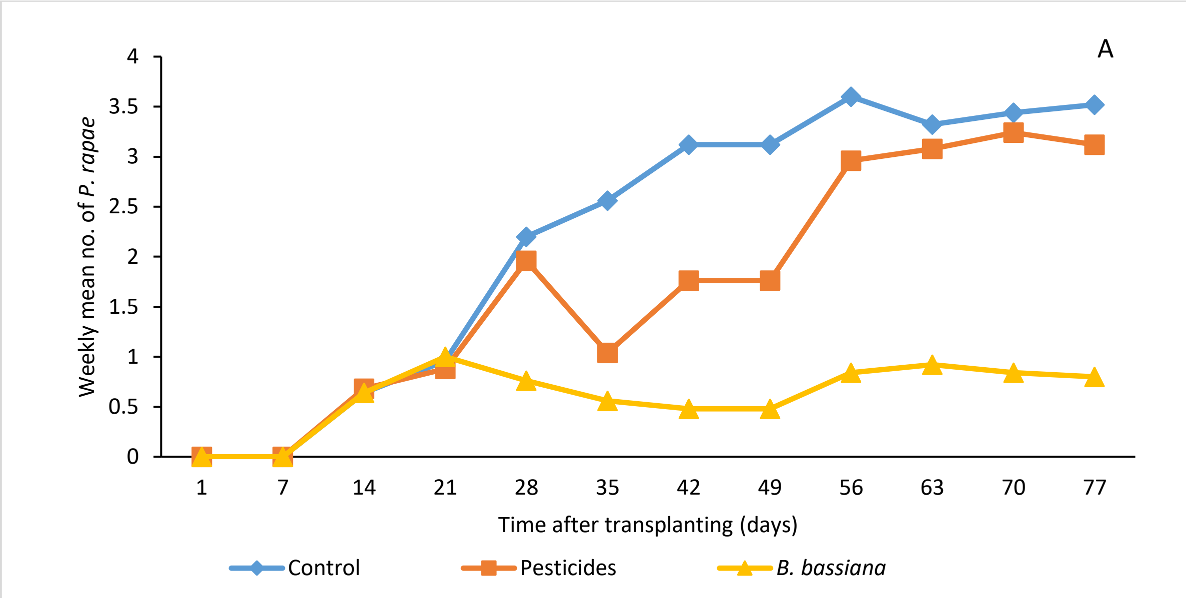
In Giza plot, the population of *P. rapae* started building up from the 7th day after transplanting, with 0.64±0.81, 0.68±0.7 and 0.64±0.81 larvae/ plant in control, insecticide and *B. bassiana* plots, respectively. Peaks were recorded on the 21st day after transplanting in case of *B. bassiana* plots and between the 28th and 56th day after transplanting in case of insecticides plots. By the end of the season, the population increased to 3.52±1.23 and 3.12±1.1 larvae/plant, in control and insecticides plots, respectively, and decreased to 0.8±0.87 larvae /plant in *B. bassiana* plots (Fig. 2A). Despite repeated insecticides applications, the population of *P. rapae* increased and approached the number found in control plots.

The insecticide treatment showed a highly significant variance (P< 0.001) in the population number of *P. rapae* from the starting date of the experiment. On the other hand, the population of *P. rapae* decreased significantly (P<0.001) in the *B. bassiana* plots, and the average decline was higher in the plots treated with *B. bassiana* than in the insecticides plots.

The interaction between treatments was significant (F =239.3, df = 2, p <0.001). There was also a significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F=1.59) and (F= 0.467) between control and insecticide treatments.

In the El-Menoufia plot, the population density of *P. rapae* started on the 7th day after transplanting, with 1.24±1.3, 1.92±1.6 and 1.28±0.8 larvae /plant in control, *B. bassiana* and insecticides plots, respectively. By the end of the experiment, after applying, the *B. bassiana*, population of *P. rapae* decreased to 0.44±0.83 larvae /plant, but, in the insecticides plots, it increased to 2.36±1.35 larvae/plant (Fig. 2B). In the control plots, the population density of *P. rapae* increased gradually from 1.24±1.23 adults/ plant on the 7th day after transplanting to 4.64±1.15 adults/ plant at the end of the experiment (Fig. 2B).

There was a significant interaction among treatments (F =336.6, df = 2, p <0.001). There was also a significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F =2.2) and (F = 1.355) between control and insecticides treatments.



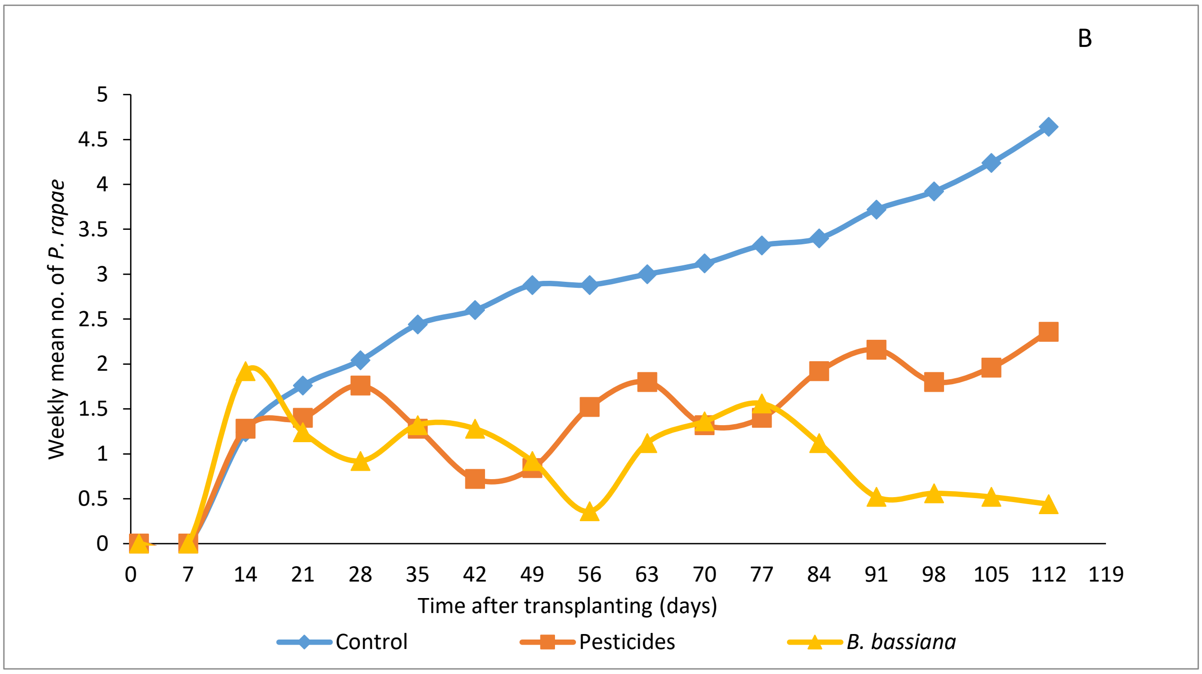


Fig 2 A,B. Effects of treatments on weekly mean number of *P. rapae* per plant during the cabbage season in Giza plots (A) and El-Menoufia plots (B).

3. Diamondback moth, *Plutella xylostella* :

In Giza plot, the population of *P. xylostella* started building up on the 42nd day after transplanting with 0.56±0.51, 0.44±0.77 and 0.4±0.87 larvae and pupae/ plant in the plots of control, insecticides and *B. bassiana*, respectively. *Beauveria bassiana* was more effective than insecticides for controlling this pest. In the plots treated with insecticides and *B. bassiana*, the population density reached 1.72±1.28 and 0.24±0.6 larvae and pupae/ plant, respectively. By the end of the season, the population increased to 2.2±1.23 larvae and pupae/plant in control plots (Fig. 3A).

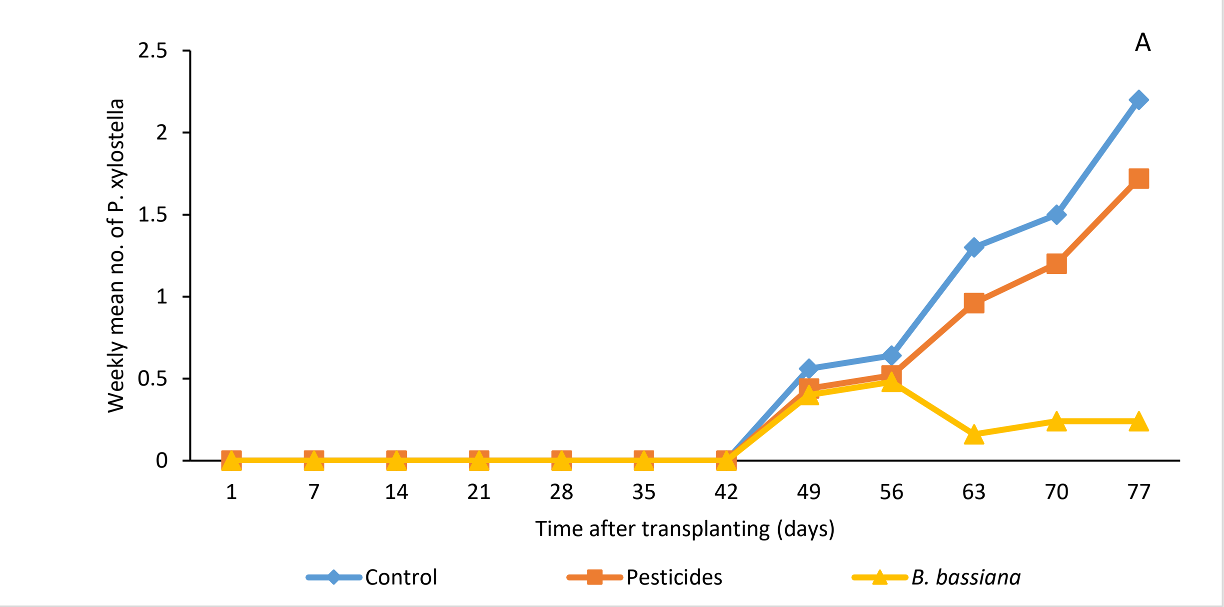
The population of *P. xylostella* decreased significantly (P<0.001) in the insecticides and *B. bassiana* plots.

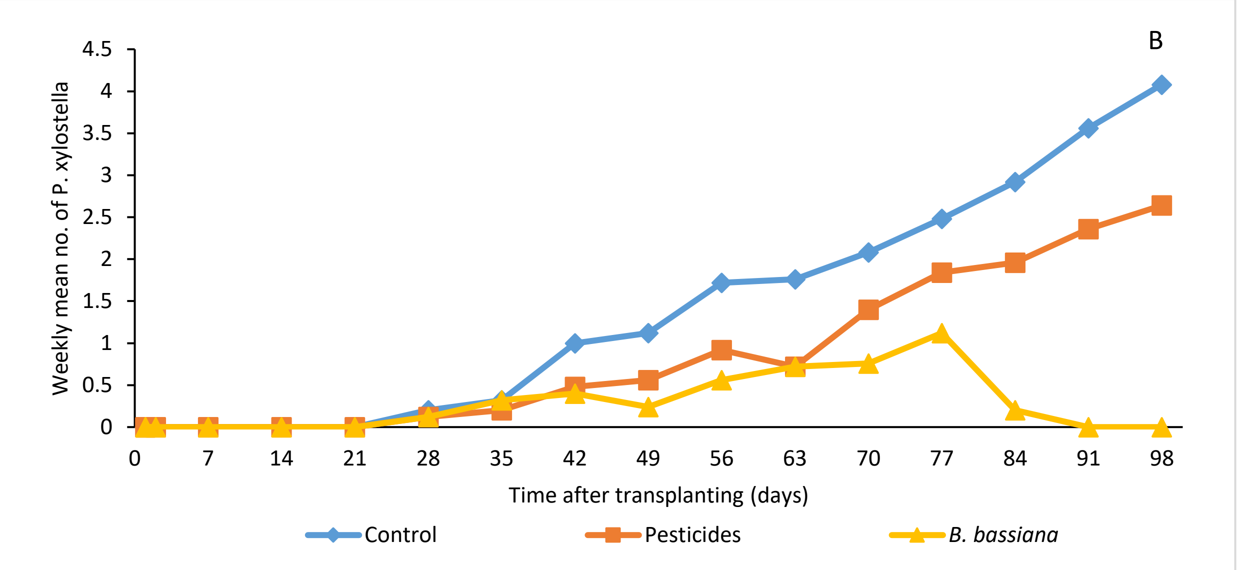
Treatments interacted significantly (F =22.2, df = 2, p <0.001). There was also significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F = 0.26) and (F = 0) between control and insecticides treatments. In El-Menoufia plot, the appearance of *P. xylostella* began on the 28th day after transplanting, with 0.2±0.41, 0.12±0.33 and 0.12±0.33 larvae and pupae/ plant in control, insecticides and *B. bassiana* plots, respectively.

In the plots treated with insecticides, the *P. xylostella* population fluctuated during the season, and ended with a high population of 2.64±1.03 larvae and pupae/plant, whereas, in the plots treated with *B. bassiana*, the population declined until it reached zero at the end of the season. By the end of the season, the population increased to 4.08±1.58 larvae and pupae/plant in control plots (Fig. 3B).

The population of *P. xylostella* increased significantly (P<0.001) in the groups treated with insecticides, while it decreased significantly (P<0.001) in the groups treated with *B. bassiana*.

There was significant interaction among treatments (F =143.3, df = 2, p <0.001). There was also significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F =1.1) and (F = 0.69) between control and insecticides treatments.





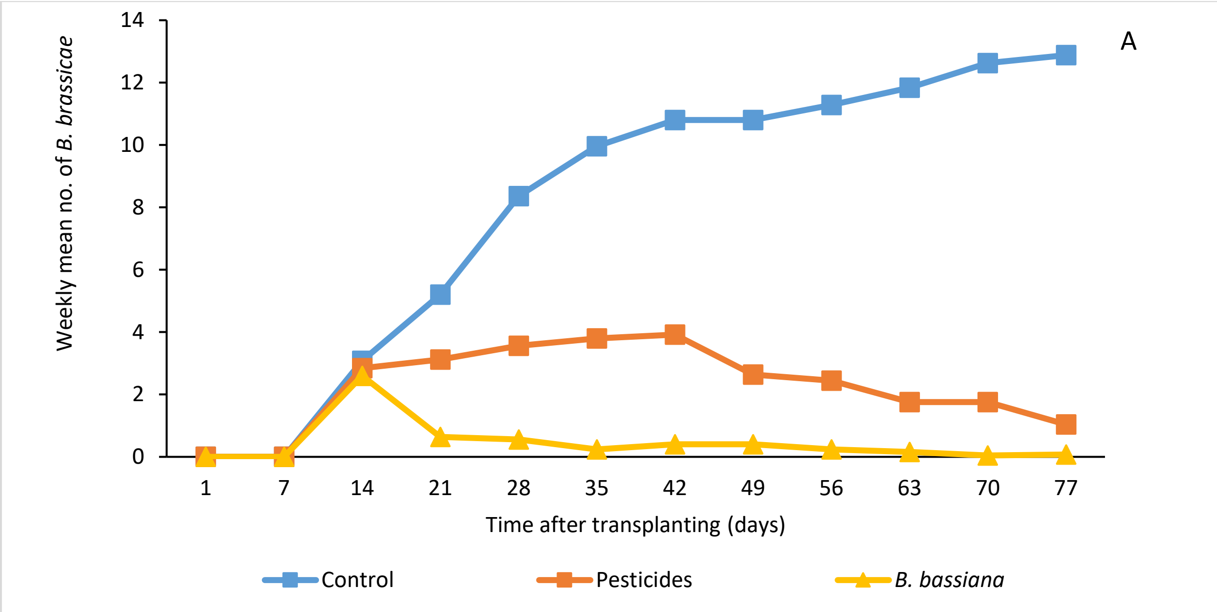
4. Cabbage aphid, *Brevicoryne brassicae* :

In Giza plot, the population of *B. brassicae* started building up on the 14th day after transplanting, with 3.08±2.72, 2.6±2.6 and 2.84±2.91 nymphs and adults/ plant in control, insecticides, and *B. bassiana* plots, respectively (Fig. 4A). The population of *B. brassicae*, reduced to 1.64±1.1 and 0.44±0.87 nymphs and adults/ plant in insecticides and *B. bassiana* plots, respectively, at the end of the season (Fig. 4A). In the control plots, the population of *B. brassicae* increased gradually, reaching 12.88±7.13 nymphs and adults/ plant on the 77th day after transplanting.

The effect of insecticides and *B. bassiana* treatments on the abundance of *B. brassicae* was significant. The population of *B. brassicae* decreased significantly (P<0.001) in the groups treated with insecticides and *B. bassiana*.
There was significant interaction among treatments (F= 328.4, df = 2, p <0.001). There was also significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F = 6.413) and (F = 7.6) between control and insecticides treatments.

In El-Menoufia plot, the population of *B. brassicae* started on the 14th day after transplanting, with 4.12±2.4, 2.12±1.94 and 2.36±2.64 nymphs and adults/ plant in control, insecticides, and *B. bassiana* plots, respectively (Fig. 4B). The population of *B. brassicae* was reduced to 3.6±0.76 and 0.28±0.97 nymphs and adults/ plant in insecticides, *B. bassiana* plots, respectively (Fig. 4B). In the control plots, the *B. brassicae* population gradually increased, reaching 11.76±2.02 nymphs and adults/ plant on the 105th day after transplanting.

The population of *B. brassicae* decreased significantly (P<0.001) in the groups treated with insecticides and *B. bassiana*. There was significant interaction among treatments (F =701.56, df = 2, p <0.001). There was also significant interaction between inspection date and treatments (p < 0.001). The difference in means between control and *B. bassiana* attained (F =6.415) and (F = 4.785) between control and insecticides treatments. In all experiments, the control group showed a highly significant variance (P< 0.001) in the number of all pests from the start date of the experiment, revealing that without control, the population of pests had the opportunity to increase in the experimental plots. On the other hand, the population of pests decreased significantly (P<0.001) in the groups that were treated with insecticides, and *B. bassiana*.



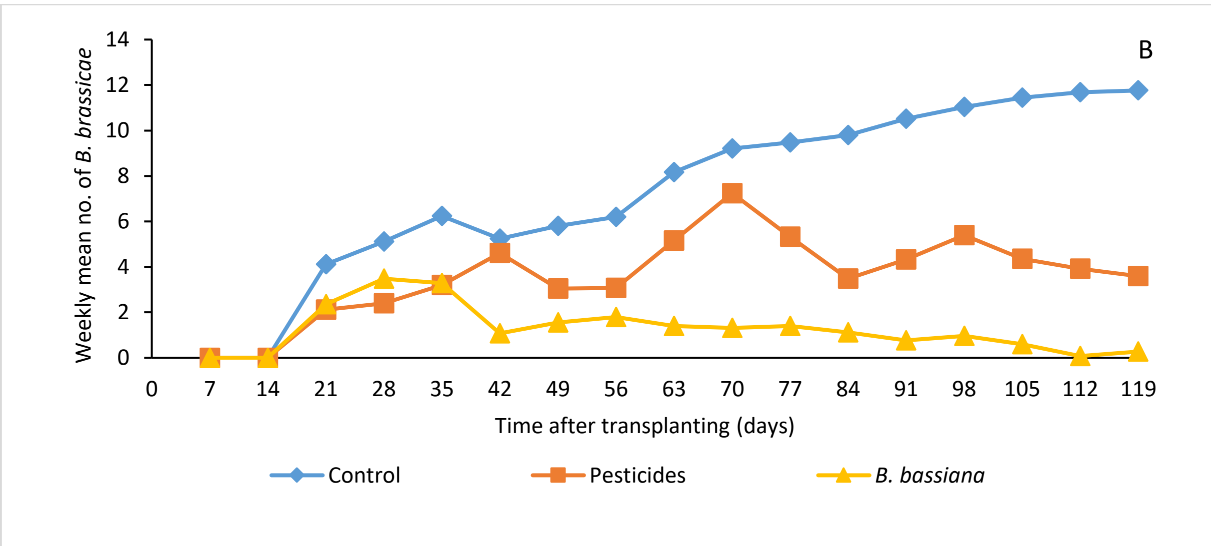


Fig 4 A, B. Effects of treatments on weekly mean number of *B. brassicae* per plant during the cabbage season in Giza plots (A) and El-Menoufia plots (B).

DISCUSSION

The findings of this study showed that cabbage was infested by numerous insect pests, including onion thrips, *T. tabaci*, cabbage white butterfly, *P. rapae*, diamondback moth, *P. xylostella*, and cabbage aphids, *B. brassicae*. The same findings were observed in many previous studies (Abdel-samad 2010; Rahouma 2018; El-Sheikh 2020; Morsy and Elwan 2021). Also, the onion thrips, *T. tabaci*, was identified as a major pest of cabbage (Ngosong 2017), which was also confirmed in this study. Embaby and Lotfy (2015) reported that *P. rapae* (17.9%) is the most common brassica pests, followed by *B. brassicae* (7.59%), and *P. xylostella* (1.38%), while *Spodoptera exigua* L. was the least (0.27%).

The study demonstrated that *B. bassiana* effectively could controlled the major insect pests of cabbage, *T. tabaci*, *P. rapae*, *P. xylostella*, and *B. brassicae*.

Several studies have been conducted to investigate the effects of applying *B. bassiana* against cabbage pest species (Ibrahim and Low 1993; Vandenberg et al., 1998; Garcia et al., 2005; Araujo et al., 2009; Godonou et al., 2009; Garcia et al., 2009; Michereff et al., 2011 and Agboyia et al., 2020).

Wu et al., (2013) tested various strains of *B. bassiana* against *T. tabaci* and found high levels of virulence. When *B. bassiana* was applied as a foliar application and the soil drenched with neem extract, the mortality of *T. tabaci* increased (Al-mazra'awi et al., 2009). Gulzar et al., (2021a) reported that the effects of single treatments, fungi; *B. bassiana* and *M. anisopliae* were more effective than the nematodes; *Heterorhabditis bacteriophora* and *Steinernema feltiae* in controlling *T. tabaci*. Additionally, *B. bassiana* (WG-11) showed higher mortality rates than *M. anisopliae* (WG-02). The cabbage white butterfly, *P. rapae* causes damage by rapidly eating plant foliage and can strip infested plants in a short period of time. Larvae bore into heads, infecting them with body parts and a greenish brown excrement. The diamondback moth, *P. xylostella* feeding on the outer leaves causes damage to the plant (Sabbour and Sahab 2005). Due to the quality restrictions placed on fresh market vegetables, management control of lepidopteran pests on cabbage has relied on either a low threshold (one larva/3 plants) or scheduled weekly sprays (Cartwright et al., 1987). In general, insecticides have to be applied every one or two weeks to maintain the quality of the cabbage crop, which has resulted in numerous cases of insecticide resistance in *P. rapae* (Chou et al., 1984; Han et al., 1987). The threshold of *P. rapae* and *P. xylostella* approximated one larva per plant (Mailloux and Belloncik,1995).

It appears from this study that *B. bassiana* was more active in controlling *P. rapae* and *P. xylostella* than the application of pesticides. After using *B. bassiana* in both sites, the populations of *P. rapae* and *P. xylostella* became less than the threshold. Vandenberg et al., (1998) and Ibrahim and Low (1993) reported that three applications of a *B. bassiana* spore suspension were effective in controlling diamondback moth larvae *P. xylostella* on crucifers. Shelton et al., (1998) found that applying *B. bassiana* was effective after 8 days against the diamondback larvae of *P. xylostella* on crucifer leaves and found acceptable percentages of spore viability.Sabbour and Sahab (2005) reported that the fungi *B. bassiana* decreased the percentage of infestations rate with *P. xylostella* to be 31, 28, and 21% after 20, 50 and 90 days of treatments, respectively, in cabbage field trails. In addition, *B. bassiana* reduced the infestations rate of *P. rapae* infestations in cabbage field trails to 24, 27, and 20% after 20, 50, and 90 days of treatment, respectively.

According to Garcia et al., (2009) the bioinsecticides, *B. bassiana* (native strains BbPM, Bea-SinTM, and Meta-SinT at a concentration of 1.2x 10^{12} conidia / hectare) can be used to control imported cabbageworm in commercial cabbage in Durango if applied several times over a 28-day period. Atwa et al. (2009) reported that moderate insect population reduction of *P. rapae* was obtained by *B. bassiana* (F2), while the least insect population reduction occurred with *B. bassiana* (F 1) in cauliflower under field conditions.

In this study, both insecticides and *B. bassiana* succeeded to control *B. brassicae* in both study sites with higher effect for *B. bassiana* than insecticides. The EPF, *B. bassiana* was effective in controlling of aphids and diamondback moth in cabbage when applied at (6g/l). Their side effects on biocontrol agents such as parasitoids are not clearly elucidated (Waiganjo et al., 2005-2007). Pacheco et al., (2017) observed significant mortality of the aphid, *Aphis craccivora* Koch on cucumber and cabbage when treated with *B. bassiana* isolates.

CONCLUSION

The EPF, *B. bassiana* succeeded in suppressing the population of onion thrips, *T. tabaci*, cabbage white butterfly, *P. rapae*, diamondback moth, *P. xylostella* and cabbage aphid, *B. brassicae* on cabbage leaves under field conditions than by using the insecticides. The EPF, *B. bassiana*, is being promoted for the management of important cabbage pests in the field. Besides, it is safer for the environment and less damaging to humans.

Abbreviations

CFU= colony-forming unit: A CFU is defined as a single, viable propagule that produces a single colony (a population of the cells visible to the naked eye) on an appropriate semisolid growth medium.

EPF = entomopathogenic fungi

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فاعلية الفطر *Beauveria bassiana* ، الممرض للحشرات وبعض المبيدات الحشرية على بعض حشرات الكرنب فى الحقل

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يعد الكرنب من أكثر الخضروات الشتوية انتشارًا في جميع أنحاء العالم. تهاجمه مجموعة واسعة من الآفات الحشرية ، مما يؤدي إلى خسائر في المحصول. اعتاد المزارعون على استخدام المبيدات الحشرية لإنتاج رؤوس كرنب خالية من التلف. هدفت الدراسة الحالية إلى تقييم فاعلية الفطر الممرض للحشرات *Beauveria bassiana* في مكافحة الآفات الاقتصادية للكرنب ومقارنتها بتأثير المبيدات الحشرية التقليدية في موقعين مزروعين بالكرنب في مصر. تم حصر أربعة أنواع من الحشرات. كانت أكثر آفات الكرنب شيوعًا : تربس البصل *Thrips tabaci* و فراشة ابو دقيق الكرنب *Pieris rapae* والفراشة ذو الظهر الماسى *Plutella xylostella* ومن الكرنب *Brevicoryne brassicae* . أظهرت النتائج أن *T. tabaci* كان أكثر الآفات انتشارا. بنهاية الموسم بلغ متوسط تعداد *T. tabaci* 6.2 ± 39.72 و 7.68 ± 1.2 يرقة ، حشرة كاملة / نبات بالجيزة ، 45.44 ± 8.27 و 2.68 ± 2.8 يرقة ، حشرة كاملة / نبات بالمنوفية وذلك على النباتات المعالجة بالمبيدات الحشرية و *B. bassiana* على التوالي.
بعد تطبيق *B. bassiana* ، أصبحت تعداد كلا من *P. rapae* و *P. xylostella* أقل من الحد الاقتصادى الحرج. أما في حالة تطبيق المبيدات فقد بلغ تعداد *P. rapae* 1.23 ± 3.52 و 2.36 ± 1.35 يرقة / نبات و *P. xylostella* 1.28 ± 1.72 و 2.64 ± 1.03 يرقة وعذارى / نبات في الجيزة والمنوفية على التوالي. أظهرت النتائج أن الفطر الممرض للحشرات *B. bassiana* سيطر بشكل فعال على الآفات الحشرية الرئيسية على الكرنب في كلا موقعي الدراسة. وبالتالى يمكن التوصية بإستخدام *B. bassiana* كعامل من عوامل المكافحة البيولوجية، لمكافحة بعض الآفات الحشرية والاقتصادية على الكرنب في الحقل.

الكلمات المفتاحية: فطريات ممرضة للحشرات ، مبيدات حشرية ، آفات حشرية ، الكرنب.