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Evaluation of some insecticides from different groups against cotton aphis *gossypi*i, whitefly *Bemisia tabac*, and their side effects on the associated natural enemies, under field conditions

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Abstract
This study cared out to evaluated the insecticidal and the residual effect of, thiamethoxam at 25WG 20/ 100littr, Acetamprid at 25 WG 25 gr/ 100 littr, lambadacyalothrin 5%EC at 375 cm/ feddan and profenonfps 72% EC 750 cm/ feddan under field conditions on *Aphis gossypii* and *Bemisia tabaci* and their side effects on the associated natural enemies during two consecutive seasons 2020 and 2021 Beni- suef Governorate in Egypt on cotton fields. The results showed that all the pesticides used had the most effect against *Aphis*, *Aphis gossypii* and *Bemisia tabaci*, after 24, 3-days, 7-days and 15-days of spray. Moreover, thiamethoxam, Acetamprid, lambadacyalothrin and profenonfps proved also reduction to the populations of *Coccinella septempunctata* and *C. carnea*. Also these results indicted to the initial and residual effect signification of these insecticides was highly lasting up to 15 days. From these results we suggested that, choosing suitable insecticide to control the tested cotton pests not only depends on its efficiency but also its toxicity to natural enemies.

Keywords: insecticides, *Aphis gossypi*i, *Bemisia tabac*, associated natural enemies

Introduction
Cotton is considered an important crop in Egypt, it infests by several arthropod pests throughout their life spans. In recent years, thrips, aphids, whiteflies, and jas-sids have become harmful pests in cotton planted fields. They suction the sap of tissues and unripe leaves in the earlier morning, making it sometimes obligatory to re-sow (Salama *et al*. 2006) [26]. *Bemisia tabac* and, *Aphis gossypii* still vital insects of numerous fields; it is considered one of the multi-host pests, as it secretes a honey substance that is considered a mediator for some fungal and bacterial diseases (Hunter and Polston, 2001 Berlinger, 1986; Jorge and Mendoza, 1995) [17, 6, 13]. For controlling these pests substantially with insecticide treatments; the expansive use of insecticides has led to several problems, include the reduction of natural enemis caused by insecticides causing rejuvenescence of new pests and the eruption of secondary pests (Fernandes *et al*., 2010) [11]. *Chrysoperla carnea* is a polyphagous sucker that preys on a wide range of pest species similar as; aphids, scale insects, leafhoppers, whiteflies, psyllids, thrips, psocids, Lepidoptera, hence they are truly important biocontrol agents. These natural enemies fail to survive as a result of the extensive use of pesticides and sudden environmental changes (Nayar *et al*., 1976) [24]. Coccinella septempunctata, it's an aphidophagous enemy species and important natural control agent (Hodek & HonÄ•k, 1996, Alexidze) [15]. Extensive use of insecticides will lead to the death of many of the vital enemies of the pest, as well as the emergence of many secondary pests that harm the crop. (Cloud, 2012). One of the forms to avoid the rejuvenescence of pests is the use of insecticides for controlling target pest. In addition, there's growing global concern over the environmental impacts of insecticides use. Hence, it's critical to develop new groups of insecticides acting considerably on certain insects to combat largely resistant nonentity, and to conserve their effectiveness by applying insecticides resistance operation strategies (Horowitz *et al*., 1998) [16]. Neonicotinoids are selective insecticides against sucking pests, used intensely since imidacloprid was first introduced in 1991. Neonicotinoids act as a nicotinic acetylcholine receptor and thus have specific exertion against the nonentity nervous system (Maienfisch *et al*., 2001). They are considerably less toxic to humans than the organophosphorus and carbamate insecticides. Several primary target insect pests for neonicotinoids insecticides have been shown a high potential for resistance development (IRAC 2008) [19].
The objects of the present study to estimate the initial and residual effect of thiamethoxam, Acetamprid, lambadacyalothrin and profenonfps at recommended rate against cotton aphid *aphis gossypii*, whitefly *Bemisia tabaci* and the associated natural enemies, *Coccinella septempunctata* and *Chrysoperla carnea* on cotton plants.

Materials and Methods
Insecticides used
Thiamethoxam 25WG 20/ 100littr water.
Acetamiprid 25 WG 25 gr/ 100littr
Lambadacyalothrin 5% 375 cm/ feddan
profenonfps 72% EC 750 cm/ feddan

Experimental design
This study was done in Beni- Suef Governorate, Egypt in 2020 and 2021 seasons. The area was about 1050 m2, divided into equal four plots 210 m2. Each treatment as well as the u treated plots was replicated four times bout52.5 m2 in a completely randomized block design. To estimate the effectiveness of these treatments, 25 cotton leaves per replicate were chosen erratically from the bottom, middle, and the top of the cotton leaves per plant. The upper and lower leaf surfaces were examined precisely beforehand at the morning and numbers of whiteflies, cotton aphid and associated natural enemies, *Chrysoperla carnea* and *Coccinella septempunctata* counts were recorded. Leaf slice

and nonentity counting were made just before the spraying and at 24h, 3, 7 and 15 days after the spraying. The reduction percent of the population was estimated by using Henderson and Tilton's equation (1955) Statistical analysis Data were analyzed by (ANOVA). Means were determined for significance at0.05 using LSD test.

Results

Results in Table (1) indicated that thiamethoxam, Acetamprid, lambadacyalothrin and profenonfps showed effectual reduction at 24h from treatments. Reduction in the two successive seasons (2020 and 2021) recorded 85.21, 89.17, 91.27 and 90.51 % reduction for these insecticides in (2020) respectively, while was 94. 53, 95.18, 95.61 and 92.26% reduction on *Aphis gossypii*, in (2021), respectively. The insecticide effect in reduction was reduced at 3, 7 and 15- days' periods of observations throughout in (2020 and 2021) seasons. After 3 days from treatments recorded 67.23, 75.45, 75.62 and 76.31 % reduction in (2020) and 64.41, 75.15, 82.32 74.41 % reduction, on *Aphis gossypii*, in (2021), respectively. Reaction at 7 days was 52.32, 55.87, 61.43, and 65.31% reduction, in (2020) season and 52.23, 67.61, 69.56 and 54.42 % reduction on *Aphis gossypii*, in (2021), respectively. But At 15 days was 42.43, 39.62, 37.22 and 34.31 % reduction; for (2020) season and 35. 63, 38.23, 36.52 and 28.71 % reduction, on Aphis gossypii, in (2021), respectively.

Table 1: Reduction percent of *Aphis gossypii* treated with different insecticides under field condition during 2020 and 2021

2020 season					
Treatment	**Rate/fed.**	**% Reduction**			
		24	3-days	7-days	15-day
Thiamethoxam	20g/100littr water	85.21	67.23	52.32	42.43
Acetamprid	25 gr/100littr water	89.17	75.45	55.87	39.62
lambadacyalothrin	375 cm/feddan	91.27	75.62	61.43	37.22
profenonfps	750 cm /feddan	90.51	76.31	d	34.31
LSD at 5%		2.14	3.12	1.02	2.08
2021 season					
Thiamethoxam	20g/100littr water	94. 53	64.41	52.23	35. 63
Acetamprid	25 gr/100littr water	95. 18	75.15	67.61	38.23
lambadacyalothrin	375 cm/feddan	95.61	82.32	69.56	36.52
profenonfps	750 cm /feddan	92.26	74.41	54.42	28.71
LSD at 5%		1.95	1.8	1.03	3.22

Data in table (2) showed that thiamethoxam, Acetamprid, lambadacyalothrin and profenonfps showed much important strong reduction at 24 h. from treatments on *Bemisia tabaci*. Reduction in (2020 and 2021) seasons reached 91.41, 84.21, 92.18 and 90.25 % reduction (2020) respectively, but was 91.14, 87.32, 90.15 and 92.31 % reduction on *Bemisia tabaci* at 24 h from treatments in (2021) seasons. Respectable in reduction was detected at 3, 7 and 15-days period after treatments in (2020- 2021) seasons. Reduction at 3 days recorded 51.24, 57.31, 75.30 and 78.22% in (2020) and 69.32, 62.22, 71.11 and 72.62 %, on *Bemisia tabaci* in 2021 respectively,. Reaction at 7 days was (49.35, 45.21, 71.15 and 63.23% on *Bemisia tabaci* in (2020) and 53.41, 57.53, 64.23 and 55.42 %, in 2021 season respectively. But At 15 days was 32.21, 39.21, 47.71 and 48.52% in (2020) season and 43.17, 51.32, 37.34 and 41.12% reduction, in (2021) respectively

Table 2: Reduction percent of *B. tabaci* treated with different insecticides under field condition during 2020 and 2021

2020 season					
insecticides	**Rate/fed.**	**% Reduction**			
		24	3-days	7-days	15-day
Thiamethoxam	20g/100littr water	91.41	51.24	49.35	32.21
Acetamprid	25 gr/100littr water	84..21	57.31	45.21	39.21
lambadacyalothrin	375 cm/feddan	92.18	75.30	71.15	47.71
profenonfps	750 cm /feddan	90.25	78.22	63.23	48.52
LSD at 5%		3.3	1.03	1.78	3.54
2021 season					
Thiamethoxam	20g/100littr water	91.14	69.32	53.41	43.17
Acetamprid	25 gr/100littr water	87.32	62.22	57.53	51.32
lambadacyalothrin	375 cm/feddan	90.15	71.11	64.23	37.34
profenonfps	750 cm /feddan	92.31	72.62	55.42	41.12
LSD at 5%		1.08	2.11	2.23	3.99

Data in Table (3) showed that, collection density of *Coccinella septempunctata* reduced after use of thiamethoxam, Acetamprid, lambadacyalothrin and profenonfps in comparason with control treatments at 324h, 3, 7 and 15 days after aplication. During (2020), thiamethoxam and acetamprid, were effect with a reduction 87.65, 92.12% during (2020), and 95.22, 89.31% reaction during (2021) season, respectively. Also, lambadacyalothrin, and profenonfps were very effect in low the population of *Coccinella septempunctata* with a percentage of reduction 89.12, 90.43% during (2020) and 94.25, 92.13 % during ((2021), when used these insecticides at 24 h from treatments respectively. thiamethoxam, Acetampridthe gave reduction after 3 days intervals from treatment reached to 52.23, 68.32 %, during (2020), and 61.54, 77.63 % for (2021 period. Also, lambadacyalothrin, and profenonfps gave effect reached to 79.61, 80.16 % and 79.11, 81.52 % reduction at (2021), respectively. Reduction at 7 days thiamethoxam, acetamprid recorded 44.31, 51.32, and 45.12, 52.32 % reduction, at the two season. But lambadacyalothrin, and profenonfps caused 64.32, 65.22 and 63.24, 72.64 % reduction, at two season, respectively, thiamethoxam, acetamprid at 15 days recorded 35.19, 38.21, % reduction at (2020) season and 32.25, 34.22 at (2021) season. Lambadacyalothrin, and profenonfps caused and 34.22, 49.17 % at (2020) period and, 42.22, 55.61 % reduction at (2021) period respectively.

Table 3: Reduction percent of *Coccinella septempunctata* treated with different insecticides under field condition during 2020 and 2021

2020 season					
Treatment	**Rate/fed.**	**% Reduction**			
		24	3-days	7-days	15-day
Thiamethoxam	20g/100littr water	87.65	52.23	44.31	35.19
Acetamprid	25 gr/100littr water	92.12	68.32	51.32	38.21
lambadacyalothrin	375 cm/feddan	89.12	79.61	64.32	34.22
profenonfps	750 cm /feddan	90.43	80.16	65.22	49.17
LSD at 5%		3.09	2.3	2.93	1.54
2021season					

Thiamethoxam	20g/100littr water	95.22	61.54	45.12	32.25
Acetamprid	25 gr/100littr water	89.31	77.63	52.32	34.32
lambadacyalothrin	375 cm/feddan	94.25	79.11	63.24	42.22
profenonfps	750 cm /feddan	.92.13	.81.52	72.64	55.61
LSD at 5%	-	1.09	1.52	1.237	2.2

Results in (Table 4) showed that thiamethoxam, acetamprid, lambadacyalothrin and profenonfps were more effective on C. *carnea.* Thiamethoxam and acetamprid caused 85.45, 82.67 % reduction during (2020), but lambadacyalothrin and profenonfps gave reduction reached to 89.26, 92.18 %, during (2020), season at 24 h from treatments, respectively. Also, at 3-days reduction reached to 67.62, 65.32 % reduction for thiamethoxam, acetamprid, and 76.16, 81.25% for lambadacyalothrin and profenonfps in (2020) season respectively, at 7-days reduction percentages reached to 52.32, 44.22 for thiamethoxam, acetamprid and 65.34, 72.12% for lambadacyalothrin and profenonfos, these reduction reached to 41.22, 45.19 for thiamethoxam, acetamprid and 42.12 34.32 % % reduction for lambadacyalothrin and profenonfps in (2020) season at15-days from treatments, respectively.

During (2021) data in the same table indicated that thiamethoxam, acetamprid, lambadacyalothrin and profenonfps caused an important reduction in the *C. carnea* reached to 78.67, 82.21, 92.31 and 91.21 % reduction at 24h from treatments, respectively. These reduction percentages reduced to 61.16, 52.26, 77.36 and 75.31% reduction at 3-days from treatments, respectively. But at 7-days from treatments reduction were 42.41, 45.34, 49.76 and 65.25 % reduction respectively. These reduction percentages at 15-days were 26.21, 24.31, 35.24 and 42. 37 reductions for thiamethoxam, acetamprid, lambadacyalothrin and profenonfps respectively

Table 4: Reduction percentage of *Chrysoperla carnea* treated with different insecticides under field condition during 2020 and 2021

2020 season					
Treatment	**Rate/fed.**	**% Reduction**			
		24	3-days	7-days	15-day
Thiamethoxam	20g/100littr water	85.45	67.62	52.32	41.22
Acetamprid	25 gr/100littr water	82.67	65.32	44.22	45.19
lambadacyalothrin	375 cm/feddan	89.26	76.16	65.34	42.12
profenonfps	750 cm /feddan	92.18	81.25	72.12	34.32
LSD at 5%	-	2.85	2.13	2.37	2.66
2021 season					
Thiamethoxam	20g/100littr water	78.67	61.16	42.41	26.21
Acetamprid	25 gr/100littr water	82.21	52.26	45.34	24.31
lambadacyalothrin	375 cm/feddan	92.31	77.36	49.76	35.24
profenonfps	750 cm /feddan	91.21	75.31	65.25	42.37
LSD at 5%	-	2.23	3.44	2.11	2.6

Discussion

The previous results that we obtained through this research indicated that thiamethoxam, acetamprid, lambadacyalothrin and profenonfps insecticides were effective as leaf treatments at 24h and caused a high significant reduction in cotton aphid *A. gossypii* and white fly *B. tabaci* populations. In addition, the efficiency and residual effects of these insecticides persisted up to 15 days after treatments and agree with many researchers. El-Naggar and Zidan, (2013) [8] indicated that neonicotinoid insecticides were highly effective against *A. gossypii* and reduced the population of this pest (up to 15days) under field conditions.

Muhammad Aslam *et al,* (2004) Muhammad Aslam, *et al* (2004) [21]. Indicated that Confidor and Mospilan, were most effective insecticides for jassid, up to seven days, while Advantage was ineffective to control jassid population. Mospilan and Actara were the most effective insecticides against whitefly, while Mospilan, Confidor and Tamaron were highly effective against thrips.

Arzlan Abbas *et al* (2021) [1] revealed that imidacloprid, acetamiprid, nitenpyram, movento, buprofezin and chlorfenapyr insecticides were effective against *A. gossypii*, after 96 hours of spray, except buprofezin and movento, caused immature and adult mortality. Nitenpyram and buprofezin exhibited the highest mortality rate of adult aphids after 24 h of spray.

Shi K, Jiang L *et al* (2011) [27] indicated that dinotefuran is the most effective insecticide for use against imidacloprid-resistant *A. gossypii*. To avoid further resistance development, the use of nitenpyram, acetamiprid and thiacloprid should be avoided on imidacloprid-resistant populations of A. gossypii.

Maiensfisch, P (2001) [20] cited that thiamethoxam is the first commercially available second-generation neonicotinoid and belongs to the thianicotinyl sub-class. It is marketed under the trademarks Actara for foliar and soil treatment and Cruiser for seed treatment. The compound has broad-spectrum insecticidal activity and offers fantabulous control of a wide variety of commercially important pests in many crops.

Misra (2002) [22] found that imidacloprid as well as thiamethoxam proved significantly superior in sucking pests.

Asif, M.U *et al*.; (2018) [3] showed that Imidacloprid, nitenpyram, cyhalothrin profenofos+cypermethrin, bifenthrin and carbosulfan insecticides caused considerable reduction of whitefly, jassid and thrips at 24 hours, 72 hours and even 7 days after application. Imidacloprid followed by the nitenpyram tested to be most efficacious for bringing around a meaningful change in the populations of whitefly and thrips. Nitenpyram had the maximal percentage reduction (73.80%) against jassid at 7 day after application but that was non-significantly unlike from imidacloprid (63.49%), whereas, the conventional insecticides such as lambda cyhalothrin, profenofos+cypermethrin, bifenthrin and carbosulfan showed 57.93%, 52.38%, 47.61% and 42.06% reduction, respectively.

Ibrahim M. M.A. and Al-Shannaf, H.M.H. (2017) [18]. Revealed that the maximal general average effect of 81.85, 72.26 and 59.46% reduction were recorded for dinotefuran on aphis gossypii, *N. veridula* and *Tetranychus* spp., respectively. On the separate hand, the highest general average effect of 80.01 and 74.82 % reduction were recorded for parathion-methyl on *B. tabaci* and *Empoasca* spp, respectively. In casing of *S. littoralies* the maximal general mean effect of 75.91 % reduction were recorded for Parathion-methyl insecticide. In point to the lateral effects of proven compounds on predators associated with cotton pests, the dinotefuran insecticide recorded highest general mean effect of 68.05 and 88.46 % reduction on lady bird

beetles and true spider mites during the 2nd season, respectively. On the other hand, the parathion-methyl insecticide recorded highest general mean effect of 70.03, 71.88 and 68.11 % reduction on green lacewing, scmynus, and heave beetle during the 2nd season and 65.43 % on orius bug during the 1st season respectively.

BALA, *et al*, (2018) [4]. Reported that three applications of diafenthiuron 40.5% + acetamiprid 3.9% WP at 600 g/ ha showed the best efficacy for controlling whitefly, thrips and red spider mite, respectively.

Vijay Bodaa* and Mohammad Ilyasb (2017) [28] reported that clothianidin was found most superior in reducing aphids, jassids and mealy bug population on 3rd, 7th and 14th days after 1st and 2nd spray. However the next best treatments were acetamiprid and thiamethoxam. Whereas, the treatment fipronil was found most superior in reducing thrips population on 3rd, 7th and 14th days after 1st and 2nd spray. The treatment Spiromesifen was found more superior in reducing whiteflies population on 3rd, 7th and 14th days after 1st and 2nd spray.

Barrania, A.A *et al* (2019) [5] showed that, sulfoxaflor and flupyradifurone exhibited superior and accelerate activity against *B. tabaci* and *A. gossypii*, and the littlest reduction percentages were recorded by acetamiprid. Under the same conditions, three acetamiprid, sulfoxaflor and flupyradifurone insecticides had moderate toxic effect against natural enemies; *Chrysoperla carnea* and *Coccinella spp*,

Elbert *et al*. (1998) [10] reported that exposure of *C. carnea* larvae to imidacloprid resulted in a 40% reduction in the population under field conditions. However, thiamethoxam caused 86.7% mortality of the *C. carnea* larvae and found to be a moderately harmful after 24 hours and harmful after 48 hours exposure for semi field and field tests

Gaber, A. S.; *et al* (2015) [12] indicated that thiamethoxam, dinotefuran, acetamiprid and imidacloprid tested to be the most effective insecticides in reducing aphid collection up to 21 life after treatment and caused reduction percent ranged from 73.58 to 96.42%%, whereas pirimicarb and insecticide showed the minimal change with reduction percent ranged 38.08 to 66.68%.

In plus, the selectivity effects of acetamiprid, imidacloprid, pirimicarb and malathion low to *C. undecimpunctata* with an middling ranged from 78.05 to 96.43% reduction Thiamethoxam reduced the population with reduction ranged from 68.72 to 69.20% reduction and. Dinotefuran showed a slightly effect to C. undecimpunctata with an calculate reduction 44.3 and 41.81%. On the other hand, acetamiprid and dinotefuran caused reaction in the collection of C. carnea with an amount ranged from 28.28 to 56.52% reaction. Thiamethoxam and imidacloprid low the accumulation with an number ranged from 55.53 and 64.39% and. By contrast, malathion and pirimicarb showed the highest reduction in the population with an average ranged from 67.15 to 96.57% reduction

Nasreen *et al.*, (2005) [23] cited that low concentration of diafenthiuron, buprofezin, thiodicarb, imidacloprid, carbosulfan, methamidophos, acetamiprid, thiamethoxam were found harmless while high concentration of both insecticides was found slightly harmful after 24 hours exposure.

Generally, the present work showed that tested neonicotinoids and insecticides can be used effectively to control cotton aphid, *A. gossypii* and whiteflies, *Bemisia tabaci* in cotton fields, and proved less toxic to natural enemies. These results could be useful for the selection of suitable insecticides for use in IPM program in cotton plants to control the cotton aphid and whiteflies under field conditions.

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