Field Evaluation of some Insect Growth Regulators and Plant Originated Insecticides Against Sucking-Piercing Insects on Cucumber Plant and Their Side Effects on The Associated Predators

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ABSTRACT

Commercial formulations of some botanical products azadirachtin, orange oil, and jojoba oil and insect growth regulators (IGRs) buprofezin, novaluron, and pyriproxyfen were evaluated as safe alternatives to synthetic insecticides imidacloprid and Pymetrozine against aphid *Aphis gossypii* Glover and whitefly *Bemisia tabaci* Gennadius in cucumber fields. Two experiments were conducted during 2021 and 2022 seasons, at El-hager area, Abou El-matameer, Al-Behira governorate. Side effects of the tested insecticides were also observed on the two predators lady beetle *Coccinella septumpunctata* Linnaeus and aphid lion *Chrysoperla carnea* Stephens. Imidacloprid significantly (P<0.05) achieved the highest initial and residual activity against aphid and whitefly in both seasons. The initial and residual reduction percentages of aphid were 94.5 and 98.9% in 2021 and 91.5 and 96.5% in 2022 as well as reduction percentages of whitefly was 85.7 and 92.4% in 2021 and 86.8 and 93.1% in 2022. Novaluron, buprofezin, pyriproxyfen and azadirachtin showed a moderate activity against whitefly and aphid in both seasons while orange and jojoba oils revealed the least reduction percentages. However, orange and jojoba oils have the least side effects on the aphid lion where the residual reduction percentages were 5.3 and 6.4% in 2021 and 6.4 and 7.3% in 2022. The least side effects on the lady beetle were exhibited by jojoba oil followed by orange oil and azadirachtin where the residual reduction percentages were 10.8, 14.7 and 15.6% in 2021 and 11.1, 16.1 and 15.3% in 2022, respectively. Pyriproxyfen, novaluron and buprofezin achieved more initial and residual toxicity on the two predators. On the other hand, imidacloprid and pymetrozine have the highest initial and residual side effects against the two predators. The reduction percentages of all treatments on the two predators were less than 50%. Therefore, all treatments were considered harmless according to the IOBC classification. The good selectivity feature of these formulated botanical products and IGRs, makes them good tools and suitable for integrated pest management (IPM) programs of sucking piercing insects.

Keywords: Aphid; Botanicals; IGRs; Natural Enemies; Whitefly; Selectivity.

INTRODUCTION

Cucumber *Cucumis sativus* Linnaeus is cultivated in Egypt and all over the world. Its fruit contains many nutritional elements such as carbohydrates, proteins, fats, fibers and minerals. Cucumber is a source of many vitamins such as A, C, K and E (Vimala *et al.*, 1999). Among all sucking insects attacking cucumber, aphids and whiteflies are the most dangerous. Aphid is one of the most dangerous insects infesting vegetable plants causing a greet damage as it able to suck the plant sap and transmit plant viruses into the leaf tissues (Abou-Taleb and Barrania, 2014). Whitefly feeds on the phloem sap of more than 500 host plants and can transmit more than 90 types of plant viruses (Hunter and Polston, 2001). The infestation by these insects causes either direct and indirect damage by sucking the plant sap and by transmitting virus diseases (Shehata *et al.*, 2009).

The application of insecticides is one of the management options that can reduce infestation by sucking insects (VanDoorn *et al.*, 2015 and Mesbah *et al.*, 2016). Recently, insect populations have become resistant due to the misuse of these insecticides. Human health and environmental concerns over insecticide use also increasingly favor the development of alternative and safer methods for pest control (Cherry *et al.*, 1997). European Food Safety Authority (2009) stated that the presence of residue in fruits, vegetables, and green leaves beyond the maximum limit is a serious issue for human health. As an alternative, insecticidal substances derived from plants are safer for humans as well as the environment, more readily biodegradable, and may prevent the development of insect resistance (Isman, 2006). These pesticidal plants are primarily more affordable for small-scale farmers and have a low environmental persistence (Isman, 2008).

Besides, The indiscriminate use of pesticides causes destruction of natural enemies such as predators and parasitoids (Dent and Binks, 2020). The predatory lady beetles (Coccinellidae: Coleoptera) and aphid lion

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(Chrysopidae: Neuroptera) are widely recognized as important and successful biological control agents for many insects such as whiteflies and aphids (Halder and Seni, 2021). Lady beetles are highly polyphagous insect that consumes a majority of the different kinds of aphid it encounters (Pedigo *et al.*, 2021). The Chrysopidae family of lacewings is also very effective and has attracted the attention of entomologists in biological control programs (Brooks and Barnard, 1990). Biological control agents that suppress these insects should be managed and combined with insecticides in the integrated pest management (IPM) (Baker *et al.*, 2020). Generally, insecticides that control insect pests with low or no adverse effect on natural enemies are considered appropriate to be used in IPM programs (Stara *et al.*, 2011). Therefore, the need to use selective insecticides with different mode of actions are highly recommended.

Botanical bioinsecticides derived from azadirachtin, orange oil and jojoba oil as well as insect growth regulators pyriproxyfen, buprofezin and novaluron useful as alternatives to synthetic origin insecticides such as imidacloprid and Pymetrozine. Thus, the aim of this study is to evaluate the above-mentioned insecticides against aphid *Aphis gossypii* Glover and whitefly *Bemisia tabaci* Gennadius as well as the two associated predators, lady beetle *Coccinella septumpunctata* Linnaeus and aphid lion *Chrysoperla carnea* Stephens on cucumber in two successive seasons 2021 and 2022.

MATERIALS AND METHODS

Insecticides:

The Insecticides used with manufacturers were clarified in the table (1)

Field experiments:

Two experiments were conducted during 2021 and 2022 seasons, at El-hager area, Abou El-matameer, Al-Behira governorate. Cucumber seeds variety Beta Alpha were sowed on April 10, 2021 and April 18, 2022. Treatments were arranged in a randomized complete block design. Four replicates of each treatment (84 m^2 each) were performed. According to the manufacturer's recommendations, the insecticides were sprayed by Knapsack sprayer equipment (CP3) at the rate of 150 liter per feddan on May 5, 2021 and May 10, 2022. The control was only sprayed with water.

The efficiency of the treatment applications was performed on adult instar of whitefly *B. tabaci* and aphid *A. gossypii* was recorded by counting the target insects on the lower surface of 20 cucumber leaves of 10 plants per each plot. The predators lady beetle and lion aphid were also recorded. The count of insect pests and predators were recorded pretreatment and on days 3, 5, 7 and 10 after treatment early in the morning, when flight activity is low, counts were conducted according to Butler Jr *et al.* (1988). The initial reduction percentages were recorded after 3-days of application. The residual effects were the mean of 5, 7 and 10-days reduction percentages. Based on Henderson and Tilton (1955), reduction percentages were calculated. Insecticide treatments used in this study were categorized as their effects on the natural enemies according to the International Organization of Biological Control (IOBC) classification to three categories as following: N= harmless or slightly harmful (reduction field and semi-field 0-50%, laboratory <30%), M= moderately harmful (reduction field and semi-field 51-75%, laboratory 30-79%), and T= harmful (reduction field and semi-field >75%, laboratory ≥ 80%) (Boller *et al.*, 2005).

Statistical analysis:

Initial reduction percentages of insects were compared using one way analysis of variance (ANOVA). Residual reduction percentages were compared using a factorial split plot design, with insecticides treatments allocated the main plots and time intervals as sub-plots. All data were compared for significance by $LSD_{0.05}$ using SAS software version 9.4 (SAS, 2017).

Table 1. The evaluated insecticides with field rate and supplier

Trade name	Common name	Recommendation	Produced by
Antifly 10% EC	Pyriproxyfen	75 cm^3 / 100 liter	CAM for Agrochemicals
PREV-AM 6% SL	Orange oil (d-limonene)	500 ml / 100 liter	Oro Agri International Ltd
Roxy 10% EC	Novaluron	300 cm^3 / fed.	UPL Ltd
Applaud 25%SC	Buprofezin	600 cm^3 / fed.	Nihon Nohyaku Co., Ltd.
Tido 50%WG	Pymetrozine	80 gm / 100 liter	Hailir Pesticides and Chemicals Group Co. Ltd
Top Healthy 60% EC	Jojoba oil	300 ml / 100 liter	Top Chemicals
Achock 0.15%EC	Azadirachtin	200 ml / 100 liter	Godrej Agrovet Ltd
Confidor® 35%SC	Imidacloprid	25 ml / 100 liter	Bayer CropScience

RESULTS AND DISCUSSION

Field efficiency of some insecticides against sucking piercing insects on cucumber:

- **Aphid *A. gossypii***

Field evaluation of some insecticides against aphids on the cucumber in 2021 and 2022 seasons was carried out (Tables 2 and 3). The highest initial reduction percentages were achieved by imidacloprid (94.5 and 91.5%) followed by pymetrozine (84.8 and 83.9%) and azadirachtin (77.1 and 74.8%) in 2021 and 2022 seasons. There is no significant difference in the efficiency of IGR insecticides novaluron, buprofezin, and pyriproxyfen and azadirachtin which showed a moderate residual activity in controlling aphids on cucumber in both seasons. Orange and jojoba treatments achieved the least reduction percentages of aphids in both seasons. On the other hand, Imidacloprid significantly achieved the highest initial (94.5 and 91.5%) and residual (98.9 and 96.5%) activity against aphid in 2021 and 2022 seasons.

According to Abdel-Rahman and Abou-Taleb (2008), Confidor® (imidacloprid) was the most effective aphid control product on cotton plants. Shehata *et al.* (2009) also mentioned that Confidor® achieved the highest aphid control on the cucumber plants. Neem oil contains effective compounds against insect pests either as anti-feeding or as insect growth regulators that lead gradually to mortality of treated insects (Kraus *et al.*, 1981 and Lee *et al.*, 1991). Aphid numbers were also reduced gradually with Confidor®, a nicotinic acetylcholine receptor agonist that was slightly potent on days 7 and 14 after application, as reported by Tomizawa & Casida (2003) and Horowitz *et al.* (1998).

Table 2. Reduction percentages in aphid numbers on cucumber after treatment by different control agents (2021)

Treatments	%Reduction				
	Initial	Residual			Mean residual %reduction
	3-day	5-days	7-days	10-days	
Pyriproxyfen	74.5[c]	80.3	84.6	85.4	83.4[d]
Orange oil	63.8[e]	69.3	77.5	79.2	75.3[e]
Novaluron	76.4[c]	84.5	88.5	92.3	88.4[c]
Buprofezin	73.9[c]	78.5	85.3	91.7	85.2[cd]
Pymetrozine	84.8[b]	91.4	93.3	94.6	93.1[b]
Jojoba oil	67.7[d]	74.4	78.1	81.4	78.0[e]
Azadirachtin	77.1[c]	82.6	87.5	90.2	86.8[cd]
Imidacloprid	94.5[a]	97.8	99.4	99.4	98.9[a]

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

Table 3. Reduction percentages in aphid numbers on cucumber after treatment by different control agents (2022)

Treatments	%Reduction				
	Initial	Residual			Mean residual reduction%
	3-day	5-days	7-days	10-days	
Pyriproxyfen	71.4[c]	76.3	81.4	83.2	80.3[cd]
Orange oil	58.4[e]	63.6	68.7	73.3	68.5[e]
Novaluron	73.2[c]	80.2	84.7	85.4	83.4[c]
Buprofezin	71.5[c]	74.2	79.4	81.2	78.3[d]
Pymetrozine	83.9[b]	86.2	91.8	92.0	90.0[b]
Jojoba oil	63.5[d]	66.1	70.1	72.8	69.7[e]
Azadirachtin	74.8[c]	79.0	81.2	82.3	80.8[cd]
Imidacloprid	91.5[a]	93.9	97.1	98.5	96.5[a]

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

- **whitefly *B. tabaci***

In this study, numbers of insecticides were evaluated against whitefly on cucumber fields during 2021 and 2022. Imidacloprid had a significant ($P<0.05$) effect on the population of whitefly and showed the highest initial and residual activity, followed by buprofezin and pymetrozine (Table 4 and 5). The initial and the mean residual reduction percentages of whitefly achieved by imidacloprid was 85.7 and 92.4% in 2021 and 86.8 and 93.1% in 2022. Orange oil significantly ($P<0.05$) achieved the least initial and residual activity.

It was recorded that, buprofezin prevents the adult emergence from the pseudopupa (Valle *et al.*, 2002). Moreover, buprofezin was highly effective against growth and development of the immature in the greenhouse, while it significantly suppressed the adult whitefly populations on strawberry in the field (Bi *et al.*, 2002). Bhatt *et al.* (2018) reported that among tested treatments buprofezin was the highly effective against whitefly in okra agroecosystem. El-Bessomy (2003) mentioned that imidacloprid achieved good reduction percentages against whitefly nymph after 84 hrs of application. Khalifa (2021) also indicated that *B. tabaci* adult and nymph stages were controlled efficiently by imidacloprid for two successive sprays. On the other hand, Nousseir (2001) and Al-Rubeai *et al.* (2004) reported that neem oil (azadirachtin) effectively controlled whitefly.

Novaluron and pyriproxyfen, which inhibit chitin synthesis, were barely effective against adult *B. tabaci* lower than the neonicotinoid insecticide imidacloprid in agreement with Barrania and Abou-Taleb (2014).

Table 4. Reduction percentages in whitefly numbers on cucumber after treatment by different control agents (2021)

Treatments	%Reduction				
	Initial	Residual			Mean residual reduction%
	3-day	5-days	7-days	10-days	
Pyriproxyfen	64.5[c]	66.2	69.5	71.8	69.2[d]
Orange oil	50.3[e]	52.5	55.3	56.4	54.7[f]
Novaluron	66.2[c]	68.7	70.8	73.5	71.0[cd]
Buprofezin	77.2[b]	79.3	82.4	85.3	82.3[b]
Pymetrozine	79.5[b]	81.6	84.8	88.6	85.0[b]
Jojoba oil	57.4[d]	59.1	63.7	64.7	62.5[e]
Azadirachtin	67.8[c]	70.1	73.8	77.4	73.8[c]
Imidacloprid	85.7[a]	89.1	92.4	95.7	92.4[a]

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

Table 5. Reduction percentages in whitefly numbers on cucumber after treatment by different control agents (2022)

Treatments	%Reduction				
	Initial	Residual			Mean residual reduction%
	3-day	5-days	7-days	10-days	
Pyriproxyfen	66.8[c]	69.2	74.3	78.5	74.0[c]
Orange oil	52.2[e]	53.5	58.8	60.9	57.7[e]
Novaluron	68.3[c]	71.4	75.6	78.3	75.1[c]
Buprofezin	78.8[b]	80.4	84.3	89.8	84.8[b]
Pymetrozine	80.7[b]	84.2	88.6	90.5	87.8[b]
Jojoba oil	58.9[d]	60.1	64.5	66.8	63.8[d]
Azadirachtin	69.2[c]	72.4	76.8	79.5	76.2[c]
Imidacloprid	86.8[a]	90.4	93.7	95.3	93.1[a]

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

Side effects of selected insecticides against lady beetle and aphid lion on cucumber:

In the present study, the side effects of some alternatives compared with specific insecticides on lady beetle *C. septumpunctata* and aphid lion *C. carnea* were considered (Table 6, 7, 8 and 9). Overall, there was a little difference in the populations of the two predators on cucumber treated with botanical insecticides followed by IGRs pyriproxyfen, novaluron and buprofezin expressed as initial and residual side effects against the two predators. orange and jojoba oils have the least side effects on the aphid lion where the residual reduction percentages were 5.3 and 6.4% in 2021 and 6.4 and 7.3% in 2022. The least side effects on the lady beetle were exhibited by jojoba oil followed by orange oil and azadirachtin where the residual reduction percentages were 10.8, 14.7 and 15.6% in 2021 and 11.1, 16.1 and 15.3% in 2022, respectively. On the other hand, imidacloprid and pymetrozine have the highest initial and residual side effects against the two predators. The residual percentages of the aphid lion were 32.7 and 29.1% in 2021 and 36.2 and 28.6% in 2022 and of the lady beetles were 46.1 and 45.5% in 2021 and 46.8 and 39.6% in 2022. Abou-Taleb and Barrania (2014) stated that Admire (imidacloprid) has the highest negative effect on the lady beetle and aphid lion. On the other hand, they reported that PREV-AM oil (orange oil) has the least side effects on the two predators.

The effects of synthetic chemical pesticides on the natural enemies must be investigated when the integration of natural enemies (such as lady beetles and aphid lions) and chemical control is necessary. Moreover, pesticide use practices must be modified to conserve biological control elements in the field (Ruberson *et al.*, 1998). There are some alternative pest control options that are considered to have fewer health and environmental impacts than conventional pesticides, such as insecticidal soaps, vegetable oils, and plant extracts (Fraser, 2005). This is what has been achieved to a great extent in this work by using plant products such as orange, jojoba and neem extracts, in addition to the IGR compounds such as pyriproxyfen, buprofezin and novaluron. According to the IOBC classification, all botanicals and IGRs were considered harmless against *C. septumpunctata* and *C. carnea* where the reduction percentages were less than 50% in the field.

Table 6. Reduction percentages in lady beetle numbers on cucumber after treatment by different control agents (2021)

Treatments	%Reduction				
	Initial	Residual			Mean residual %reduction
	3-day	5-days	7-days	10-days	
Pyriproxyfen	22.5 [b]	23.4	24.5	24.8	24.2 [b]
Orange oil	15.6 [c]	14.5	15.3	14.3	14.7 [c]
Novaluron	25.4 [b]	26.4	27.1	26.8	26.8 [b]
Buprofezin	23.5 [b]	24.2	25.6	26.1	25.3 [b]
Pymetrozine	33.1 [a]	40.5	46.8	49.2	45.5 [a]
Jojoba oil	9.5 [d]	10.2	11.7	10.5	10.8 [d]
Azadirachtin	12.5 [c]	14.2	16.2	16.5	15.6 [c]
Imidacloprid	34.5 [a]	38.9	46.8	52.7	46.1 [a]

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

Table 7. Reduction percentages in lady beetle numbers on cucumber after treatment by different control agents (2022)

Treatments	%Reduction				
	Initial	Residual			Mean residual reduction%
	3-day	5-days	7-days	10-days	
Pyriproxyfen	21.5[b]	22.5	23.6	24.2	23.4[c]
Orange oil	15.1[c]	15.9	16.1	16.4	16.1[d]
Novaluron	24.4[b]	25.0	25.8	26.7	25.8[c]
Buprofezin	22.5[b]	25.1	26.3	27.1	26.2[c]
Pymetrozine	34.1[a]	36.2	39.5	43.2	39.6[b]
Jojoba oil	9.1[d]	10.2	11.4	11.6	11.1[e]
Azadirachtin	13.5[c]	14.2	15.6	16.0	15.3[d]
Imidacloprid	36.5[a]	40.4	46.5	53.4	46.8[a]

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

Table 8. Reduction percentages in aphid lion numbers on cucumber after treatment by different control agents (2021)

Treatments	%Reduction				
	Initial	Residual			Mean residual reduction%
	3-day	5-days	7-days	10-days	
Pyriproxyfen	19.2[c]	21.2	22.3	24.5	22.7[b]
Orange oil	4.4[d]	5.1	6.6	7.1	5.3[c]
Novaluron	18.6[c]	20.4	22.4	23.6	22.1[b]
Buprofezin	17.2[c]	18.3	19.4	20.3	19.3[b]
Pymetrozine	21.5[b]	25.6	29.3	32.4	29.1[a]
Jojoba oil	5.4[d]	5.8	6.2	7.2	6.4[c]
Azadirachtin	18.3[c]	19.2	20.5	21.4	20.4[b]
Imidacloprid	26.2[a]	29.5	32.5	36.2	32.7[a]

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

Table 9. Reduction percentages in aphid lion numbers on cucumber after treatment by different control agents (2022)

Treatments	%Reduction				
	Initial	Residual			Mean residual reduction%
	3-day	5-days	7-days	10-days	
Pyriproxyfen	18.8[b]	20.4	21.8	22.3	21.5[c]
Orange oil	5.2[c]	5.9	6.4	6.8	6.4[d]
Novaluron	19.5[b]	20.4	21.3	22.4	21.4[c]
Buprofezin	18.2[b]	20.1	22.5	22.8	21.8[c]
Pymetrozine	22.3[b]	24.8	29.6	31.5	28.6[b]
Jojoba oil	6.2[c]	6.8	7.2	7.8	7.3[d]
Azadirachtin	20.4[b]	24.8	27.2	30.5	27.5[b]
Imidacloprid	28.5[a]	32.5	35.7	40.5	36.2[a]

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

It might be that these formulated botanicals and IGRs insecticides are hugely helpful in managing sucking piercing insects.

CONCLUSION

The present study clearly demonstrated that the bioinsecticides derived from Jojoba, orange and azadirachtin were the safest toward the two predators *C. septumpunctata* and *C. carnea* followed by the selected IGRs buprofezin, novaluron, and pyriproxyfen with good field parameters against whitefly and aphid. Imidacloprid was the most efficient insecticide significantly followed by pymetrozine against aphid as well as followed by pymetrozine and buprofezin against whitefly. On the other hand, imidacloprid and pymetrozine have the highest initial and residual side effects against the two predators. All compounds resulted in reduction percentages of the two predators less than 50% in the field. According to the IOBC classification, all used IGRs and plant originated insecticides were considered harmless against the two predators. The remarkable selectivity of these treatments makes them suitable for IPM programs against sucking piercing insects.

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الملخص العربي

التقييم الحقلى لبعض منظمات نمو الحشرات والمبيدات الحشرية من أصل نباتي ضد الحشرات الثاقبة الماصة على نبات الخيار وآثارها الجانبية على المفترسات المصاحبة

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تم تقييم تجهيزات تجارية لبعض المنتجات النباتية الأزاديراكتين وزيت البرتقال وزيت الجوجوبا ومنظمات نمو الحشرات (IGRs) البيبروفيزين والنوفالورون والبايريبروكسيفين كبدائل آمنة لمبيدات الحشرات المحضرة الإيميداكلوبريد والبيميتروزين ضد المن *Aphis gossypii* والذبابة البيضاء *Bemisia tabaci*. أجريت تجربتان خلال موسمي ٢٠٢١ و ٢٠٢٢ بمنطقة الحاجر أبو المطامير بمحافظة البحيرة. كما تم ملاحظة الآثار الجانبية للمبيدات المختبرة على المفترسين خنفساء أبو العيد *Coccinella septumpunctata* وأسد المن *Chrysoperla carnea*. أظهر مبيد الإيميداكلوبريد أعلى فعالية أولية ومتبقية معنوياً ضد حشرات المن والذبابة البيضاء في كلا الموسمين. نسب الخفض الأولية والمتبقية من المن كانت ٩٤,٥ و ٩٨,٩٪ في موسم ٢٠٢١ و ٩١,٥ و ٩٦,٥٪ في موسم ٢٠٢٢ بالإضافة إلى أن نسب خفض الذبابة البيضاء كانت ٨٥,٧ و ٩٢,٤٪ في موسم ٢٠٢١ و ٨٦,٨ و ٩٣,١٪ في موسم ٢٠٢٢. أظهر النوفالورون والبيبروفيزين والبايريبروكسيفين والأزاديراكتين فعالية متوسطة ضد الذبابة البيضاء والمن في كلا الموسمين بينما أظهرت زيوت البرتقال والجوجوبا أقل نسب خفض. ومع ذلك، كان لزيوت البرتقال والجوجوبا أقل الآثار الجانبية على أسد المن حيث كانت نسب الخفض المتبقية ٥,٣ و ٦,٤٪ في موسم ٢٠٢١ و ٦,٤ و ٧,٣% في موسم ٢٠٢٢. وقد أظهر زيت الجوجوبا أقل الآثار الجانبية على خنفساء أبو العيد يليه زيت البرتقال والأزاديراكتين حيث كانت نسب الخفض المتبقية ١٠,٨ و ١٤,٧ و ١٥,٦٪ في موسم ٢٠٢١ و ١١,١ و ١٦,١ و ١٥,٣٪ في موسم ٢٠٢٢، على التوالي. وقد حقق البايريبروكسيفين، النوفالورون و البيبروفيزين المزيد من السمية الأولية والمتبقية على المفترسين. من ناحية أخرى، فإن الإيميداكلوبريد والبيمتروزين لهما أعلى الآثار الجانبية الأولية والمتبقية ضد المفترسين. كانت نسب الخفض لجميع المعاملات على المفترسين أقل من ٥٠٪. لذلك، تم إعتبار جميع المعاملات غير ضارة وفقًا لتصنيف IOBC. تشير النتائج إلى أن ميزة الانتقائية الجيدة لتلك المستحضرات النباتية ومنظمات نمو الحشرات تجعلها كأداة مفيدة ومناسبة لبرامج الإدارة المتكاملة للآفات (IPM) لهذه الأفات الحشرية الثاقبة الماصة.

الكلمات الرئيسية: المن؛ المنتجات النباتية؛ منظمات نمو الحشرات؛ الأعداء الطبيعية؛ الذبابة البيضاء؛ الانتقائية.