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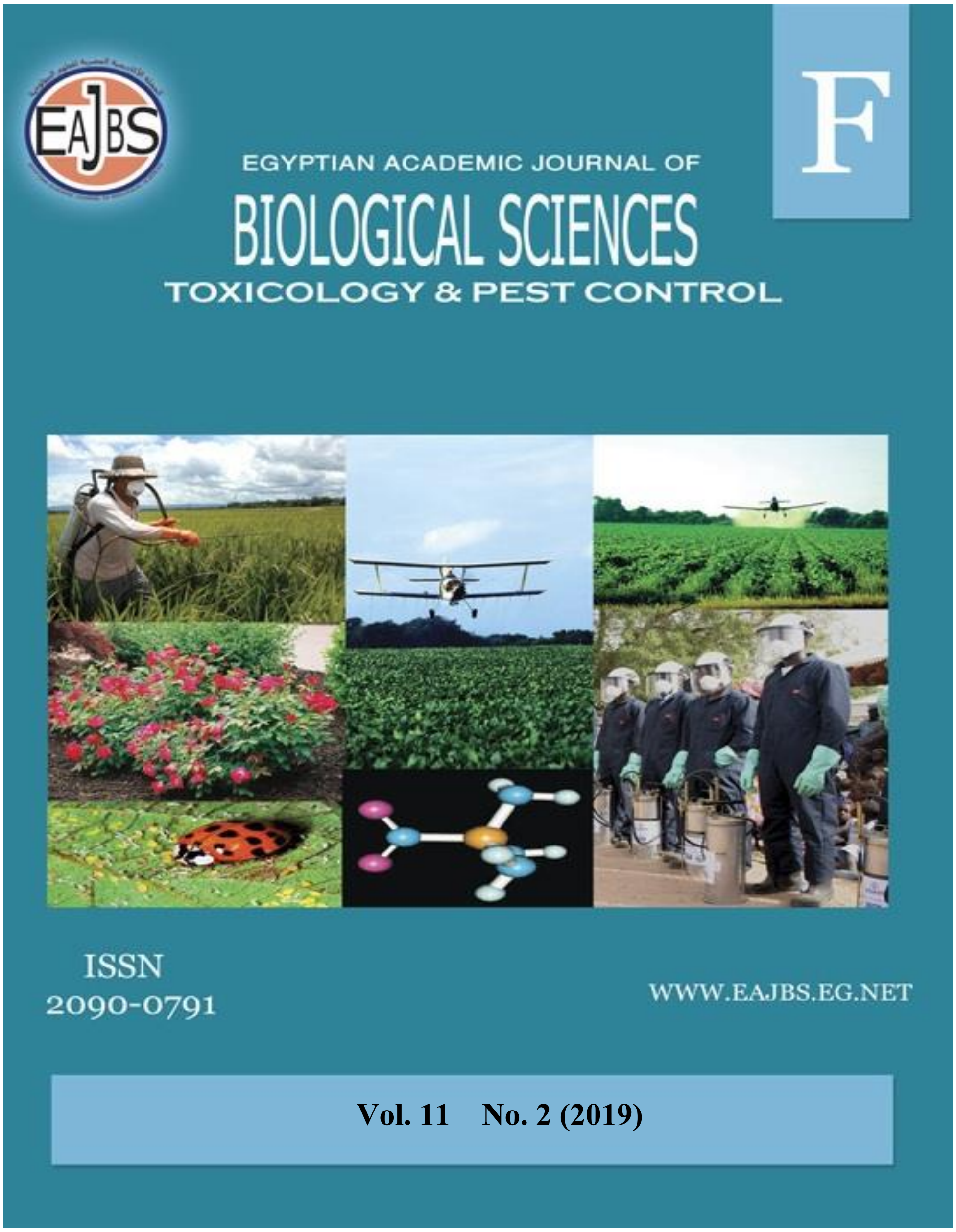

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Risk Assessment of Recommended Pesticides in Non-Target Organisms In Egyptian Agro-Ecosystems

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ABSTRACT

Despite many advantages of pesticides, there are potential hazards or risks when using farm chemicals. These risks may be associated with all chemicals, whether they are industrial chemicals, pesticides, household products or even natural chemicals found in the environment. Undesirable side effects of the agro-chemicals uses usually stem from a lack of understanding of their risks for the environment. Some of these effects are: 1) reduction of beneficial species including; predators, parasitoids and pathogens of pests, as well pollinators, 2) residues in food for humans and feed for livestock can be a consequence of direct application of a chemical to the food sources, by the presence of pollutants in the environment or by transfer and bio-magnification of the chemical along a food chain, 3) resistance to a the pesticide used that developed in target and non-target pests due to overuse of the chemicals, and 4) soil and groundwater contamination by leached chemicals. The study aimed to assess the side effects of various recommended chemical pesticides by the Egyptian Ministry of Agriculture on non-target organisms in different Egyptian agricultural ecosystems. Throughout a period of (42 months, May 2013 – Jan. 2017), 190 field trials were conducted, in 14 locations (4 Governorates), in 15 crops, using 71 pesticides, on 20 target pests, 9 non-target pests and 5 non-target predatory species. The direct count technique was practiced for data collection. The majority of the recommended pesticides tested, demonstrated different population reduction percentages, reaching 85.8 and 94.60% for non-target pests and predators, respectively.

INTRODUCTION

Pesticides are an integral part of agriculture and in many cases; they are still the most powerful tool in pest control worldwide. Many crop productions in Egypt is likely to remain dependent on the continued pesticide use, despite their potential hazards or risks. Selectively of pesticides, especially to the beneficial arthropods, is a key data for the sustainable agriculture and IPM implementation programs. In such programs, these beneficial arthropods must be preserved from adverse effects, especially from non-selective pesticides. As well, the vegetable crops represent one of the major groups of crops that have to be produced under least contaminated conditions. The residues in eaten food for humans and feed for livestock can be a consequence of the direct application of a chemical to the food source, by the presence of pollutants in the environment or by transfer and bio-magnification of the chemical along a food chain. Not all residues are undesirable, although a good agricultural practice must be observed to prevent unnecessary and excessive levels of residues. Vegetable crops are harvested frequently at close intervals, and thus the intensive use of chemicals becomes questioned due to the possible contamination of products with chemical residues. A growing consumer market of vegetable production is thus one of the main factors encouraging farmers to convert to organic agriculture production. Increased consumer awareness of food safety issues and environmental concerns has also contributed to the growth in organic farming over the last few years. Therefore, there is a real need to reconsider the level of toxicity of different compounds recommended to be used against different pests, especially in the vegetable crop fields and/or greenhouses.

In Egypt, mostly 70% of the total amount of insecticides, used for pest control in all crops combined, is used in cotton fields, such applications showed a negative impact of pesticides, as a sharp decline (about 70–80% reduction in the numbers of predatory species populations) occurred in cotton field post applications, as well as in other crops like wheat, as the reduction in numbers of predatory and parasitoid species ranged between 68 – 72% (El-Heneidy *et al.,* 1987, 1991, 2015, 2017, Goda *et al.,* 2016, and Adly 2016).

The present study is a contribution for minimizing risk assessments of recommended agricultural pesticides to non-target organisms in Egyptian agro-ecosystems and to develop management programs based on safe pest control methods by using alternatives or less toxic (selective) chemical pesticides for both common target and their associated non-target organisms in the agro-ecosystems.

MATERIALS AND METHODS

Working Sites:

Field studies were implemented in 14 sites (2-5 locations/Governorate), mainly in 4 regions, relatively have different Egyptian agro-ecosystems; Menoufia, and Kafr El-Sheikh (2 and 3 sites, respectively), representing the Middle and Upper Delta (Lower Egypt), Fayoum (4 sites), representing Middle Egypt and (5 sites) in Behaira (Noubaria), representing new reclaimed areas in the western desert.

Target Crops:

Most of the economic crops, that usually receive high volumes of pesticide applications in Egypt, were selected for such risk assessments under field conditions. Among those crops were: 5 field crops (cotton, maize, faba bean, soybean and wheat); 8 vegetable crops (tomato, cucumber, green pepper, potato, bean, eggplant, onion, squash as well as cucumber and green pepper (under greenhouse conditions)), and 2 fruit crops (citrus and grapevine).

Target Organisms:

Throughout the field studies, the targets included (20 pest species) and 9 (Pests) and 5 (Predatory species) as non-target organisms. Also, the pollinators (mostly the honeybees) were taken into consideration.

Used Pesticides:

Recommended pesticides studied, represented several groups, mainly; organophosphorus, carbamates, pyrethroids, oils and bio-pesticides, recommended by the Egyptian Ministry of Agriculture and Land Reclamation to be used against major pests in the Egyptian fields. The pesticides were tested at their recommended doses and their risk assessments against non-target organisms were estimated.

Data Collection:

Field inspections were carried out at (3-5 feddan/ location). The direct count technique for data collection was practiced by specialists. A complete randomized block design (4 replicates/ experimental plot) was undertaken at different locations of the 4 Governorates. Knapsack sprayers were used in case of vegetable and greenhouse crops, while a motorized hydraulic sprayer was used in case of field and fruit crops.

Methodology:

Population densities of the common targeted pests, non-target pests and predatory species, on 20-50 plants or 16-20 trees/crop/location/date) were estimated by counting at day 1 (pre-treatment) and 1, 5, 10, 15 and 20 days post-treatment. Based on mortality percentages (% of reduction in the populations), the tested pesticides were screened and sorted according to their toxicity against the tested materials for pesticides' selectivity and for conserving the beneficial by avoiding their seasonal active periods. Separate studies on the side effects of pesticides on the pollinators, represented by the honeybees, were also carried out by specialists. Reduction percentages in the populations of non-target organisms compared to the target pests were calculated and corrected, using Henderson and Tilton (1955) equation:

$$\text{Reduction } \% = (1 - A/B \times C/D) \times 100$$

Where:

A = No. of individual post-treatment
B = No. of individual pre-treatment
C = No. of individuals in the check pre-treatment
D = No. of individuals in the check post-treatment

The reduction percentage in the population at day 1 post-treatment was calculated as initial kill, while that at 5, 10, 15 and 20 days post treatment were considered as residual effects. All data were statistically analysed.

Side Effects of Pesticides on Target and Non-Target Organisms:

Side effects of the studied pesticides on non-target organisms (pests and predators) were estimated under field and/or greenhouse conditions, following the protocols developed by the IOBC (International Organization of Biological Control) -group 'Side-effects of Pesticides on Beneficial Organisms' (Hassan, 1977 and Sterk *et al.*, 1999). Pesticides were classified into the toxicity categories proposed by the IOBC working groups for semi- and field trials as: Class 1: harmless (< 25% mortality), Class 2: slightly harmful (25-50%), Class 3: moderately harmful (51-75%) and Class 4: harmful (> 75%) (Hassan, 1985). Selective biological or chemical compounds are needed in such cases (Hassan, 1994).

RESULTS AND DISCUSSION

Throughout the study period of 42 months, 190 field trials were conducted all the year around. The trials were carried out in 14 locations (4 Governorates), in 15 crops, using 71 pesticides, on 20 target pests and 9 non-target pests and 5 non-target predatory species. A summary data of the field trials, locations, and pesticides tested, the main target and non-target pests, and predators were tabulated in the table (1). The results revealed that in general most of the target and non-target organisms were influenced by applying the pesticides. Reduced rates in the population densities of both target and non-target organisms, as direct effects of the pesticide applications, were indicated in the table (2).

Reduction percentages varied at different pest and/ or predatory species as well as each of the pesticide used. As shown in the table (2), a total of 69 trials (36.3% out of the total trials) was practiced in field crops represented by: 31, 24, 7, 4, and 3 in cotton, maize, faba bean, soybean and wheat, respectively, and carried out as: 37 at Tala and 13 at Quesna (Menoufia Governorate 72.5%), 5, 2, and 5 at Fayoum, 2 Etsa, 2 Sanoures, and 1 Ebshway (Fayoum Governorate 14.5%), and 7 at Desouk and 2 at Quellin (Kafr El-Sheikh Governorate 13%). In the field crop trials, 36 pesticides were tested as 13, 10, 6, 4, and 3 in cotton, maize, faba bean, soybean and wheat, respectively.

Table (1): Summary data of the field trials carried out throughout the study period (2013-2017)

Crops	Total no. of field trials	Total no. of pesticides tested	Total no. of locations	Total no. of target pests	Total no. of non-target pests	Total no. of non-target predators
1- Field crops						
1. Cotton	31	13	6 (3 Govern.)	5	6	5
2. Faba bean	7	6	1 (1 Govern.)	1	1	1
3. Maize	24	10	4 (3 Govern.)	4	1	4
4. Soybean	4	4	1 (1 Govern.)	2	-	3
5. Wheat	3	3	1 (1 Govern.)	1	-	1
2- Vegetable crops						
1. Bean	3	3	1 (1 Govern.)	1	-	1
2. Cucumber						
2.a. Open fields	7	5	4 (3 Govern.)	4	3	4
2.b. Greenhouses	23	12	4 (4 Govern.)	7	4	4
3. Eggplant	3	3	2 (1 Govern.)	2	4	3
4. Onion	3	3	1 (1 Govern.)	1	-	2
5. Pepper						
5.a. Open fields	5	3	3 (3 Govern.)	3	2	4
5.b. Greenhouses	11	6	2 (2 Govern.)	4	3	3
6. Potato	13	6	6 (3 Govern.)	6	4	2
7. Squash	1	1	1 (1 Govern.)	1	2	1
8. Tomato	31	20	8 (3 Govern.)	5	3	4
3- Fruit crops						
1. Citrus	8	6	2 (2 Govern.)	2	3	4
2. Grapevine	13	6	5 (2 Govern.)	3	5	3

Conclusion: 15 crops, 190 field trials, 71 pesticides, 14 locations (4 Governorates), 20 target pests, 9 non-target pests, and 5 non-target predators.

For the vegetable crop field trials, a total of 100 trials (52.6% out of the total trials) was practiced represented by 31, 30, 16, 13, 3, 3, 3 and 1 in tomato, cucumber, green pepper, potato, green bean, eggplant, onion, and squash, respectively, and carried out as: 31 at Tala and 7 at Quesna (Menoufia Governorate 38%), 24 at Ebshway, 4 at Fayoum, 3 Etsa, and 1 Sanoures (Fayoum Governorate 32%), and 15 at Noubaria, 6 at South-Tahrir, 5 at Abdel–Wahab, and 2 at Adam (Behira Governorate 28%), and 2 at Balteem (Kafr El-Sheikh Governorate 2%). In the vegetable field crop trials, 62 pesticides were tested as 20, 17, 9, 6, 3, 3, 3 and 1 in tomato, cucumber, green pepper, potato, green bean, eggplant, onion, and squash, respectively. For the fruit crop field trials, a total of 21 trials (11.1% out of the total field trials) was practiced represented by: 13 and 8 in grapevine and citrus, respectively, and carried out as: 12 at Tala and 3 at Quesna (Menoufia Governorate 71.4%) and 3, 1, 1, and 1 at Abdel–Wahab, Noubaria, South-Tahrir, and El Boustan, respectively (Behaira Governorate 28.6%). In the fruit field crop trials, 12 pesticides were tested as 6 pesticides in each of the grapevine and citrus (Table 2).

In the 15 crops studied and through the 190 field trials; the target pest species were: *Spodoptera littoralis* (Boisd.), *Pectinophora gossypiella (*Saund.*), Earias insulana* (Boisd.), *Aphis* spp., *Bemesia tabaci* (Genn.), *Thrips tabaci* L., *Sesamia cretica L.,* *Ostrinia nubilalis* (Hb.), *Helicoverpa armigera (*Hb.*)*, *Tuta absoluta* (Meyrick), *Phthorimaea operculella* (Zeller), *Agrotis ipsilon* (Hufn.), *Lobesia batrana* (Schiff), *Ceratitis capitata* (Wied.), mealy bugs, *Tetranychus urticae* Koch, and the plant diseases; Early- and late-blight, Powdery- and downy mildew. The non-target pest species were: *Aphis* spp., *B. tabaci*, *T. tabaci*, *S. littoralis*, *E. insulana*, *B. zonata*, jassids, mealy bugs, and *T. urticae*, while the non-target predatory species were: *Coccinella undecimpunctata* L., *Chrysoperla carnea* (Steph.), *Syrphus* spp., *Paederus alfierii* (Koch.), and true spiders (Table 2).

Average reduction rates in target insect pest populations ranged between 56.61-79.56% in cotton, 50.0-86.30% in maize, 67.43-90.23% in faba bean, 71.62 - 83.36% in Soybean, and 70.37 - 81.75% in wheat. For vegetable crops, these averages ranged between 57.36 - 89.0% in tomato, 54.63 - 88.8 and 65.65 - 89.31% in cucumber and 76.92 - 89.55 and 62.0 - 86.34% in green pepper open fields and greenhouses, respectively, 66.56 - 82.78% in potato, 80.42 - 89.27% in bean, 51.22 - 69.0% in eggplant, 71.51 - 85.15% in onion. For fruit crops, the averages ranged between 58.33 - 89.40% in grapevine and 68.40 - 84.92% in citrus. As well, the average reduction rates in target plant diseases ranged 33.14 - 53.90% (Table 2).

Average reduction rates in non-target pest species populations in the 15 studied crops ranged between 6.37 - 77.81% in *Aphis* spp., 15.10 - 83.37% in *B. tabaci*, 41.67 - 83.26% in *T. tabaci*, 67.86 - 69.39% in *S. littoralis*, E.59.35 - 80.75& in *E. insulana*, 66.30 - 71.87% in *B. zonata*, 11.65 - 77.70%v in Jassids, 52.35 - 75.92% in mealy bugs, and 10.08 - 71.87% in *T. urticae.* The least negative effect was recorded on non-target organisms (mainly sucking insects) in case of using the selective pesticides against plant diseases.

The side effect of pesticide applications showed the highest mortality rates among the natural enemies, particularly the predatory species tested. The effect varied according to the pesticide used/or the field crop tested. The effect of pesticides on the populations of the predatory species; *C. undecimpunctata* and *C. carnea* (as a reduced rate) tested in the 190 field trials is indicated in the table (2). The mean reduction rate ranged between 18.9 – 97.2% in the case of the coccinellid species and between 14.3 – 92.6 % in the case of the lacewing.. Correspondent reduction rates in the predatory species populations; *C. undecimpunctata*, *C. carnea*, *Syrphus* spp., and true spiders ranged between 26.72 - 96.90, 40.0 - 91.11, 83.30 - 95.50, and 59.49 - 86.18%, respectively in the field crops, 8.76 - 97.20, 10.10 - 92.90, 13.0 - 95.54, and 66.53 - 82.10%, respectively in vegetable crops, and 27.78 - 83.48, 57.50 - 81.96, 59.5 - 90.54% for *C. undecimpunctata*, *C. carnea*, and true spiders, respectively in fruit crops.

Among the pesticides applied, Actellic 50% was the most toxic pesticide to both predatory species, while Actara 25% WG was the least toxic one. According to the classification of the IOBC the side effect of the pesticides on the non-target predatory species was classified into the 4 toxic level classes; 1, 2, 3, and 4 (Hassan, 1977 and 1994), as 1, 4, 6 and 28 on C. *undecimpunctata* and *as* 1, 3, 8 and 27 on *C. carnea*, respectively. It means that 72 and 69% of the evaluated pesticides were highly toxic (class 4 > 75% mortality) on both predatory species, respectively. Some pesticides have been classified in more than one class depending upon target pest and crop tested.

Reduced rates in the population of the predators in different field trials, represented by *C. undecimpunctata* (as an example), ranged between 11.4 – 93.4%. It was the least in the eggplant and the highest in tomato fields, respectively (Table 2). The low reduction in the case of the eggplant was due to the less number of trials carried out (only 3 trials) and the groups of the type of pesticides recommended to be used under greenhouse conditions.

According to the IOBC classification, almost all pesticides used to demonstrate different mortality rates and population reduction rates in non-target pests and predators ranged mostly between the toxicity levels 2 – 4. In the field crop trials, the 3 categories in non-target pests were represented by 19.4, 61.2 and 19.4%, and 5.4, 25.2 and 69.4% in the predator populations of the levels 2, 3, and 4, respectively. Almost none was recorded at level 1 (harmless) (<25% mortality). In the vegetable field trials, correspondent 3 categories in non-target pests were 32.3, 49.0 and 18.8%, and 13.7, 35.3 and 51.0% of the predator populations. A few cases were recorded at level 1 (harmless). In the fruit field trials, the 3 categories in non-target pests were represented by 20.0, 66.7 and 13.3%, and they were 2.8, 41.7 and 55.5% in the predator populations of the levels 2, 3, and 4, respectively. Generally, as indicated, the percentages of reductions in the vegetable fields (open fields and/or greenhouses) were relatively lower than the ones of the field crops due to the types of pesticides recommended. Vegetable crops are harvested frequently at close intervals, and thus the intensive use of chemicals becomes questioned due to the possible contamination of products with chemical residues (Perdikis *et al.*, 2008). Also, in the predators' populations, the percentages of reductions were significantly higher than in the non-target pests, especially in category 4. Considering, the highest number of field trials conducted (31 trials in each of cotton and tomato) the 3 toxicity categories were in 23.1, 63.5 and 13.4%, opposed to 6.7, 20.0 and 73.3% in the predator populations of the levels 2, 3, and 4, respectively in cotton, while they were 8.6, 51.4 and 40.0% in non-target pests and 1.7, 22.8 and 75.5% in the predator populations of the levels 2, 3, and 4, respectively. The side effect of pesticide applications showed higher mortality rates among the predatory species tested. It attained 73.3 and 75.5% in cotton and tomato, respectively as category 4. In Egypt, mostly 70% of the total amount of insecticides, used for pest control in all crops combined, is used in cotton fields, such applications showed a negative impact of pesticides, as a sharp decline (about 70–80% reduction in the numbers of predatory species populations) occurred in cotton field post applications, as well as in other crops like wheat, as the reduction in numbers of predatory and parasitoid species ranged between 68 – 72% (El-Heneidy *et al.,* 1987, 1991, 2015, 2017, Goda *et al.*, 2016, and Adly 2016).

Generally, it is clearly demonstrated that several non-target organisms were affected by the use of pesticides. Percentages of reduction in the predator populations were higher than in the non-target pests, and simply the ones targeted plant diseases were the less toxicity as they did not exceed the level 3.

Throughout the study period 2013-2017, out of the 71 pesticides tested and the 43 ones recorded the toxicity level 4 to the non-target predatory species, the four: Actellic 50% EC, 4 Romactin 1.8% EC + Caploil, Sumi-Alpha 10% EC, and Super actara 25% WG, were very risky (> 90% reduction within a range of 90.54 - 94.60%). Actellic 50% EC, the highest one, is an OP group, while the other 3 represent different pesticide groups. Thirty pesticides recorded (> 80% reduction within a range between 80.34 and 89.20%). Eleven ones (36.7%) belong to the OP group, which means that this group represents one of the most toxic groups of pesticides to non-target organisms, especially the beneficial, therefore this has to be taken into consideration in the selectivity of pesticides recommended to be used in different agro-ecosystems in Egypt (Table 2).

Table (2): List of pesticides, rates of application, crops, average reduction % (Category) in target and non-target pests and beneficial studied in the field trials through the period 2013-2017

Trade Name	Common Name	Group	Rate of Application	Crop	Target Pest	Average Reduction % (Category)			Recommendation
						Target pest	Non-target pests	Non-target beneficial	
Acrobat copper 46% WP	Copper oxychloride	Cinnamic acid	150 gm/ 100 L w	Cucumber (GH)	Downy mildew	-	68.38% (3)	71.88 % (3)	++
Actara 25% WG	Thiamethoxam	Neonictinoid	20 gm/ 100 L w	Tomato	*Bemesia tabaci*	68.75% (3)	78.64% 4)	75.0% (3)	++
Actellic 50% EC	Birimiphos-methyl	OP	375 ml/ 100 L w	Tomato	*B. tabaci*	87.50% (4)	83.20% (4)	94.60% (4)	+++
Agrothion 57% EC	Malathion	OP	l L/ feddan	Potato	*Phethorimaia operculela*	72.40% (3)	68.75% (3)	79.07% (4)	++
Aphox 50% DG	Pirmicarb	Carbamate	50 mg/ 100 Lw	Faba bean	*Aphis craccivora*	81.03% (4)	-	85.95% (4)	+++
Avaunt 15% SC	Indoxacarb	Oxadiazine	100 ml/ 100 L w	Tomato	*B. tabaci*	75.72% (4)	68.51% (3)	70.51% (3)	++
			150 ml/ feddan	Grapevine	*Lobesia botrana*	70.60% (3)	61.21% (3)	78.43% (4)	++
Carathion 57% EC	Malathion	OP	1 l/ feddan	Maize	Aphids	68.67% (3)	-	81.21% (4)	+++
Challenger 36% SC	Chlorfenapyr	OP	45 ml/ 100 L w	Bean, Tomato, Eggplant	*Tetranychus urticae*	76.14% (4)	66.10% (3)	72.16% (3)	++
			25 ml/ 100 L w	Pepper (GH)		62.00% (3)	36.68% (2)	33.41% (2)	+
Chess 50% WG	Pymetrozine	Triazine	125 gm/ 100 L w	Cucumber	*B. tabaci*	88.81% (4)	82.30% (4)	88.90% (4)	+++
Chloro Z 48%	Chlorpyrifos	OP	1 l/ feddan	Cotton	*Earias insulana*	56.61% (3)	18.60% (1)	37.10% (2)	+
Chlorzan 48%	Chlorpyrifos	OP	1 l/ 400 ml w	Cotton	*Pectinophora gossypiella*	74.74% (3)	68.16% (3)	81.85% (4)	+++
Commando 35% SC	Imidacloprid	Neonictinoid	75 ml/ 100 L w	Cucumber (GH)	*Aphis gossypii, B. tabaci*	84.17% (4)	78.06% (4)	84.95% (4)	+++
Confidate 35% SC	Imidacloprid	Neonicotinoid	75 g/100 L w	Tomato	*B. tabaci*	81.04% (4)	38.10% (2)	86.50% (4)	+++
Cure M 72% WP	Mancozeb	-	250 g/ 100 L w	Cucumber (GH)	Downey mildew	-	50.67% (3)	69.00% (3)	++
Delcup 23.5% L	Copper sulfate	Inorganic sulfate	250 ml /100 L w	Cotton	*B. tabaci, Thrips tabaci*	61.73% (3)	65.24% (3)	67.31% (3)	++
Delta care 10% EC	Hexythiazox	Benzamide	50 ml/ 100 L w	Cucumber (GH)	*T. urticae*	85.58% (4)	62.12% (3)	72.24% (3)	++
Detergent pH 7	Fatty acid of potassium	Fatty acid of potassium	1 l/ 100 L w	Cotton	*Thrips tabaci*	70.60% (3)	62.95% (3)	-	++
Dipel D. F.6.4% WP	*Bacillus thuringiensis*	Biopesticide	200 gm/ feddan	Grapevine	*L. botrana*	75.00% (3)	27.27% (2)	27.78% (2)	+
Dithane M45 80% WP	Mancozeb	Dithiocarbamate	250g /100 l w	Potato	Early Blight	-	57.14% (3)	61.63% (3)	++
Dorsil 48% EC	Chlorpyrifos	OP	1 l / feddan	Cotton	*P. gossypiella*	67.14% (3)	74.62% (3)	79.66% (4)	++
Dursban 48% EC	Chlorpyrifos	OP	1 l / feddan	Maize	*Sesamia cretica, S. littoralis*	52.94% (3)	-	76.67% (4)	++
				Potato	*A. ipsilon*	66.56% (3)	72.32% (3)	88.92% (4)	+++
Endo 50% EC	Ethio	OP	1 l/ feddan	Maize	*Ostrinia nubilalis*	56.67% (3)	-	53.33% (3)	++
Evridor 24% SC	Imidacloprid	Neonictinoid	30 ml/ 100 Lw	Citrus	Citrus mite	73.40% (3)	81.25% (4)	75.00% (3)	++
Excellent 1.9% EC	Emamectin benzoate	Avermectin	300 cm/feddan	Cotton	*E. insulana*	69.84% (3)	7.84% (1)	26.72% (2)	+
Goldben 90% SP	Methomyl	Carbamate	300 ml/ feddan	Maize	*S. cretica*	71.0% (3)	-	64.44% (3)	++
Helban 485 EC	Chlorpyrfos	OP	1 l/ feddan	Maize	*O. nubilalis*	62.50% (3)	-	60.00% (3)	++
Imaxi 35% SC	Imidacloprid	Avarmectin	75 ml/ 100 L w	Tomato	*B. tabaci*	79.59% (4)	83.34% (4)	87.50% (4)	+++
Infinito 68.75% SC	Fluopicolide	Benzamide	125 ml/100 L w	Cucumber	Downy mildew	-	50.94% (3)	59.10% (3)	++
Kocide 53.2%	Copper hidroxide	Copper hidroxide	180 g/ 100 L w	Cucumber (GH)	Downey mildew	-	40.14% (2)	57.81% (3)	+
Lannate 90% SP	Methomyl	Carbamate	300 g/ feddan	Maize	*S. littoralis*	74.89% (3)	-	78.84% (4)	++
Maccomite 10% WP	Hexythiazox	Accaricide	Maccomite 10% WP	Pepper	*T. tabaci*	76.92% (4)	54.76% (3)	76.57% (4)	++
Malathion 57% EC	Malathion	OP	Malathion 57% EC	Faba bean	Aphids	79.57% (4)	74.87% (3)	83.28% (4)	+++
Malatox 57% EC	Malathion	OP	Malatox 57% EC	Citrus	*Ceratitis capitata*	67.46% (3)	68.30% (3)	78.70% (4)	++
Malson Cheminova 57% EC	Malathion	OP	Malson Cheminova 57% EC	Maize, Wheat	Aphids	72.32% (3)	-	85.64% (4)	+++
Match 5% EC	Lufenuron	Chitin synthesis Benzoylurea	40 g/ 100 L w	Tomato	*Tuta absoluta*	67.90% (3)	49.50% (2)	50.20% (3)	+
			160 ml/ feddan	Potato	*P. operculela*	79.53% (4)	53.57% (3)	61.63% (3)	++
			160 ml/ feddan	Grapevine	*L. botrana*	69.40% (3)	53.80% (3)	59.90% (3)	++
Marshal 20% EC	Carbosulfan	Carbamate	100 ml/ feddan	Faba bean	*A. craccivora*	90.23% (4)	-	88.09% (4)	+++
Movinto 10% SC	Spirotetramat	Tetramic acid	75 ml/ 100 L w	Onion	*T. tabaci*	85.15% (4)	-	80.94% (4)	+++
Mospilan 20% SP	Acetamiprid	Neonicotinoid	10 g/100 L w	Pepper, Cucumber, Tomato	*B. tabaci, A. gossypii*	68.90% (3)	66.38% (3)	84.40% (4)	+++
			25 g/100 L w	Potato, Tomato, Pepper, Faba bean	*B. tabaci, A. craccivora*	80.19% (4)	84.20% (4)	84.40% (4)	+++
Neodrin 90% WP	Methoxyl	Carbamate	300 gm/ feddan	Maize	*S. littoralis*	77.20% (3)	-	82.01% (4)	+++
Neomyl 90% SP	Methoxyl	Carbamate	300 gm/ feddan	Maize, Soybean	*S. cretica, S. littoralis*	50.00% (2)	-	80.95% (4)	+++
No-blight 50% WP	Thiram	Imidazolinone	250 g/ 100 L w	Squash	Early blight	-	47.74% (2)	57.87% (3)	+
Nomolt 15% SC	Teflubenzuerone	Benzoulurea	160 ml/ feddan	Tomato	*T. absoluta, B. tabaci*	69.72% (3)	73.70% (3)	70.20% (3)	++
Ortus super 5% EC	Fenpyroximate	Metachondria complex	50 ml/ 100 L w	Eggplant (GH), Cucumber (GH), Pepper (GH), Bean	*T. urticae*	54.63% (3)	70.00% (3)	81.34% (4)	+++
Oshin 20% SG	Dinotefuran	Neonoctinoid	50 ml/100 L w	Cucumber	*A. gossypii*	83.16% (4)	-	84.09% (4)	+++
Oxon 5% EC	Lambda-Cyhalothrin	Pyrethroids	375 cm/ feddan	Cotton	*E. insulana*	63.50% (3)	17.19% (1)	29.80% (2)	+
Pandel 8% SC	Sulfer	Inorganic sulfur	100 ml/ 100 L w	Cucumber (GH)	Powdery mildew	-	64.11% (3)	69.45% (3)	++
Pasha 1.9% EC	Emamectin benzoate	Avarmectin	250 ml /100 L w	Potato	*B. tabaci*	77.21% (4)	68.38% (3)	85.00% (4)	+++
Pestban 48% EC	Chlorpyrifos	OP	1 l/ feddan	Cotton	*P. gossypiella, B. tabaci*	74.44% (3)	73.33% (3)	80.34% (4)	+++
				Maize	*S. cretica*	67.68% (3)	-	20.00% (1)	+
Pestox 15% SC	Alfa Cypermathrine	Pyrethroids	165 ml / feddan	Cotton	*P. gossypiella*	72.60% (3)	73.10% (3)	89.20% (4)	+++
Pride 20% EC	Fenazaquin	Quinazolinone	60 ml/ 100 L w	Tomato	*T. urticae*	75.99% (4)	-	82.50% (4)	+++
Proclaim 5% SG	Emamectin Benzoate	Avermectin	80 g/ feddan	Tomato	*H. armigera, T. absoluta*	78.20% (4)	77.70% (4)	84.20% (4)	+++
Punch 40% EC	Flusilazole	Triazole	40 ml/ 100 L w	Pepper	Powdery mildew	-	59.79% (3)	66.45% (3)	++

Continue Table 2

Balex 50% WP	-	-	150 g/ 100 L w	Potato	Late blight	-	55.03% (3)	59.76% (3)	++
Radiant 12% SC	Spintoram	Spinosyns	35 ml/ feddan	Tomato	*T. absoluta*	81.41% (4)	84.70% (4)	88.11% (4)	+++
Seldan 48% EC	Chlorpyrifos	OP	1 l/ feddan	Soybean	*S. littoralis*	71.62% (3)	-	83.73% (4)	+++
Bidoroil Gold M 68% WG	Metalaxl M+Mancozeb	Phenylamide acylanil + dithiocarbamate	200g/ 100 Lw	Cucumber, Pepper	Downy mildew	-	57.44% (3)	64.58% (3)	++
Bidoroyl Mancozid	Metalaxyl Mancozed	Metalaxyl Mancozed	205 g/ l l	Cucumber (GH)	Powdery mildew	-	16.47% (1)	15.90% (1)	+
					Early blight, Late blight	-	11.55% (1)	20.33% (1)	+
				Pepper (GH)	Powdery mildew	-	46.81% (2)	57.33% (3)	++
					Early blight, Late blight	-	46.68% (2)	63.85% (3)	++
Romactin 1.8% EC + Caploil	Abamectin	Avarmectin	30 ml Romactin + 1.5 Caploil/ 100l w	Citrus	*T. urticae*	84.92% (4)	-	90.54% (4)	+++
Sanmite 20% WP	Pyridaben	Acarcide	65 ml/ 100 L w	Cucumber (GH), Bean	*T. urticae*	89.31% (4)	71.00% (3)	68.81% (3)	++
Selecron 72% EC	Profenofos	OP	187.5 ml/ 100 L w	Tomato	*B. tabaci*	77.36% (4)	-	85.02% (4)	+++
Sparkill 25% EC	Cyperethrin	Pyrethroids	250 ml/ feddan	Cotton	*P. gossypiella*	74.72% (3)	79.16% (4)	86.34% (4)	+++
Sumi Alpha 10% EC	Esfenvalerate	Parathroids	250 ml/ feddan	Cotton	*P. gossypiella*	74.39% (3)	68.05% (3)	91.11% (4)	+++
Sumithion 50% EC	Fenitrothion	OP	1 l/ feddan	Maize, Wheat	Aphids	78.15% (4)	-	88.21% (4)	+++
Super actara 25% WG	Thiamethoxam	Neonictinoid	20 gm/ 100 L w	Tomato	*B. tabaci*	77.37% (4)	80.32% (4)	93.65% (4)	+++
Switch 62.5% WG	Cyprodinil, Fludioxonil	Anilinopyrimidine	75 g/ 100 L w	Cucumber (GH)	Fruit rot	-	54.34% (3)	63.28% (3)	++
Tafaban 48% EC	Chlorpyrifos	OP	1 l / feddan	Maize	*S. cretica*	76.05% (4)	-	73.68% (3)	++
				Tomato	*T. absoluta*	74.39% (3)	79.54% (4)	80.95% (4)	+++
Teleton 72% EC	Profenofas	OP	750 ml/ feddan	Cotton	*P. gossypiella*	63.02% (3)	59.50% (3)	79.20% (4)	++
Topas 10% EC	Penconazole	Triazole	25 cm/ 100 L w	Pepper	Powdery Mildew	-	46.81% (2)	57.33% (3)	++
Topron 5% EC	Chlorfluazuron	Chitin synthesis	1 l/ 400 ml w	Cotton	*P. gossypiella*	74.74% (3)	68.16% (3)	81.85% (4)	+++
Vertimec 1.8% EC	Abamectin	Avermectin	25 ml + 40 ml KZ oil / 100 L w	Citrus	*T. urticae*	69.05% (3)	65.30% (3)	69.90% (3)	++
				Cucumber	*B. tabaci*, *T. urticae*	78.01% (4)	67.33% (3)	73.46% (3)	++
Warant 70% WG	Imidaclopride	Neonectinoid	30 g/ 100 L w	Faba bean	*A. craccivora*	67.43% (3)	-	81.06% (4)	+++

Based on the classification of the IOBC working groups for semi- and field trials, the tested pesticides are classified as: Class 1: harmless (< 25% mortality) ■, Class 2: slightly harmful (25-50%) ■, Class 3: moderately harmful (51-75%) ■ and Class 4: harmful (> 75%) ■
+ (Recommended) ++ (Slightly recommended) +++ (Risky)

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ARABIC SUMMARY

مخاطر استخدام المبيدات الكيماوية الموصى بها
على الكائنات غير المستهدفة فى النظم البيئية الزراعية المصرية

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على الرغم من المزايا العديدة للمبيدات الحشرية، هناك مخاطر أو مخاطر محتملة عند استخدام هذه المواد الكيميائية الزراعية. قد ترتبط هذه المخاطر بجميع المواد الكيميائية، سواء كانت مواد كيميائية صناعية أو مبيدات أو منتجات منزلية أو حتى مواد كيميائية طبيعية موجودة في البيئة. تنبع الآثار الجانبية غير المرغوب فيها لاستخدامات المواد الكيميائية الزراعية عادة من عدم فهم مخاطرها على البيئة. بعض هذه الآثار مثل: 1) خفض الأنواع المفيدة شاملة المفترسات والطفيليات ومسببات أمراض الآفات وكذلك الملقحات، 2) المتبقيات في غذاء البشر وأعلاف الماشية نتيجة التطبيق المباشر لمادة كيميائية على مصادر الغذاء، أو عن طريق وجود ملوثات في البيئة أو عن طريق النقل والتضخيم الحيوي للمادة الكيميائية على امتداد السلسلة الغذائية، 3) زيادة صفة المقاومة للمبيدات المستخدمة في الآفات المستهدفة وغير المستهدفة بسبب الإفراط في استخدام المركبات الكيميائية، و 4) تلوث التربة والمياه الجوفية بالمواد الكيميائية المغسولة. هدفت هذه الدراسة إلى تقييم الآثار الجانبية لمختلف المبيدات الكيميائية الموصى بها من قبل وزارة الزراعة المصرية على الكائنات غير المستهدفة في النظم البيئية الزراعية المختلفة في مصر، وذلك على مدار فترة (42 شهرًا ، مايو 2013 - يناير 2017). أجريت 190 تجربة حقلية، في 14 موقعًا (تمثل 4 محافظات)، في 15 محصولًا، باستخدام 71 مبيدا للآفات، على 20 حشرة مستهدفة، 9 آفات غير مستهدفة و 5 أنواع من المفترسات غير المستهدفة. تم استخدام طريقة العد المباشر لجمع البيانات. أظهرت غالبية مبيدات الآفات الموصى بها والتي تم اختبارها، نسبًا مختلفة للحد من تعداد الآفات، بلغت 85.8 و 94.60٪ للآفات غير المستهدفة والمفترسات الحشرية، على التوالي.