Phytotoxicity effects of some insecticides on cotton plant

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Abstract: Cotton (*Gossypium hirsutum* L.) is one of the most important crops in Egypt and represents a major component on the national economy. Cotton in Egypt is attacked by many pests (i.e. insect, mites, nematodes, pathogens, virus, fungi and weeds), which can cause serious losses in the yield. This study aims to evaluate the phytotoxicity effect of eight insecticides formulated products of 4 active ingredients; **Diflubenzuron, Chlorfluazuron, Lufenuron,** and **Profenofos** on cotton plant. The Field experiments were applied at Sharkia and Kafr-El-Sheikh governorates, Egypt during the cotton growing season of 2019. All tested insecticides showed significant decrease in shoot height, squares, flowers and bolls number of the cotton plant at two governments after two weeks from applications. The carotene, chlorophyll (a&b), total chlorophyll and chlorophyll A/B ratio were assessed after one and two weeks from insecticides application. The chlorophyll A/B ratio after one week from application recorded significant decrease with KfrZ, Caprice, Topron, Match and Delron Elnasr; meanwhile it increased with Dimilin, Newbenyione and Ferary. After two weeks from application all insecticides treatments decrease chlorophyll contents compared with control at Kafr El-Sheikh governorate. The A/B ratio was increase at all treatments after one and two weeks from application of all insecticides except Delron Elnasr72%EC compared with control at Sharkia governorate. Recommended insecticides on cotton planting in Kafr-Elsheikh governorate are chlorfluazuron 48% SC and profenofos72%EC whereas in El Shrkia governorate is profenofos 72%EC.

Keywords: cotton, insecticides, phytotoxicity, morphology, pigments,

1.Introduction

Cotton (*Gossypium hirsutum* L.) is one of the most important crops in Egypt and represents a major component on the national economy. Due to the limitation of the cultivable land in Egypt and the increasing of the population, an increase for the other major crop like wheat was requested, leading to decrease the land reserved for cotton plantation. To compensate the reduction in cotton plantation, it is recommended to increase the productivity of the cotton by following a complete package of recommendation, including selecting the high productive strain, optimizing the land preparation, fertilization, irrigation, planting and harvesting dates and reducing the waste caused by cotton pests.

Cotton in Egypt is attacked by many pests (i.e. insect, mites, nematodes, pathogens, virus, fungi and weeds), which can cause serious losses in the yield varied from year to year and from area to another (**El-Wakeil and Abdallah, 2012**). However, an increase in crop productivity without adequate crop protection does not make sense, because an increase in attainable yields is often associated with an increased vulnerability to damage inflicted by pests **(Oerke, 2006**). Phytotoxicity is the ability of pesticides to cause temporary or permanent damage for vegetative or generative organs, which reduce or totally inhibit germination, and to cause other physiological and morphological changes in sensitive plant species, and/or to certain varieties or genetic lines. Damage occurs in various ways, mostly as a chlorosis, i.e. partial or complete destruction of chloroplasts, when leaves become chlorotic. Necrosis (burn) is another manifestation of phytotoxicity, which can lead to complete leaf drying or defoliation according to **Vuković and Gvozdenac (2014)**. All types of pesticides can injure or kill plants. Some insecticides and fungicides can also harm plants (**Hajjar *et al.*, 2014).** The evaluation of phytotoxic effects of insecticides is based on the morphological traits of seedlings such as germination, plant height, (fresh and dry weight), leaf area, stem diameter and pigments (chlorophyll a, chlorophyll b, Total chlorophyll, A/B ratio and carotenoids pigments) which act an important toxicity indication (**Asrorov *et al.*, 2014**).The application of insecticides against sucking insect in cotton reduced pest damage as compared to control. Application of insecticides also resulted in enhanced crop maturity and yield compared to control plots (**Ghulam *et al.*, 2016).** So, this study aims to evaluate the phytotoxicity effect of some treated insecticides on cotton plants.

2.Materials and Method

2.1.Applied Insecticides:

Eight formulated insecticides of 4 active ingredients were applied for controlling early-stage cotton insects as follows:

2.1.1.Diflubenzuron 48%SC

2.1.1.1.Dimilin48%SC at the rate of 125cm/Fed.

2.1.1.2.Newbenyione 48%SC at the rate of 125cm/Fed.

2.1.2.Chlorfluazuron5%EC

2.1.2.1.KfrZ 5%EC at the rate of 400cm / Fed.

2.1.2.2.Caprice 5%ECat the rate of 400cm /Fed.

2.1.2.3.Topron 5%ECat the rate of 400cm /Fed.

2.1.3.Lufenuron 5%EC

2.1.3.1.Match 5%EC at the rate of 100cm /Fed.

2.1.3.2.Ferary 5%EC at the rate of 160cm /Fed.

2.1.4.Profenofos 72%EC

Deleron Elnasr 72% EC at the rate of 750cm/Fed.

2.2.Experimental design and treatments:

Two field trials were conducted into two different Egyptian governorates to determine the phytotoxicity of the above mentioned products on the cotton plant.

2.2.1.The first trial was carried out in Kafr El-sheikh governorate, Egypt (2019). The cotton variety Giza 86 was planted and treated with the tested insecticides before flower stage (75day from planting).

2.2.2.The second trial was conducted in Sharkia governorate, Egypt (2019). The cotton variety Giza 94 was cultivated. The insecticides were applied at the same growth stage of the 1sttrail.

Cotton was planted under normal field conditions, Irrigation, and fertilization.

2.3.Physical and chemical analysis of the grown soil: The soil physical and chemical characteristics of the field are presented in Tables1and 2

Table (1) Physical and chemical characteristics of Kafr-Elsheikh governorate field soil

Physical properties					SP%	EC DS/m	pH
Clay%	**Silt%**	**Sand%**	**Total%**	**Texture**			
38.4	39.4	22.2	100	Clay	55	3.97	7.85

Chemical properties							
Soluble cations (meq/L)				**Soluble anions (meq/L)**			
Ca^{++}	**Mg^{++}**	**Na^{+}**	**K^{+}**	**CO_3^{-2}**	**HCO_3^{-1}**	**Cl^{-1}**	**So_4^{-2}**
11	6.1	21	0.9	-	2	31.9	5.1

Table (2) Physical and chemical characteristics of Sharkia governorate field soil

Physical properties					SP%	EC DS/m	pH
Clay%	**Silt%**	**Sand%**	**Total%**	**Texture**			
36.7	37.5	25.8	100	Clay	52	3.74	7.89

Chemical properties							
Soluble cations (meq/L)				**Soluble anions (meq/L)**			
Ca^{++}	**Mg^{++}**	**Na^{+}**	**K^{+}**	**CO_3^{-2}**	**$HCO_{3\ 1}^{-}$**	**Cl^{-1}**	**So_4^{-2}**
12	7.1	23	0.9	-	2	29.2	4.3

2.4. Phytotoxicity measurements:

2.4.1. Morphological phenomenon:

Morphological phenomenon such as shoot height, squires, balls, and flowers number per plant were recorded after two weeks from insecticides application.

2.4.2. Pigment contents:

Chlorophyll A, B and carotenoids were assessed after one and two weeks from application. The procedures mentioned by **Hiscox and Israelstam (1979)** were followed 10 mg of leaf tissues in fraction were placed in a test tube containing 5ml dimethyl sulphoxide (DMSO). Chlorophyll and carotenoids were soaked into the fluid without grinding and incubating overnight at 65℃ for pigments extraction. Absorbance was measured by Shanghai Lab-spectrum instrument Co., Ltd Model, Alpha-1102 at 644 and 662 nm for chlorophyll determination, and 470 nm for carotenoids. Total chlorophyll, chlorophyll a and b were calculated by using **Arnon equation (1949)**, while **Cañal *et al.* (1985)** was used for carotenoids.

Arnon equation:

Chl. a = 12.7 x A 662 – 2.69 x A 644 mg/L

Chl. b = 22.9 x A 644 – 4.68 x A 662 mg/L

Chl. a+b = 20.2 x A 644 + 8.02 x A 662 mg/L

Cañal equation:

$$\text{Carotenoids} = \frac{A470 - 1.28\ (\text{Chl. a mg/L}) + 56.7\ (\text{Chl. b mg/L})}{256 \times 0.906}\ \text{mg/L}$$

2.4.3. Statistical analysis:

The statistical analysis was done by using a one-way ANOVA by SPSS statistical software according to **Landau and Everitt (2004)**. The results were presented as mean ± SD (standard deviation). Each of the experimental values was compared to the corresponding control. Statistical significance was accepted when the means were compared using the L.S.D. test at $P < 0.05$.

3. Results and Discussions

3.1. First trial (Kafr-Elsheikh governorate):

3.1.1. Morphological measurements

Table (3) indicated the morphological measurements after two weeks from application and recorded that there were no significant differences between all tested insecticides on cotton shoot height compared with the control. The cotton squares number showed significant decrease for all insecticides except Match, Ferary 5%EC and Delron Elnasr 72%EC compared with control. Also, all treatments were significant decreased cotton flowers and boll numbers except treatment of Delron Elnasr 72%EC compared with control.

Phytotoxicity occurs in the plants after the applied sprays or drenches contaminate the plants cells; negatively impacting their cellular components like chloroplasts, which will inhibit the leaf function and respiration, remove the waxy cuticle layer that offers protection, as well as effecting the plants hormonal system and cause osmotic imbalance in the roots. Because miscalculation of rates and products used in tank mixes can increase penetration into cells or leaves, simple over-application can be a common problem. With the tests we perform, we can collect all pertinent data concerning that issue as well. The phytotoxic effect of profenofos was assessed based on the morphological traits of seedlings (Root length, Shoot length, Fresh weight and dry weights) and phyto-pigments (chlorophyll a, chlorophyll b, Total chlorophyll, and carotenoid) of the test species, *Vigna radiate* L. All morphological traits and pigments were significantly reduced with increase in pesticide concentration (**Mishra *et al*., 2014**).

Table (3) Effect of tested insecticides on cotton plant phenomenon grown at Kafr-Elsheikh governorate after two weeks from application.

Treatment		Shoot height (cm)	Squares (No.)	Flowers (No.)	Bolls (No.)	Boll/Squares (%)
Cont.		101.0±0.02 [a]	21.00±0.1 [a]	13.33±1.52 [a]	9.00±0.09 [a]	42.9
Diflubenzuron 48%Sc	**Dimilin**	98.00±0.03 [a]	16.00±1.01[c]	6.88±0.58 [c]	4.59±1.1[c]	28.7
	Newbenyione	98.00±0.01 [a]	15.00±1.02[c]	6.66±0.57 [c]	4.90±1.1[c]	32.7
Chlorfluazuron 5%Ec	**KfrZ**	99.00±0.02 [a]	18.33±0.04 [b]	9.88±0.15[b]	6.33±0.01[b]	34.5
	Caprice	100.66±0.03[a]	18.00±0.04 [b]	9.99±0.16 [b]	6.99±0.01[b]	38.8
	Topron	99.00±0.02 [a]	19.33±0.04 [b]	9.33±0.17 [b]	6.66±0.01[b]	34.5
Lufenuron5%Ec	**Match**	97.66±0.01 [a]	21.00±0.1 [a]	10.33±0.16[b]	4.00±1.1 [c]	19.0
	Ferary	99.33±0.02 [a]	20.33±0.04[a]	10.00±0.17[b]	4.33±1.1[c]	22.4
Profenofos72%Ec	**Delron Elnasr**	97.66±0.01 [a]	20.00±0.1 [a]	12.33±1.51 [a]	8.66±0.08 [a]	43.3

Values are means of three replicates of each parameter ± standard deviation.
Means within each column followed by the same letter are not significant at $p > 0.05$.

3.1.2. Pigment contents:

The carotene, chlorophyll a, and b, total chlorophyll (a+b) and chlorophyll ratio (a/b) of cotton leaves were assessed on cotton leaves two times after one and two weeks from insecticides application. Data in Tables (4 and 5) illustrated that carotene and chlorophyll a and b pigments showed no significant differences between all tested insecticides compared with control after one week or two weeks from application except KfrZ Caprice and Topron which recorded significant decreased in chlorophyll (a) after one week, and Delron Elnasr 72%EC which showed no significant differences compared with control.

After one week from application, chlorophyll a/b ratio recorded significant decrease with KfrZ, Caprice, Topron, Match and Delron Elnasr but it increased with Dimilin, Newbenyione and Ferary. After two weeks from application all insecticides treatments recorded significant decrease compared with control.

Shakir *et al*. (2016) reported that pesticides are highly toxic substances. Their toxicity may not be absolutely specific to the target organisms but can adversely affect different processes in the non-target host plants and the results revealed that seed germination was decreased by the insecticides and this effect was more prominent at early stages of exposure. The effect of insecticides was

Table (4) Effect of tested insecticides on pigments content of cotton plant (mg/g fresh weight) after one week from application at Kafr-Elsheikh governorate.

Treatment		Carotene	Ch. A	Ch. B	Total (a+b)	Ratio (a/b)
Control		0.08±0.01[a]	2.28±0.12[a]	0.37±0.01[a]	2.65±0.03[a]	6.2
Diflubenzuron 48%Sc	**Dimilin**	0.07±0.02[a]	2.25±0.13[a]	0.36±0.02[a]	2.61±0.03[a]	6.3
	Newbenyione	0.07±0.02[a]	2.26±0.12[a]	0.35±0.01[a]	2.61±0.03[a]	6.5
Chlorfluazuron 5%Ec	**KfrZ**	0.08±0.01[a]	1.90±0.03[b]	0.36±0.01[a]	2.26±0.03[b]	5.3
	Caprice	0.08±0.01[a]	1.91±0.04[b]	0.37±0.02[a]	2.28±0.04[b]	5.2
	Topron	0.08±0.01[a]	1.92±0.03[b]	0.34±0.01[a]	2.26±0.01[b]	5.6
Lufenuron5%Ec	**Match**	0.07±0.02[a]	2.28±0.12[a]	0.38±0.02[a]	2.66±0.03[a]	6
	Ferary	0.07±0.02[a]	2.29±0.13[a]	0.36±0.01[a]	2.65±0.02[a]	6.4
Profenofos72%Ec	**Delron Elnasr**	0.07±0.02[a]	2.22±0.12[a]	0.37±0.02[a]	2.59±0.02[a]	6

Values are means of three replicates of each parameter ± standard deviation
Means within each column followed by the same letter are not significant at $p > 0.05$.

Table (5) Effect of tested insecticides on pigments content of cotton plant (mg/g fresh weight) after two weeks from application at Kafr El-Sheikh governorate.

Treatment		Carotene	Ch. A	Ch. B	Total (a+b)	Ratio (a/b)
Control		0.079±0.05[a]	2.39±0.01[a]	0.35±0.02[a]	2.74±0.09[a]	6.8
Diflubenzuron 48%Sc	**Dimilin**	0.076±0.04[a]	2.09±0.09[b]	0.35±0.03[a]	2.44±0.01[b]	6
	Newbenyione	0.078±0.06[a]	2.1±0.08[b]	0.34±0.04[a]	2.44±0.02[b]	6.2
Chlorfluazuron 5%Ec	**KfrZ**	0.077±0.05[a]	2.14±0.09[b]	0.35±0.02[a]	2.49±0.01[b]	6.1
	Caprice	0.078±0.05[a]	2.17±0.08[b]	0.34±0.02[a]	2.51±0.02[b]	6.4
	Topron	0.078±0.04[a]	2.18±0.09[b]	0.35±0.01[a]	2.53±0.01[b]	6.2
Lufenuron5%Ec	**Match**	0.079±0.05[a]	2.20±0.08[b]	0.35±0.03[a]	2.55±0.02[b]	6.3
	Ferary	0.079±0.05[a]	2.19±0.09[b]	0.34±0.01[a]	2.53±0.01[b]	6.4
Profenofos72%Ec	**Delron Elnasr**	0.079±0.03[a]	2.34±0.01[a]	0.35±0.03[a]	2.69±0.09[a]	6.7

Values are means of three replicates of each parameter ± standard deviation .
Means within each column followed by the same letter are not significant at $p > 0.05$.

observed on the photosynthetic pigments, a decrease in pigments concentrations was caused at higher doses but an increase was observed at lower doses of insecticides.

3.2. The second trial (Elshrkia governorate):

3.2.1. Morphological measurements:

Data in Table (6) illustrated that the shoot height of cotton plant were planted in El Shrkia governorate after two weeks from application and recorded significant decrease with all treatments except KfrZ,Caprice 5%EC and Topron 5%Ec compared with control.The numbers of squares and flowers of cotton plant recorded a significant decrease with all insecticides application except Match, Ferary and Delron Elnasr compared with control. Also, the cotton bolls number recorded significant decrease with all insecticides compared with control.

Table (6) Effect of tested insecticides on cotton plant phenomenon grown at Elsharkia governorate after two weeks from application.

Treatment		Shoot height (cm)	Squares (No.)	Flowers (No.)	Bolls (No.)	Boll/Squares (%)
Cont.		100.66±.001 [a]	20.66±0.57 [a]	10.66±0.05 [a]	9.33±0.57 [a]	45.2
Diflubenzuron 48%Sc	**Dimilin**	90.66±2.08 [b]	11.33±0.1 [c]	6.00±0.001 [c]	3.60±0.09 [c]	31.8
	Newbenyione	89.00±0.1 [b]	10.33±0.1 [c]	5.99±0.001 [c]	3.66±0.09 [c]	35.4
Chlorfluazuron 5%Ec	**KfrZ**	99.00±0.001 [a]	15.00±0.01 [b]	8.06±1.10 [b]	5.10±0.03 [b]	34.0
	Caprice	98.66±0.001 [a]	14.33±0.01 [b]	7.99±1.10 [b]	5.30±0.01 [b]	37.0
	Topron	98.00±0.001 [a]	14.66±0.01 [b]	8.00±1.10 [b]	5.20±0.02 [b]	35.5
Lufenuron5%Ec	**Match**	89.33±0.1 [b]	19.33±0.57 [a]	9.66±0.05 [a]	4.98±0.01 [b]	25.8
	Ferary	90.66±0.1 [b]	18.33±0.57 [a]	9.33±0.05 [a]	4.87±0.03 [b]	26.6
Profenofos72%Ec	**Delron Elnasr**	89.66±0.1 [b]	17.33±0.57 [a]	9.66±0.05 [a]	5.00±0.02 [b]	28.9

Values are means of three replicates of each parameter ± standard deviation .
Means within each column followed by the same letter are not significant at $p > 0.05$.

3.2.2. Pigments content:

A decline in chlorophyll pigments contents could be due to the breakdown of thylakoids and chloroplast envelops as revealed by evident changes in chloroplast ultra-structural alterations (**Wang *et al.*, 2016**). The carotene, chlorophyll a, chlorophyll b, total chlorophyll and chlorophyll a/b ratio of cotton leaves were assessed on cotton leaves two times after one and two weeks from insecticides application.

Data in Tables (7 and 8) indicated that carotene pigments in cotton leaves indicated no significant differences with all insecticides except Delron Elnasr which recorded significant decreased compared with control after one week from application. After two weeks from application, the carotene pigment showed no significant differences between all insecticides treatments compared with control.

Chlorophyll a and b measurements in cotton leaves between all insecticide treatments recorded significant decrease except Delron Elnasr 72%EC compared with control after one week or two weeks.

Total chlorophyll showed no significant differences with all insecticides except Delron Elnasr72%EC after one week and two weeks compared with control.

The chlorophyll a/b ratio was increased at all treatments after one week and two weeks from application except Delron Elnasr 72%EC compared with control.

Zhi-Yong *et al.* (2011) recorded that the effect of chlorpyrifos was assessed based on morphological traits (root and shoot length, fresh and dry weight of roots and shoots). It has been observed that when the chlorpyrifos applied at the rates of 1.0 mg/l and 10.0 mg/l caused significant phytotoxic effects (**Gvozdenac *et al*., 2013)**. In contrast to the results of this study, **Wang *et al*. (2007)** showed that chlorpyrifos had not affected the growth of wheat and oilseed rape seedlings even at high rates, indicating that those species were not good indicators of the presence of that insecticide in water.

From the above mentioned data and Fig.1, we can conclude that Match and Ferary showed the highest phytotoxic effect and it could be due to their negatively effects on growth and development of the treated plants. Pesticide toxicity results in reduction of chlorophyll and protein contents, accompanied by decreased photosynthetic efficiency of plants. Pesticide stress also generates reactive oxygen species which causes oxidative stress to plants. To attenuate the negative effects of oxidative stress, the antioxidative defense system of plants gets activated, and it includes enzymatic antioxidants as well as non-enzymatic antioxidants **(Sharma *et al*., 2019)**.

Table (7) Effect of tested insecticides on pigments content of cotton plant (mg/g fresh weight) after one week of application at Elshrkia governorate.

Treatment		Carotene	Ch. A	Ch. B	Total (a+b)	Ratio (a/b)
Control		0.08±0.01^{a}	2.40±0.03^{a}	0.39±0.03^{a}	2.79±0.09^{a}	6.2
Diflubenzuron 48%Sc	**Dimilin**	0.07±0.02^{a}	2.29±0.09^{b}	0.30±0.09^{b}	2.59±0.2^{c}	7.6
	Newbenyione	0.06±0.01^{a}	2.20±0.08^{b}	0.31±0.08^{b}	2.51±0.2^{c}	7.1
	KfrZ	0.05±0.02^{a}	2.25±0.09^{b}	0.32±0.09^{b}	2.57±0.2^{c}	7
Chlorfluazuron 5%Ec	**Caprice**	0.05±0.01^{a}	2.38±0.08^{b}	0.31±0.08^{b}	2.69±0.02^{b}	7.7
	Topron	0.06±0.02^{a}	2.37±0.09^{b}	0.33±0.03^{b}	2.70±0.04^{b}	7.2
Lufenuron5%Ec	**Match**	0.07±0.01^{a}	2.35±008^{b}	0.32±0.03^{b}	2.67±0.03^{b}	7.3
	Ferary	0.06±0.02^{a}	2.34±0.09^{b}	0.34±0.03^{b}	2.68±0.03^{b}	6.9
Profenofos72%Ec	**Delron Elnasr**	0.02±0.09^{b}	2.40±0.03^{a}	0.39±0.03^{a}	2.79±0.09^{a}	6.2

Values are means of three replicates of each parameter ± standard deviation .
Means within each column followed by the same letter are not significant at p > 0.05.

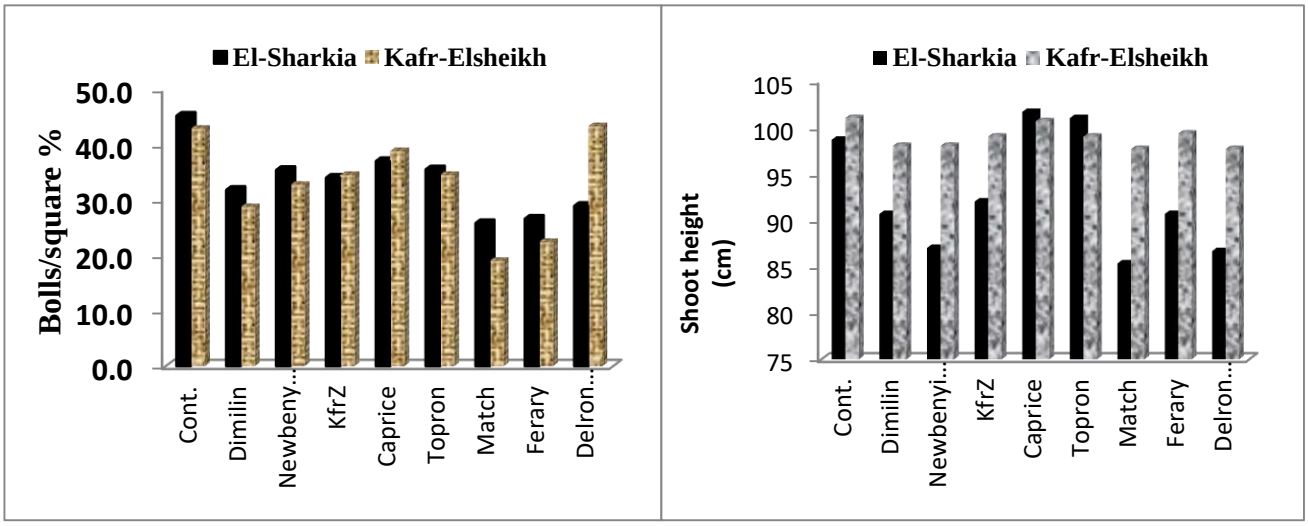

Fig.1: Effect of tested insecticides on cotton plant phenomenon grown in Elsharkia and Kafr-Elsheikh governorate after two weeks from application

Table (8) Effect of tested insecticides on pigments content of cotton plant (mg/g fresh weight) after two weeks of application at Elshrkia governorate.

Treatment		Carotene	Ch. A	Ch. B	Total (a+b)	Ratio (a/b)
Control		0.09±0.03[a]	2.78±0.01[a]	0.59±0.01[a]	3.37±0.02[a]	4.7
Diflubenzuron 48%Sc	**Dimilin**	0.09±0.02[a]	2.57±0.08[b]	0.44±0.01[c]	3.01±0.1[b]	5.8
	Newbenyione	0.09±0.03[a]	2.57±0.07[b]	0.43±0.02[c]	3.0±0.1[b]	6
Chlorfluazuron 5%Ec	**KfrZ**	0.08±0.03[a]	2.46±0.3[c]	0.46±0.09[b]	2.92±0.1[b]	5.3
	Caprice	0.08±0.02[a]	2.47±0.3[c]	0.45±0.09[b]	2.92±0.1[b]	5.5
	Topron	0.07±0.02[a]	2.48±0.3[c]	0.46±0.09[b]	2.94±0.1[b]	5.4
Lufenuron5%Ec	**Match**	0.08±0.03[a]	2.19±0.1[d]	0.38±0.1[d]	2.57±0.3[c]	5.8
	Ferary	0.08±0.04[a]	2.06±0.1[d]	0.36±0.1[d]	2.42±0.3[c]	5.7
Profenofos72%Ec	**Delron Elnasr**	0.09±0.02[a]	2.74±0.01[a]	0.58±0.01[a]	3.32±0.02[a]	4.7

Values are means of three replicates of each parameter ± standard deviation .
Means within each column followed by the same letter are not significant at $p > 0.05$

Conclusion

Cotton plant were planted in Kafr-Elsheikh governorate after two weeks from application recorded less toxicity with chlorfluazuron 48% SC and profenofos72%EC than Lufenuron5%EC whereas cotton plant were planted in El Shrkia governorate after two weeks from application recorded less toxicity with profenofos 72%EC than all the rest of insecticides.

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تأثيرات السميه النباتية لبعض المبيدات الحشرية على نبات القطن

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يعتبر القطن (*Gossypium hirsutum* L.) من أهم المحاصيل في مصر ويمثل مكونًا رئيسيًا في الإقتصاد القومي. يتعرض القطن في مصر للإصابة من قبل العديد من الآفات (مثل الحشرات ، الحلم ، والديدان الخيطية ، مسببات الأمراض ، الفيروسات ، الفطريات ، الأعشاب الضارة) مما قد يتسبب في خسائر فادحة في المحصول.

تهدف الدراسة إلى تقييم تأثير السمية النباتية لثمانية مبيدات حشرية التي تنتمي لمجاميع فعالة: دايفلوبنزيورون ، كلورفلوازورون ، ليوفينرون ، بروفينفوس على نبات القطن. تم تطبيق التجارب الحقلية بمحافظتي الشرقية وكفر الشيخ بمصر خلال موسم زراعة القطن لعام ٢٠١٩.

وأظهرت جميع المبيدات الحشرية المختبرة انخفاضاً معنوياً في ارتفاع الساق وعدد السوارس والأزهار واللوز لنبات القطن في المحافظتين بعد أسبوعين بجميع المعاملات.

تم تقييم نسبة الكاروتين ،الكلوروفيل أ ، ب ، الكلوروفيل الكلي و نسبة الكلوروفيل أ / ب بعد أسبوع وأسبوعين من تطبيق المبيدات الحشرية وسجلت جميعها انخفاض معنوي عن الكنترول الغير معامل.

سجلت نسبة الكلوروفيل أ / ب بعد أسبوع واحد من التطبيق انخفاضاً معنوياً مع كلا من كفرزد , كابرس , توبرون , ماتش و دليرون النصر ولكنها زادت مع ديملين , نيوبنيون و فيراريز. بينما بعد أسبوعين من التطبيق سجلت جميع معاملات المبيدات انخفاضًا مقارنةً بمعاملة الكنترول في محافظة كفر الشيخ.

زادت نسبة الكلوروفيل أ / ب في جميع المعاملات بعد أسبوع وأسبوعين من التطبيق لجميع معاملات المبيدات ماعدا دليرون النصر مقارنة بمجموعة الكنترول في محافظة الشرقية.

المبيدات الحشرية الموصى بها لمكافحة آفات نبات القطن في محافظة كفر الشيخ هي كلورفلوازورون و بروفينفوس بينما في محافظة الشرقية يوصي باستخدام بروفينفوس.