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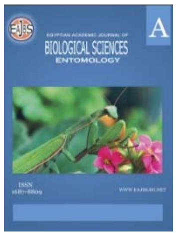

Activity of Flonicamid and Two Neonicotinoid Insecticides against *Bemisia tabaci* (Gennadius) and Its Associated Predators on Cotton Plants

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ABSTRACT

The sweet potato whitefly, *Bemisia tabaci* (Genn.), is a world-wide pest causing severe damages to numerous economic crops and has acquired resistance to most of conventional insecticides, particularly organophosphates and pyrethroids. Hence, Flonicamid, thiamethoxam and imidacloprid were evaluated for their efficacy against different developmental stages of *B. tabaci* on cotton plants under laboratory and field conditions at Sakha Agricultural Research Station, Egypt, during the cotton growing seasons of 2016 and 2017. Their side effects on the predacious stages of the associated predators i.e., the larvae of *Chrysoperla carnea*, both adults and larvae of *Coccinella spp*. and *Scymnus spp*., and true spiders were studied in the field as well. Results of the laboratory trials indicated that flonicamid provided no insecticidal activity on *B. tabaci* eggs, while thiamethoxam was significantly the most effective with LC_{50} value of 37.38 mg a.i.L^{-1}. Thiamethoxam possessed the highest toxic effect against the 2nd instar nymphs followed by imidacloprid and flonicamid recording LC_{50} values of 30.37, 136.41, and 226.54 mg a.i.L^{-1}, respectively. Under the field conditions, the activity of thiamethoxam did not differ significantly from that of imidacloprid recording from 83.19 – 93.24% and from 77.02 – 82.48% control of adults and immature stages of *B. tabaci*, respectively. Flonicamid demonstrated sufficient control, where it resulted in 75.67 to 80.64% and 64.97 to 69.58% reduction in the adults and immature stages, respectively. All the tested insecticides were more effective against adults than immature whitefly. Flonicamid was significantly the most harmless to the associated predators causing 21.01 to 23.75% reduction. Thiamethoxam and imidacloprid resulted in 35.24 to 49.96% reduction in the associated predator's population. These results suggest that flonicamid, thiamethoxam and imidacloprid could be successfully incorporated in IPM programs to control *B. tabaci* under the field conditions.

INTRODUCTION

In Egypt, cotton plants are liable to be attacked by numerous pests throughout the different stages of plant growth from seedling emergence till harvesting. The sweet potato whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae), is considered one of the most damaging pests of cotton world-wide (Bayhan *et al*., 2006). *Bemisia tabaci* infests cotton plants under the Egyptian conditions during the period of plant growth season extended from early June to late October with its population peak in August (El-Zahi *et al*., 2012). It damages the infested plants either directly by sucking the phloem sap or indirectly by secretion of large quantities of honeydew which promotes the growth of black sooty mold fungi, hinders the photosynthesis of leaves, and contaminates the cotton fibers resulting in low marketability of the yield (Berlinger, 1986). This insect can transmit 111 virus species, some of which are of high economic importance (Jones, 2003). Cotton growers mostly rely upon synthetic insecticides to control *B. tabaci* infesting their crops particularly organophosphates and pyrethroids. The dependency on these conventional insecticides has led to the development of pest resistance (Ahmad *et al.*, 2002) and negative impacts on non-targeted organisms and natural enemies (Gonzales-Zamora *et al.,* 2004). Hence, there is urgent need to explore new classes of insecticides with new mods of action, more effective against the pests, and less dangerous to the environment and biodiversity.

Imidacloprid, thiamethoxam, and other five commercially marketed active ingredients belong to a new class of neurotoxins named neonicotinoids, which also referred to as chloronicotinyls, nicotinoids, nitromethylenes and nitroguanidines (Schuster and Morris, 2002). Neonicotinoids exhibited systemic properties and long residual activity and act as agonists of postsynaptic nicotinic acetylcholine receptors in the insect central nervous system (Bai *et al*., 1991). This new class of insecticidesis relatively non-toxic to the natural enemies (Wolweber and Tietjen, 1999), less toxic to vertebrates comparing to the other chemical insecticides (Goulson, 2013), and effectively controlled *B. tabaci* resistant to the conventional insecticides on different crops (Palumbo *et al*., 2001). Flonicamid is a novel systemic insecticide that belongs to pyridinecarboxamide group and acts as irreversible inhibitor of aphid feeding (Roditakis *et al.,* 2014). This compound was first discovered by Ishihara Sangyo Kaisha, Ltd., Japan, and was launched in many parts of the world such as USA, Brazil, France, and Korea since 2005 (Morita *et al.,* 2007). Although flonicamid is well documented as aphicide, low data are available on its efficacy against *B. tabaci* particularly under the field conditions. Therefore, the present work was designed to study the activity of flonicamid, thiamethoxam and imidacloprid against different developmental stages of *B. tabaci* infesting cotton plants as well as its associated predators under laboratory and field conditions

MATERIALS AND METHODS

Insecticides:

Commercial formulations of flonicamid (Teppeki 50% WG, ISK Biosciences Europe N.V, Belgium), imidacloprid (Rodex 35% SC, Jiangsu Yangnong Chemical group Co. Ltd., China) and thiamethoxam (Actara 25% WG, Syngenta Agrosciences, Switzerland) were tested in this study and applied in the field experiments at 225, 350, and 62.5 mg AI L^{-1}, respectively.

Laboratory Experiments

Toxicological Bioassay on *Bemisia tabaci* Eggs:

The method described in Ilias *et al*. (2012) with slight modifications was adopted. Briefly, mixed-sex adult population of *B. tabaci* was collected from cotton fields using a mouth aspirator and brought to the laboratory at Sakha Agricultural Research Station, Egypt. The insects were released on cotton seedlings (*Gossypium barbadense* var. Giza 92) of 6-7 leaves and potted in a transparent ventilated cages under constant conditions of 28 ±2 °C, 65 ±5 RH and 13: 11 (L: D) photoperiod. The adults were allowed to oviposit for 24h, and subsequently they were removed from the seedlings. The number of *B. tabaci* eggs per each leaf was counted using binocular microscope and the infested leaves were labeled. The eggs-infested leaves were immersed for 20 seconds in serial dilutions of each insecticide or in water as control, with eight replications per concentration. The effect of the insecticides was evaluated after ten days of treatment, where non-hatched eggs and dehydrated nymphs were counted dead.

Toxicological Bioassay on the Second Instar Nymphs of *Bemisia tabaci*:

The protocol for the toxicological bioassay on the second instar nymphs of *B. tabaci* is similar to that described above. But in this assay, the eggs-infested leaves were dipped in the insecticides solution after ten days of the oviposition, where during this period approximately all the oviposited eggs developed to the second instar nymphs (Ilias *et al*., 2012). The mortality percentages were estimated after 15 days of treatment. Nymphs that developed into pupae or adults were considered alive, while dehydrated nymphs or those with abnormal development were counted dead.

Field Experiments Layout:

The field experiments were conducted at the Farm of Sakha Agricultural Research Station, Egypt, during the cotton growing seasons of 2016 and 2017. In both seasons, an area of about 2500 m^2 was sown with cotton seeds (*Gossypium barbadense* var. Giza 92) and divided into plots 100 m^2 each. Unplanted belts (2 m width) were left as barriers between plots to avoid the contamination with drifts. This area received the recommended agricultural practices throughout the whole season without any insecticidal treatments. Four treatments (three insecticides + control) were tested in this area under a randomized complete block design with four replications (plots). The insecticides were applied by a Knapsack sprayer, CP_3 (Cooper Pegler Co. Ltd., Northumberland, England) using irrigation water for dilutions. The final volume of spray solution represented 476 L / ha. The spraying took place on August10, 2016 and August 15, 2017.

Sampling of *Bemisia tabaci* and Its Associated Predators:

To evaluate the activity of the test insecticides, 25 cotton leaves were randomly chosen early in the morning from each replication to count the number of adult *B. tabaci* infesting them in the field. The chosen leaves were picked up and transmitted to the laboratory to count the immature stages of *B. tabaci* under a binocular microscope. Concerning the associated predators, five cotton plants were randomly chosen from each replication and examined carefully for associated predators. The counted predators were: the larvae of *Chrysoperla carnea*, adults and larvae of *Coccinella spp*. and *Scymnus spp*., and true spiders, where these stages represent the predacious stage of each predator. The sampling was made just before the spraying and 1, 3, 7, and 10 days post spray. The percentage reduction in the insect's populations was estimated using the equation of Henderson and Tilton (1955).

Statistical Analysis:

The mortality data were corrected for mortality in the control by Abbott (1925), and subjected to probit analysis based on Finney (1971). Significant differences were determined according to the overlap of 95% confidence limits. Data on mean population of *B. tabaci* per cotton leaf and associated predators per five cotton plants were subjected to one-way analysis of variance and compared for significance by Duncan Multiple Range Test (Duncan, 1955) using CoStat system for Windows, Version 6.311.

RESULTS AND DISCUSSION

Activity of the Tested Insecticides on *Bemisia tabaci*:

Data on the effectiveness of flonicamid, imidacloprid and thiamethoxam on eggs and the 2nd instar nymphs of *B. tabaci* under the laboratory conditions are presented in Table 1. It is obvious that the systemic anti-feedant compound, flonicamid, exhibited no insecticidal activity on *B. tabaci* eggs where any of its tested concentrations (which increased to three folds of the field recommended concentration) did not provide more than 15% egg mortality; hence the probit analysis could not determine its Lc_{50} value. The neonicotinoid insecticide, thiamethoxam, was significantly more effective than imidacloprid on *B. tabaci* eggs with Lc_{50} values of 37.38 and 163.19 mg a.i. $L^{-1}$for thiamethoxam and imidacloprid, respectively. Based on the Lc_{50} values and overlap of 95% confidence limits, thiamethoxam had significantly the highest efficacy on the 2nd instar nymphs of *B. tabaci* translated in Lc_{50} value of 30.37 mg a.i L^{-1} followed by imidacloprid (Lc_{50} = 136.41mg a.i. L^{-1}) and flonicamid (Lc_{50} = 226.54 mg a.i. L^{-1}). These results are in accordance with that of Roditakis *et al.* (2014) who stated that flonicamid at its maximum registered label rate demonstrated no toxicity to *B. tabaci* eggs and low potency against the 2nd instar nymphs. In this direction, Gorman *et al*. (2010) found that different strains of *B. tabaci* were more susceptible to thiamethoxam than imidacloprid in a laboratory study.

Table 1: Activity of some insecticides on eggs and the 2nd instar nymphs of *Bemisia tabaci* (Genn.) under laboratory conditions.

Insecticide	Log-dose probit mortality data for *B. tabaci* eggs				Log-dose probit mortality data for 2nd instar nymphs of *B. tabaci*			
	LC_{50} [a] 95%CL [b]	LC_{90} [a] 95%CL	Slope ± SE	X^2	LC_{50} 95%CL	LC_{90} 95%CL	Slope ± SE	X^2
Flonicamid	ND	ND	–	–	226.54 192.2 – 268.7	1648.37 1113.7 – 2973.9	1.48 ± 0.15	5.46
Thiamethoxam	37.38 19.3 – 61.4	125.76 97.5 – 308.6	2.43 ± 0.19	8.42	30.37 19.3 – 42.7	99.91 81.7 – 204.6	2.47 ± 0.18	12.15
Imidacloprid	163.19 126.1 – 202.3	473.92 385.4 – 700.2	2.76 ± 0.21	9.85	136.41 65.2 – 204.1	853.27 782.5 – 2140.2	1.61 ± 0.16	17.3

ND Not determined where any of its tested concentrations did not cause more than 15% mortality.
[a]LC_{50} and LC_{90} are expressed in mg AI L^{-1} — [b] 95% Confidence limits (lower - upper)

When the tested insecticides were evaluated against different developmental stages of *B. tabaci* under field conditions, although its activity increased gradually with time elapsing after application, flonicamid was significantly the least effective against *B. tabaci* adults in both seasons of study (Tables 2.a and 2.b) recording 75.67 and 80.64% mean of reduction in 2016 and 2017, respectively. In the other hand, imidacloprid proved to be the most potent on *B. tabaci* adults recording 90 and 93.24% mean of reduction in 2016 and 2017, respectively. Thiamethoxam showed an intermediate case of efficacy between flonicamid and imidacloprid. Statistically, flonicamid produced the lowest effect on immature stages of *B. tabaci* causing 64.97 and 69.58% mean of reduction in 2016 and 2017, respectively (Tables 3.a and 3.b). The efficiency of imidacloprid against immature stages of *B. tabaci* did not differ significantly from that of thiamethoxam in both seasons of study recording 77.02–82.48% mean of reduction. These results revealed that all the tested insecticides were more effective against adults than immature stages of *B. tabaci* under the field conditions. The low toxic effect of thiamethoxam to immature whitefly under the field conditions comparing to its high activity in the laboratory could be explained by the result of Hilton *et al.* (2014), where they found that the degradation rates of thiamethoxam were faster in the field than in the laboratory. The high efficacy of imidacloprid and thiamethoxam founded in this study is in agreement with those of Khan (2011), Abbas *et al.* (2012), Babar *et al.* (2013), Afzal *et al.* (2014) and Khalid *et al.* (2016) when they reported that imidacloprid and thiamethoxam were effective in controlling *B. tabaci* on cotton plants recording 68.3–87% mortality. Ghelani *et al.* (2014) found that flonicamid was effective against aphid, thrips, jassid, and whitefly in cotton fields and yielded 57.8–78.4% mortality. In another study, flonicamid at 125 mg a.i L^{-1} caused 95% mortality to *B. tabaci* adults 10 days after treatment (Roditakis *et al.*, 2014).

Table 2.a: Efficacy of different treatments against adult stage of *Bemisia tabaci* (Genn.) infesting cotton plants during 2016 under field conditions.

Treatment	Conc. [mg a.i./L]	Mean population per cotton leaf and percent reduction of adult *Bemisia tabaci* during season 2016					
		Pre-spray	Post spray at indicated days				Mean
			1 day	3 days	7 days	10 days	
Flonicamid	225	9.48	4.00 (54.19 b)	1.54 (78.06 a)	1.43 (81.43 b)	0.73 (88.98 a)	1.93 (75.67 c)
Thiamethoxam	350	11.26	2.33 (77.85 a)	1.34 (83.87 a)	1.40 (84.99 b)	1.09 (86.03 a)	1.54 (83.19 b)
Imidacloprid	62.5	9.59	1.16 (87.26 a)	1.00 (85.98 a)	0.48 (94.01 a)	0.49 (92.73 a)	0.78 (90.00 a)
Control	–	13.18	12.85	10.31	10.75	9.20	10.78
LSD, p= 0.05		–	15.49	10.87	3.92	7.30	6.33

Figures in parentheses refer to the percentages of reduction in *Bemisia tabaci* population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).

Table 2.b: Efficacy of different treatments against adult stage of *Bemisia tabaci* (Genn.) infesting cotton plants during 2017 under field conditions.

Treatment	Conc. [mg a.i./L]	Mean population per cotton leaf and percent reduction of adult *Bemisia tabaci* during season 2017					
		Pre-spray	Post spray at indicated days				Mean
			1 day	3 days	7 days	10 days	
Flonicamid	225	12.96	5.52 (62.76 b)	2.47 (81.54 b)	1.93 (86.53 b)	0.85 (91.71 b)	2.69 (80.64 b)
Thiamethoxam	350	12.35	3.11 (79.35 a)	1.62 (88.40 ab)	1.45 (90.07 b)	0.92 (93.16 ab)	1.78 (87.75 a)
Imidacloprid	62.5	11.48	2.40 (83.29 a)	1.12 (92.73 a)	0.32 (98.26 a)	0.21 (98.69 a)	1.01 (93.24 a)
Control	–	11.05	12.32	12.87	12.01	11.72	12.23
LSD, p= 0.05		–	12.97	9.56	4.61	6.72	6.21

Figures in parentheses refer to the percentages of reduction in *Bemisia tabaci* population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).

Table 3.a: Efficacy of different treatments against immature stages of *Bemisia tabaci* (Genn.) infesting cotton plants during 2016 under field conditions.

Treatment	Conc. [mg a.i./L]	Mean population per cotton leaf and percent reduction of immature stages of *Bemisia tabaci* during season 2016					
		Pre-spray	Post spray at indicated days				Mean
			1 day	3 days	7 days	10 days	
Flonicamid	225	49.71	23.96 (44.31 b)	18.71 (58.43 b)	9.50 (76.41 b)	7.49 (80.74 b)	14.92 (64.97 b)
Thiamethoxam	350	57.45	20.18 (61.60 a)	12.45 (74.98 a)	7.91 (82.68 ab)	4.70 (88.82 ab)	11.31 (77.02 ab)
Imidacloprid	62.5	58.01	23.43 (55.92 ab)	12.93 (76.13 a)	3.69 (92.56 a)	4.13 (93.86 a)	11.05 (79.62 a)
Control	–	56.48	51.92	52.55	47.70	45.48	49.41
LSD, p= 0.05		–	11.95	10.06	10.39	10.38	14.31

Figures in parentheses refer to the percentages of reduction in *Bemisia tabaci* population comparing to control. In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).

Table 3.b: Efficacy of different treatments against immature stages of *Bemisia tabaci* (Genn.) infesting cotton plants during 2017 under field conditions.

Treatment	Conc. [mg a.i./L]	Mean population per cotton leaf and percent reduction of immature stages of *Bemisia tabaci* during season 2017					
		Pre-spray	Post spray at indicated days				Mean
			1 day	3 days	7 days	10 days	
Flonicamid	225	38.57	19.45 (49.08 b)	13.84 (65.06 b)	8.12 (79.48 b)	5.41 (84.69 b)	11.71 (69.58 b)
Thiamethoxam	350	45.20	16.18 (64.39 a)	12.61 (75.18 a)	6.56 (86.24 ab)	4.21 (93.67 a)	9.89 (79.87 a)
Imidacloprid	62.5	42.92	17.13 (60.52 a)	10.69 (78.13 a)	2.85 (94.86 a)	2.01 (96.41 a)	8.17 (82.48 a)
Control	–	37.45	38.97	40.79	42.54	39.18	40.37
LSD, p= 0.05		–	10.74	3.69	11.00	5.76	7.69

Figures in parentheses refer to the percentages of reduction in *Bemisia tabaci* population comparing to control. In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan(1955).

Side Effects on the Associated Predators:

The side effects of flonicamid, thiamethoxam and imidacloprid on the predacious stages of *B. tabaci* associated predators i.e., larvae of *Chrysoperla carnea,* adults and larvae of both *Coccinella* spp. and *Scymnus* spp., and true spiders are summarized in Tables 4.a and 4.b. It is clear obvious that flonicamid significantly proved to be the safest to the associated predators compared to thiamethoxam and imidacloprid throughout the experiment period which extended to ten days post application resulting in 21.01 and 23.75% mean of reduction in the predators population in 2016 and 2017, respectively. Imidacloprid was the most harmful to the predators and caused 49.96 and 47.28% mean of reduction in 2016 and 2017, respectively. Thiamethoxam demonstrated less toxicity to the predators than imidacloprid recording 35.24 and 40.78% mean of reduction in 2016 and 2017, respectively. The current results closely emphasize the results of the previous investigations. Hautier *et al.* (2006) found that flonicamid was less harmful than organophosphates, pyrethroids, and neonicotinoids to the beneficial arthropods in the open field. Flonicamid could be classified as harmless to the natural enemies (Roditakis *et al*., 2014), where it was not toxic to *Aleochara bilineata, Aphidius rhopalosiphi, Adalia bipunctata, Bembidion lampros* and *Episyrphus balteatus* under the field conditions and caused 14.0 ± 10.2% mortality (Jansen *et al*., 2011). Also, Colomer *et al.* (2011) reported no reduction effects of flonicamid on the population of the predatory mite, *Amblyseius swirskii* in a pepper greenhouse. In a comparison study, Ghelani *et al.* (2014) stated that flonicamid was safer than imidacloprid and thiamethoxam to coccinellids and chrysopids under field conditions. But in spite of these results, imidacloprid and thiamethoxam were extremely less harmful to the natural enemies comparing to the common used insecticides such as organophosphates, pyrethroids and carbamates (Omar *et al*., 2002; El-Zahi and Arif, 2011). From the obtained results, it could be concluded that flonicamid, thiamethoxam and imidacloprid could be successfully incorporated into IPM programs to control *B. tabaci* under the field conditions.

Table 4.a: Toxicity of different treatments to associated predators*prevailing on cotton plants during 2016 under field conditions.

Treatment	Conc. [mg a.i./L]	Mean population per 5 cotton plants and percent reduction of associated predators* during season 2016					
		Pre-spray	Post spray at indicated days				Mean
			1 day	3 days	7 days	10 days	
Flonicamid	225	22	21 (12.69 b)	21 (11.85 c)	20 (24.46 c)	19 (35.22 c)	20.25 (21.01 c)
Thiamethoxam	350	19	17 (18.29 b)	14 (29.15 b)	13 (42.31 b)	12 (51.20 b)	14.00 (35.24 b)
Imidacloprid	62.5	23	16 (38.50 a)	13 (47.28 a)	14 (52.93 a)	11 (61.14 a)	13.50 (49.96 a)
Control	–	17	19	18	21	23	20.25
LSD, p= 0.05		–	8.15	4.61	7.51	7.65	6.37

* Associated predators included: larvae of *Chrysoperla carnea,* adult and larvae of *Coccinella spp*. and *Scymnus spp*., and true spiders.
Figures in parentheses refer to the percentages of reduction in associated predator's population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).

Table 4.b: Toxicity of different treatments to associated predators*prevailing on cotton plants during 2017 under field conditions.

Treatment	Conc. [mg a.i./L]	Mean population per 5 cotton plants and percent reduction of associated predators* during season 2017					
		Pre-spray	Post spray at indicated days				Mean
			1 day	3 days	7 days	10 days	
Flonicamid	225	29	25 (15.31 b)	24 (21.82 c)	27 (20.14 c)	23 (37.72 b)	24.75 (23.75 b)
Thiamethoxam	350	23	16 (31.50 a)	15 (38.29 b)	16 (42.40 b)	14 (50.94 a)	15.25 (40.78 a)
Imidacloprid	62.5	24	14 (40.18 a)	12 (51.30 a)	13 (53.37 a)	17 (44.25 ab)	14.00 (47.28 a)
Control	–	27	27	29	32	35	30.75
LSD, p= 0.05		–	9.85	10.50	6.31	8.31	10.78

* Associated predators included: larvae of *Chrysoperla carnea,* adult and larvae of *Coccinella spp*. and *Scymnus spp*., and true spiders.
Figures in parentheses refer to the percentages of reduction in associated predator's population comparing to control.
In the same column, means followed by the same letters are not significantly differed, p = 0.05 by Duncan (1955).

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ARABIC SUMMARY

فعالية الفلونيكاميد وإثنين من المبيدات مشابهات النيكوتين ضد الذبابة البيضاء و المفترسات المصاحبة لها على نباتات القطن

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الذبابة البيضاء من الآفات واسعة الإنتشار عالميا مسببة أضرار جسيمة للعديد من المحاصيل الإقتصاديةواكتسبت مقاومة لمعظم المبيدات التقليدية خاصة الفوسفورية والبيروثرويدات. لذا تم تقييم فعالية مركبات الفلونيكاميد والثياميثوكسام والإميداكلوبريد ضد أطوار النموالمختلفة للذبابة البيضاء على نباتات القطن تحت الظروف المعملية والحقلية في محطة البحوث الزراعية بسخا ـ مصر في موسمي نمو القطن ٢٠١٦ و٢٠١٧. كذلك تمت دراسة التأثيرات الجانبية لهذه المبيدات على الأطوار المفترسة للمفترسات المصاحبة للذبابة البيضاء في الحقل وهي يرقات أسد المن ، اليرقات والحشرات الكاملة لكل من أبو العيد و الإسكمنس والعناكب الحقيقية. أوضحت نتائج التجارب المعملية أن مبيد الفلونيكاميد ليس له أي نشاط إبادي ضد بيض الذبابة البيضاء، بينما كان مبيد الثياميثوكسام معنويا هو الأكثر فعالية مسجلا تركيز قاتل لـ ٥٠٪ من التعداد يساوي ٣٧,٣٨ مجم مادة فعالة لكل لتر. كان مبيد الثياميثوكسام أكثر فعالية من مركبي الإميداكلوبريد والفلونيكاميد ضد حوريات العمر الثاني حيث كانت قيم التركيز القاتل لـ ٥٠٪ من التعداد الخاصة بهم تساوي ٣٠,٣٧، ١٣٦,٤١ ، ٢٢٦,٥٤ مجم مادة فعالة لكل لتر على الترتيب. لم تختلف معنويا فعالية الثياميثوكسام عن الإميداكلوبريد تحت الظروف الحقلية مسجلين من ٨٣,١٩ ـ ٩٣,٢٤٪ ومن ٧٧,٠٢ ـ ٨٢,٤٨٪مكافحة للحشرة الكاملة والأطوار غير الكاملة للذبابة البيضاء على الترتيب. مبيد الفلونيكاميد أثبت مكافحة مقنعة حيث نتج عنه ٧٥,٦٧ ـ ٨٠,٦٤٪ و ٦٤,٩٧ ـ ٦٩,٥٨ ٪ خفض في تعداد الحشرة الكاملة والأطوار غير الكاملة للذبابة البيضاء على الترتيب. كانت كل المركبات المختبرة أكثر فعالية ضد الحشرة الكاملة عن الأطوار غير الكاملة للذبابة البيضاء. كان الفلونيكاميد معنويا هو الأقل ضرارا على المفترسات حيث سبب من ٢١,٠١ ـ ٢٣,٧٥٪ خفض. مركبي الثياميثوكسام والإميداكلوبريد سببا من ٣٥,٢٤ ـ ٤٩,٩٦٪ خفض في تعداد المفترسات المصاحبة.تقترح هذه النتائج أن مبيدات الفلونيكاميد والثياميثوكسام والإميداكلوبريد يمكن أن تستخدم بنجاح ضمن برامج المكافحة المتكاملة للذبابة البيضاء تحت الظروف الحقلية.