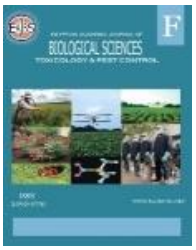
Egypt. Acad. J. Biolog. Sci., 12(1): 207-215 (2020)

Egyptian Academic Journal of Biological Sciences
F. Toxicology & Pest Control
ISSN: 2090 - 0791
http://eajbsf.journals.ekb.eg/



Impact of Sowing Dates and The Control on Sap-Sucking Pests in Pepper Plant (*Capsicum annuam L*) Under Field Conditions at Qalubiya Governorate, Egypt.

Badran , A. B
Plant Protection Research Institute (PPRI), Agriculture Research Center (ARC), Dokki 12618, Giza, Egypt.

ARTICLE INFO

Article History
Received:16/5/2020
Accepted:30/6/2020

Keywords:
Cropping system, pepper crop, sowing dates, *Bemisia tabaci*, *Myzus persicae* , *Tetranychus urticae* , pesticide, plants extract oils and reduction.

ABSTRACT

Different strategies have to be involved in keeping the pest in check and stabilizing the productivity of the cropping system. Date of planting is one of the crop habitat diversifications that are to be looked into, to minimize the incidence of pests on pepper crop so that its yield can be enhanced. The present study was conducted to observe the activity of pests of pepper crops using variety khayrat at Qaha village, Qalyoubia Governorate during two successive seasons, 2018 and 2019. which was based on a randomized complete block design (RCBD) with four sowing dates, i.e. on April, 1st; April, 20th; May, 10th, and May, 30th and replicated thrice. The observation of pests was recorded at weekly intervals from the first week of transplanting up to maturity. The results showed that the obtained data in the two studied seasons and their statistical analysis showed clearly that planting pepper plants in the earliest planting date (April, 1st) escaped significantly from the infestation of *Bemisia tabaci*, *Myzus persicae* and *Tetranychus urticae.* The second experiment was conducted during 2019 seasons to evaluate the efficiency of nine pesticide and plants extract oils on reducing the population density of whitefly nymphs (*Bemisia tabaci* (Genn.)) and Aphids individuals (*Myzus persicae* Sulzer) on pepper plants the results indicated that the comparing the mean reduction percentages in the population of *B. tabaci* nymph after applications of nine compounds it is clear that Actara WG 25% was the most potent one as a mean of reduction was 88.5% and 92.5% in the first and second spray, can be arranged in descending orders as follows: Agri Flex SC 18.56%, SAFOIL., Thyme oil, KZ oil EC 95%., closer SC24%., Black pepper oil and Cumin oil. According to the general mean percentage of reduction in the population of *M. persicae* individuals main pepper plants after applications of nine compounds it is clear that closer SC24% was the most potent one as mean of reduction was 92.8% and 95.5% in the first and second spray, can be arranged in descending orders as follows: Actara WG 25%, KZ oil EC 95%., SAFOIL., Garlic oil, Thyme oil, Agri Flex SC 18.56% and Cumin oil.

INTRODUCTION

Pepper (*Capsicum annum* L.) is an important commercial vegetable cum spice crop grown in Egypt. The crop is known to harbour more than 50 insects and 2 mite pests of which, thrips, Scirtothrips dorsalis Hood and the mites, Polyphagotarsonemus latus Banks are the major constraints for higher yields (Reddy and Puttaswamy, 2000).These sucking pests attack the crop at seedling stage itself and continue until 1st harvest, causing severe crop losses up to 34 per cent (Ahmed *et al*., 2004). Whitefly (*Bemisia tabaci* (Genn.) nymphs), Aphids (*Myzus persicae* Sulzer), in addition, red mite (Tetranychus *urticae*) are the major insect pests of pepper in Qalubiya Governorate and elsewhere in the country, often resulting in significant crop losses (Ahmed *et al*., 1987 and Kandasamy *et al*., 1990). In order to save the crop from the pest ravages, farmers resort to six to as many as 20 rounds of chemical sprays (Lingappa *et al*., 2002) leading to pest resurgence, destruction of natural enemies and pesticide residues in fruits (David 1991, Smitha and Giraddi, 2006). As pesticide residues in pepper are of great concern from the point of exports and domestic consumption as well, nonchemical pest management strategies such as use bio pesticides and plant extracts for the management of pepper pests is better approach. Capsicum species are not only cultivated as vegetable and condiment crop but are also incorporated into a number of medicinal preparations in the ancient literature around the world. 'Naga chilli' or 'Bhoot Jolokia' (Capsicum chinense Jacq.) Thrips produces a silver white discoloration with tiny black dots (this is the insect's excrement) on the upper leaf surface. The leaves become distorted and flower and fruit production is affected. It likes hot, dry conditions so water temperature with shading and ventilation. Whitefly produce lush new growth they become vulnerable to these aphids that spread viruses quickly and lead to the determent & health of the plant. Under field conditions, insects and mites in immense magnitude cause the losses to this crop. Sow pepper seeds in open filed from early April Sowing time is a major factor to influence the crop yields, earlier sowing times usually result in greater crop biomass, higher risk of lodging at the end of the season and increased risk of frost damage during flowering and pod setting. However, these risks can be outweighed by a longer growing season and subsequently higher yield potential. The optimum sowing time for maximizing yield varies with location (Davidson *et al.,* 1991; Brinsmead, 1992; Regan & Siddique, 2006 and Farghaly 2009).

Trials conducted in this work aimed to use sowing dates and the control on sap-sucking pests in pepper plants (*Capsicum annuam* L) under field conditions at Qalubiya Governorate, Egypt.

MATERIALS AND METHODS

Two field experiments were carried out in the research station, Qaha, Qalubiya governorate on pepper plants, *Capsicum annuam* L (variety khayrat) during two successive seasons, 2018& 2019. The first one was conducted to study the effect of planting dates of pepper plants on the infestation rate of pepper pests. The four selected planting dates were at 20 days intervals, on April, 1st; April, 20th; May, 10th, and May, 30th, respectively. The experimental area about 1500 m^2 was divided into 12 plots (each plot was 125 m^2). The experimental plots were laid out in a randomized complete block design and each planting date was represented by three plots. The sampling of pepper leaves started 15 days after planting. Weekly samples (10 leaves/plot) were randomly taken from each plot and put in paper bags and transferred to the laboratory for inspection to count the number of whitefly nymphs (*Bemisia tabaci* (Genn.)), Aphids individuals

(*Myzus persicae* Sulzer) and two-spotted spider mite moveable stage (*Tetranychus urticae* Koch) Normal agricultural practices were followed without insecticides treatments.

The second experiment was conducted during 2019 seasons to evaluate the efficiency of nine pesticide and plants extract oils (Table l) on reducing the population density of whitefly nymphs (*Bemisia tabaci* (Genn.)) and Aphids individuals (*Myzus persicae* Sulzer) on pepper plants. An area, about 2000 m^2 planting on May 30th, was divided into 33 plots (each plot was 55.50 m^2). Weekly samples (10 laves/ plot) and control treatment. Each compound applied two times through the harvest stage. The first spray started on July 1; 2019 and the other sprays were followed at 21 days interval, the inspection recorded before and after 24, 3,7&10 days of spray applications for recorded the reduction percentage of each pesticide was calculated according to (Henderson and Tilton formula,1955). A knapsack sprayer 20L capacity was used in applying the tested compounds as foliar treatments, the rate of applications of tested compounds listed in (Table 1). The statistical analyses of the present data were carried out using SAS program computer including f-test and L.S.D. value (SAS Institute, 1999)

Table1. List of tested pesticides, plant extracts oil and their rates of application

Trade name	Common name	Tissue	Solvent	Rate / 100-liter water
KZ oil EC 95%	mineral oil	---	Water	100cm^3
Agri Flex SC 18.56%		---	Water	120cm^3
Actara WG 25%	Thiamethoxam	---	Water	20gm
closer SC24%	"Sulfoxaflor"	---	Water	50cm^3
Thyme oil	(*Thymus vulgaris*)	Leave	Ethanol	100cm3
SAFOIL	(Orange oil) (Citrus sinensis)	Orange peel	Ethanol	100cm^3
Garlic oil	(Allium sativum)	Bulb	Ethanol/Water (1:1)	100cm3
Cumin oil	(*Cuminum cyminum)*	Seed	Ethanol	100 cm3
Black pepper oil	(*Piper nigrum)*	Seed	Ethanol	100cm3
Control	Without spray	---	Water	

RESULTS AND DISCUSSION

Data in Table (2) and Fig. (1), showed the effect of tested four different sowing dates on the infestation of pepper plant by some pests during two seasons, 2018 and 2019.

***Bemisia tabaci* (Genn.) Nymphs:**

Results in Table (2) and Fig. (1), revealed that the population density of *Bemisia tabaci* nymphs on pepper plants differed significantly according to the sowing date during the two successive seasons 2018 and 2019. In the first season, the population density of *B. tabaci* nymphs increased by delaying the sowing date. The pepper plants were sown in the earliest planting date (April, 1st) infested significantly by the lowest mean number of *B. tabaci* (60 nymphs/ 30 leaves). Followed by, the plants of the second sowing dates (April, 20th) with a mean number of *B. tabaci* (232 / 30 leaves), the third sowing dates (May, 10th) the mean number of *B. tabaci* (1100/ 30 leaves) the fourth was the highest numbers of *B. tabaci* (1623 nymphs/ 30 leaves), respectively.

In the second season, results took the same trend as obtained in the first season. The seasonal mean numbers of *B. tabaci* found in this season were (53,267, 1261, and 1830 nymphs/ 30 leaves) for the four tested sowing dates, respectively.

The obtained data in the two studied seasons and their statistical analysis showed clearly that planting pepper plants in the earliest planting date (April, 1st) escaped significantly from the infestation of *B. tabaci.*

These results agree with Abd El-Gawad (2008) indicated that were significant differences between the different planting dates on the infestation by *B. tabaci* during seasons 2005/2006. While, Ali (1993), El-Khayat *et al*. (1994), Zaki *et al*. (2002), and Esmail (2013). Shaalan (2016) concluded that the different planting dates during year effect on the development of numerous pests including *B. tabaci*, as soon as in the present study.

Table 2: Effect of planting dates on major pests of the pepper plant (*Capsicum annuam* L) during 2018&2019 seasons under field conditions at Qalubiya Governorate.

Sampling Dates	2018			2019		
	B. Tabaci	*M. persicae*	*T. urticae*	*B. tabaci*	*M. persicae*	*T. urticae*
1st sowing April, 1st	60 D	56 D	59 D	53 D	41 D	87 D
2nd sowing April, 20th	232 C	376 C	375 C	267 C	348 C	344 C
3rd sowing May, 10th	1100 B	1509 B	2900 A	1261 B	1485 B	2525 B
4th sowing May, 30th	1623 A	2100 A	2790 B	1830 A	2625 A	3162 A
F value	333.39 ***	391.38***	154.83***	841.7***	440.47***	633.15***
L.S.D.	7.66	3.56	3.35	6.24	14.88	5.26

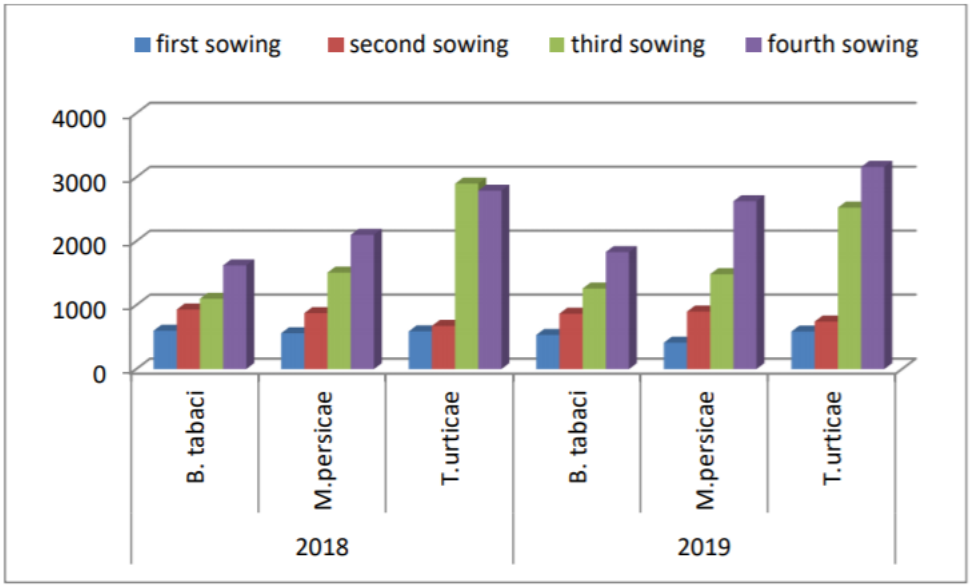


Fig. 1: Effect of planting dates on major pests of the pepper plant (*Capsicum annuam* L) during 2018&2019 seasons under field conditions at Qalubiya Governorate.

***Myzus persicae* Sulzer (individuals):**

Results in Table (2) and Fig. (1), clearly showed that the population density of *Myzus persicae* individuals on pepper plants varied according to the sowing date in the two studied seasons 2018 &2019. Regarding the obtained data in the two seasons, the infestation levels with the studied insects/ leaves on pepper plant increased successively by delaying sowing date, as the highest infestation level (2100 & 2625 individuals/ 30 leaves) were observed during the latest planting date (May, 30th) in the two seasons, respectively. While the lowest infestation occurred on pepper plants sowed in the first

sowing date (April, 1st) as the whole average of *M. persicae* individuals in the two seasons were (56 and 41 individuals/ 30 leaves), respectively. The intermediate sowing date (April, 20th and May 10th) occupied intermediate level of infestation, as the corresponding seasonal mean numbers were (376 and 348 individuals/ 30 leaves) and (1509 and 1485 individuals/ 30 leaves) in the two seasons, respectively.

***Tetranychus urticae Koch* Movable Stage:**

Results in Table (2) and Fig. (1), revealed that the population density of *T. urticae* movable stage on pepper plants differed significantly according to the sowing date during the two successive seasons 2018 and 2019. In the first season, the population density of *T. urticae* increased by delaying the sowing date. The pepper plants were sown in the earliest planting date (April, 1st) infested significantly by the lowest mean number of *T. urticae* (59 movable stage / 30 leaves). Followed by, the plants of the second sowing dates (April, 20th) with a mean number of *T. urticae* (375 movable stage / 30 leaves), the fourth sowing dates (May, 30th) the highest mean numbers of *T. urticae* (2900 movable stage / 30 leaves) the third sowing dates were of *T. urticae* (2790 movable stage / 30 leaves), respectively.

In the second season, results took the same trend as obtained in the first season. The seasonal mean numbers of *T. urticae* found in this season were (87,344, 2525, and 3162 movable stage / 30 leaves) for the four tested sowing dates, respectively.

The obtained data in the two studied seasons and their statistical analysis showed clearly that planting pepper plants in the earliest planting date (April, 1st) significantly from the infestation of *T. urticae.*

Effect of Some Pesticides On Major Pests:

Pepper plants received two sprays of each compound during the experimental period, the results of these field experiments are tabulated in Tables (3- 4)

The efficiency of different chemical compounds and plant extracts included (KZ oil EC 95%., Agri Flex SC 18.56%, Actara WG 25%, closer SC24%., Thyme oil, SAFOIL., Garlic oil., Cumin oil and Black pepper oil in reducing the population densities of pepper.

-*Bemisia tabaci* (Genn.) Nymphs:

Comparing the mean reduction percentages in the population of *B. tabaci* nymph after applications of nine compounds it is clear that Actara WG 25% was the most potent one as mean of reduction was 88.5% and 92.5% in the first and second spray

In the first spray, can be arranged in descending orders as follows: Agri Flex SC 18.56%, SAFOIL., Thyme oil, KZ oil EC 95%., closer SC24%., Black pepper oil and Cumin oil with a mean reduction of 86.9, 85.4, 81.6, 79.2, 76.0,75.2 and 72.3.for the seven agents, respectively. The least potent one was Garlic oil with a mean reduction of 61.7 and 74.5, respectively in According to the mean, percentage of reduction in *B. tabaci* counts after treatment, the compounds significantly into could be divided into five groups (F. value = 7.15 and L.S.D = 3.98 %. In the second spray found that, closer SC24%., SAFOIL., Agri Flex SC 18.56%, Thyme oil, KZ oil EC 95%., Black pepper oil and Cumin oil with a mean reduction of 92.5, 87, 85.25, 83.75, 81.5,78.7 and 74.5.for the seven agents, respectively. According to the mean, percentage of reduction in *B. tabaci* counts after treatment, the compounds significantly into could be divided into three groups (F. value = 9.43 and L.S.D = 5.14 %. (Table 3).

Table 3: Efficiency of nine control-agents against *B. tabaci* nymphs on pepper plants at Qalubiya Governorate on 2019 season.

Spray	Treatments	No. Nymph Per Treatments	Initial Kill After 24 hours	Residual effect treatments 3 Days	7 Days	10 Days	Average%
First	KZ oil EC 95%	175	61.2	74	92.8	82.0	79.2b
	Agri Flex SC 18.56%	189	65.2	75.2	100	100	86.9a
	Actara WG 25%	180	73.8	81.8	100	100	88.5a
	closer SC24%	184	53.2	65	88.4	85.8	76.0c
	Thyme	188	55.2	70.2	91.5	100	81.6b
	SAFOIL	178	62.2	78.8	100	100	85.4a
	Garlic oil	188	44.8	52.4	82.2	77.2	61.7e
	Cumin	185	45.2	55	85.4	80.2	72.3d
	Black pepper	179	47.2	57.4	85.8	91.5	75.2c
	Control	195	--	--	--	--	--
	F value = 7.15*			L..S.D. = 3.98			
Second	KZ oil EC 95%	66	69	80	94	83	81.5b
	Agri Flex SC 18.56%	59	62	79	100	100	85.25b
	Actara WG 25%	62	80	90	100	100	92.5a
	closer SC24%	64	81	89	100	100	92.5a
	Thyme	69	60	80	95	100	83.75b
	SAFOIL	58	68	80	100	100	87ab
	Garlic oil	64	57	65	85	91	74.5c
	Cumin	61	60	75	90	89	78.5c
	Black pepper	63	55	78	90	92	78.75c
	Control	243	--	--	--	--	--
	F value = 9.43*			L..S.D. = 5.14			

Means followed by the same letters are not significantly different according to the $LSD_{0.05}$

***Myzus persicae* Sulzer (individuals):**

According to the general mean percentage of reduction in the population of *M. persicae* individual's main pepper plants after applications of nine compounds it is clear that closer SC24%., was the most potent one as means of reduction was 92.8% and 95.5% in the first and second spray.

In the first spray, can be arranged in descending orders as follows: Actara WG 25%, KZ oil EC 95%., SAFOIL., Garlic oil, Thyme oil, Agri Flex SC 18.56% and Cumin oil with a mean reduction of 90.8, 88.3, 87.8, 85.0, 79.8,76.3 and75.8.for the seven agents, respectively. The least potent one was Black pepper oil with a mean reduction of 73.0 and 75.3, respectively. According to the mean, percentage of reduction in *M. persicae* counts after treatment, the compounds significantly into could be divided into six groups (F. value = 3.11 and L.S.D = 2.21 %. In the second spray found that as the same trend, Actara WG 25%, SAFOIL., KZ oil EC 95%., Garlic oil, Thyme oil, Agri Flex SC 18.56%, Cumin oil and Black pepper oil with a mean reduction of 94.8, 88.8, 87.5, 85.0, 84.3,80.3,78.3 and 75.3 for the nine agents, respectively. According to the mean, percentage of reduction in *M. persicae* counts after treatment, the compounds

significantly into could be divided into seven groups (F. value = 2.03 and L.S.D = 1.89 %. (Table 4).

Table 4: Efficiency of nine control-agents against *M. persicae individuals* on pepper plants at Qalubiya Governorate on 2019 season.

Sprav	Treatments	No. Nymph Per Treatments	Initial Kill After 24 hours	Residual effect treatments 3 Days	7 Days	10 Days	Average %
First	KZ oil EC 95%	110	72	88	93	100	88.3b
	Agri Flex SC 18.56%	98	44	61	100	100	76.3c
	Actara WG 25%	105	75	88	100	100	90.8a
	closer SC24%	103	81	90	100	100	92.8a
	Thyme	99	62	75	87	95	79.8d
	SAFOIL	109	69	82	100	100	87.8b
	Garlic oil	95	70	82	90	98	85.0c
	Cumin	87	61	69	82	91	75.8e
	Black pepper	98	58	66	79	89	73.0f
	Control	91	--	--	--	--	--
	F value = 3.11*			L.S.D. = 2.21			
Second	KZ oil EC 95%	55	69	84	97	100	87.5c
	Agri Flex SC 18.56%	52	51	70	100	100	80.3e
	Actara WG 25%	61	79	100	100	100	94.8a
	closer SC24%	53	82	100	100	100	95.5a
	Thyme	49	66	87	90	94	84.3d
	SAFOIL	52	70	85	100	100	88.8b
	Garlic oil	55	72	81	89	98	85.0c
	Cumin	46	61	70	89	93	78.3f
	Black pepper	51	57	72	82	90	75.3g
	Control	166	--	--	--		--
	F value = 2.03*			L. S.D. = 1.89			

These results are in agreement with those obtained by On the other hand, (Koul *et al*., 2008), found that essential aromatic oils were used to control many pests on various crops. Further, while resistance development continues to be an issue for many synthetic pesticides, it is likely that resistance will develop more slowly to essential oil-based pesticides owing to the complex mixtures of constituents that characterize many of these oils. Badran *et al*., 2018 indicted that, when using a chemical pesticide, essential aromatic oils (Garlic, Dill) and mineral oil alone and in binary mixtures found highly significant differences between the thirteen tested compounds. The leafminer, *T. absoluta* control were using 4cm Coragen 20% SC / 25cm mineral oil, 3cm Coragen 20% SC / 25cm mineral oil, 4cm Voliam Flexi 40% WG / 25cm mineral oil and 40cm Dill oil / 25cm mineral oil showed high mortality .the low effect was using 20cm Garlic oil / 25cm mineral oil and Fargalla F. H. (2020) studied that, the efficient treatments are Tracer and Saif oil followed by KZ Oil + Potassium Soap. It is clear from the results that the local cultivar preferred to cultivate in Luxor, where the best vegetative growth, as well as the

highest yield of fruits and the highest productivity of essential oil percentage and the highest oil yield, provided the treatment of plants with Tracer or Saif oil, where they have a strong impact on aphid resistance, which reflected on the production of local fennel type increased

Conclusion

The results showed that the obtained data in the two studied seasons and their statistical analysis showed clearly that planting pepper plants in the earliest planting date (April, 1st) escaped significantly from the infestation of *B. tabaci*, *Myzus persicae* and *Tetranychus urticae.* results indicated that the comparing the mean reduction percentages in the population of *B. tabaci* nymph after applications of nine compounds it is clear that Actara WG 25% was the most potent one, can be arranged in descending orders as follows: Agri Flex SC 18.56%, SAFOIL., Thyme oil, KZ oil EC 95%., closer SC24%., Black pepper oil and Cumin oil. According to the general mean percentage of reduction in the population of *M. persicae* individuals main pepper plants after applications of nine compounds it is clear that closer SC24% was the most potent one, can be arranged in descending orders as follows: Actara WG 25%, KZ oil EC 95%., SAFOIL., Garlic oil, Thyme oil ., Agri Flex SC 18.56% and Cumin oil.

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ARABIC SUMMARY

تأثير مواعيد الزراعة ومكافحة على الآفات الثاقبة الماصةالتي تصيب نبات الفلفل (*Capsicum annuam* L) تحت ظروف الحقل في محافظة القليوبية، جمهورية مصر العربية

بدران عبد الفتاح بدران
معهد بحوث وقايه النباتات- مركز البحوث الزراعيه – الدقى - الجيزة

لابد أن تكون هناك استراتيجيات مختلفة لإبقاء الآفة تحت السيطرة وتحقيق الاستقرار في إنتاجية نظام المحاصيل. مواعيد الزراعة هو أحد الوسائل لمعرفة مدى التنوع للافات على المحاصيل المختلفة التي سيتم دراساتها، لذلك لمعرفة الموعد الماسب لتقليل حدوث الاصابة بالآفات على محصول الفلفل حتى يمكن تحسين محصولها. أجريت هذه الدراسة لرصد نشاط آفات على محصول الفلفل باستخدام صنف (خيرات) في قرية قها بمحافظة القليوبية خلال موسمين متتاليين ٢٠١٨ و٢٠١٩، والذي استند إلى تصميم قطع عشوائية كاملة (RCBD) مع أربعة تواريخ للزراعة، أي في ١ أبريل؛ ٢٠ أبريل؛ مايو، ١٠ و٣٠مايو. تم تسجيل الآفات على فترات أسبوعية من الأسبوع الأول من الزرعة حتى النضج. أوضحت النتائج أن البيانات التي تم الحصول عليها في موسمي الدراسة وتحليلها الإحصائي أظهرت بوضوح أن زراعة نباتات الفلفل في (١ أبريل) كانت اقل تعداد للإصابة ب *Bemisia tabaci* و *Myzus persicae* و *Tetranychus urticae*. أجريت التجربة الثانية خلال مواسم ٢٠١٩ لتقييم كفاءة تسع مبيدات حشرية وزيوت مستخلصات نباتية في تقليل الكثافة السكانية للحوريات البيضاء (Genn) *Bemisia tabaci*.)) وحشرات المن (*Myzus persicae* Sulzer) على نباتات الفلفل. بمقارنة نسب الخفض المتوسطة في عدد الحوريات *B. tabaci* بعد استخدام تسعة مركبات، من الواضح أن Actara WG 25٪ كان الأكثر فاعلية حيث كان متوسط الانخفاض ٨٨,٥٪ و ٩٢,٥٪ في الرشة الاولى والثانية، يمكن أن يكون مرتبة ترتيبًا تنازليًا على النحو التالي: Agri Flex SC 18.56٪، SAFOIL.، زيت الزعتر، زيت KZ EC 95٪. ، أقرب SC24٪. ، زيت الفلفل الأسود وزيت الكمون. وفقًا لمتوسط النسبة المئوية العامة للانخفاض في عدد الحوريات من نباتات الفلفل الرئيسية للأفراد بعد استخدام تسعة مركبات، فمن الواضح أن Closer٪SC24 كان الأكثر فاعلية حيث كان متوسط الانخفاض ٩٢,٨٪ و ٩٥,٥٪ في الرشة الأول والثاني يمكن ترتيبها بترتيب تنازلي على النحو التالي: Actara WG 25٪ ، KZ oil EC 95٪ .، SAFOIL. ، زيت الثوم ، زيت الزعتر. ، Agri Flex SC 18.56٪ وزيت الكمون.