TESTING THE REPELLENT EFFECT OF SOME PESTICIDES AGAINST HOUSE SPARROW FOR PROTECTING FIELD CROPS

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Abstract

Laboratory and field experiments were conducted to study the repellent and toxic effect of five pesticide compounds represented the different chemical groups against house sparrow *Passer Domesticus niloticus* to protect field crops at Beni Suef Governorate. Laboratory results showed that in both non choice and free choice feeding tests, Pirimicarb (carbamate compound) was the most repellent one followed by Chloropyrifus, Diazinon (organophosphorus compounds) and Cyphenothrin (pyrethroid) while Propineb compound (carbamate) was the lowest repellent one. Also, the determined R_{50} values (repellency effect) and LD_{50} (toxic effect) indicated that Pirimicarb was more repellent and Diazinon was more toxic to house sparrow while Propineb was the lowest repellent and toxic one. Concerning the field studies, results were corresponding with those obtained from laboratory studies as Pirimicarb compound induced the highest protection to the different crops i. e. wheat, broad bean, sunflower and sorghum from house sparrow attack.

INTRODUCTION

Recently, bird pests specially house sparrow, *Passer domesticus niloticus* became one of the most important problems to the field crops in Egypt. Birds damage to cereal crops reaches up to 10% of the production in African countries (Bruggers and Ruell, 1981). Some control operations against noxious bird depend upon avicides used. Some problems could be associated with the application of these compounds such as the adverse impact in non target species. For this reason, bird repellent approach is considered safe for the environment and living creatures. In this work, laboratory and field trails were conducted to study the repellent effect of some pesticide compounds against house sparrow *Passer domesticus niloticus* to protect field crops from the bird attacks.

MATERIALS AND METHODS

1- Tested Compounds

1-1- Carbamate compounds

- Antracol 70%, WP.

Common name : Propineb.

Chemical name: [[(1-methyl –1,2- ethhanediyl) bis [carbamodithioate]] (2-)] = zinc homopolymer.

Action : Fungicide.

Rat oral LD_{50} > 5000 mg / Kg.

- Aphox 50%, EC.

Common name : Pirimicarb.

Chemical name : 2-dimethylamino-5,6-dimethylpyrimidin -4-YL dimethylcarbamate.

Action : Insecticide (selective avicide).

Rat oral LD_{50} = 147 mg / Kg.

1-2- Organo phosphorus compounds

- Diazinon 60%, WP.

Common name : Diazinon

Chemical name: O,O-diethyl O- (2- isopropyl-4-methyl-6 pyrimidinyl) phosphorothioate.

Action : Insecticicde and acaricide.

Rat oral LD_{50} = 1250 mg / kg.

- Rosfin 50%, SL.

Common name : Chloropyrifos – methyl

Chemical name : O,O – dimethyl- O- (3,5,6-trichloro-2 pyridinyl) phosphorothioate.

Rat oral LD_{50} = 1000-3700 mg / kg.

1-3- Pyrethroid compound:

- Gokilat N. F (4/12), SL .

Common name : Cyphenothrin.

Chemical name:(RS) -α- Cyano -3- phenoxybenzyl (1R)- cis, trans- chrysanthemate.

Action : Insecticide.

Rat oral LD_{50} = 318 – 2640 mg / kg.

2- Animals the adult individuals of house sparrow bird, *Passer domesticus niloticus* were trapped by Paro trap and transferred to laboratory. The trapped birds were caged individually in wire mesh box for two weeks for acclimatization with diet

and water. The unhealthy animals were excluded. Animals were weighed and given a reference number for each one. Ten animals were used for each test.

3- Laboratory Experiments:

3-1- Non – choice feeding method the method that described by Sheft *et al.* (1982) was followed. Ten grams of whole sorghum grains were offered to each bird for 4 successive days. The same birds were offered another 10 g sorghum grains coated with different concentrations of each tested compound (ten birds for each concentration) for the same pre – treatment period. The consumed amount of untreated and treated sorghum grains was daily calculated. The repellency potential was calculated according to the equation given by Bullard *et al.* (1983).

$$\text{Repellency \%} = 1 - \frac{\text{Consumed amount of treated grains (g)}}{\text{Consumed amount of treated + untreated grains (g)}} \times 100.$$

3-2- Free- choice feeding method the method described by Russell *et al.* (1989) was adopted. Ten grams treated and another untreated sorghum grains were offered daily to each bird in small separated dishes for 4 successive days. The position of two dishes was altered daily to avoid any bias to certain location. Ten animals were used for each concentration. The consumed amount of treated and untreated grains were recorded. The repellency potential was calculated according to the same equation mentioned above.

3-3- Determination of R_{50}: R_{50} value means that 50% of the population of birds consumed less than half of the offered treated food. R_{50} values were calculated for each tested compound according to Engeman *et al.* (1989). Ten birds caged individually were used for each concentration of each compound. Untreated sorghum grains were offered to each bird for 4 successive days for acclimatization and testing. Then, the treated sorghum grains were offered to each bird for 24 h. Birds that consumed less than 40% from the offered food were considered repelled. The percentage of food consumption and repelled bird from treated grains were determined for each concentration. The estimated R_{50} values were calculated according to Weil (1952).

3-4- Determination of LD_{50} serial doses of each tested compound were calculated as mg / kg body weight were prepared and orally intubated to the birds. Five animals were used for each dose. Animals were fasted for 6 h at least before treatment. A parallel control test was conducted. Mortality percentages were recorded up to 48 h

after treatment. LD_{50} values were calculated using special tables given by Horn (1956). Hazard factor was calculated from the following equation (Schafer *et al.,* 1983).

$$\text{Hazard factor} = \frac{R_{50} \text{ (mg / kg grains)}}{LD_{50} \text{ (mg / kg b. w.)}}$$

4 - Field Experiments The protective potential of the tested compounds to field crops (wheat, broad bean, sunflower and sorghum) from house sparrow birds attacking during ripening stage was studied under the field conditions of Beni Suef Governorate. Each compound was sprayed at rate of 0.05% by hand compression sprayer during the flowering stage of each crop. Each compound was applied on one feddan for each crop and replicated three times in addition to another one feddan left untreated as a check control. Bird damage assessment was carried out in treated and untreated areas every 15 days after spraying (El- Deeb, 1990). Protection index (P.I) was calculated by the equation of Inglis and Isscson (1987) as follows:

$$\text{Protection Index} = \frac{\text{Mean damage percentage in untreated - Treated plots}}{\text{Mean damage percentage in untreated plots}} \times 100$$

RESULTS AND DISCUSSION

1- Laboratory Studies date in Tables 1 show the repellency effect of tested pesticide compounds against house sparrow using non and free choice feeding tests. Results indicate that all tested concentrations of the evaluated compounds exhibited considerable repellency effect. This effect increased with increasing compound concentrations. Also, the repellency effect of the all compound was higher in case of non choice feeding than free choice feeding test. Propineb compound at 0.024, 0.029, 0.042 and 0.050% concentration caused 63 & 58 , 71 & 65 , 77 & 70 and 80 & 73 % repellency with non and free choice feeding, respectively. The same pattern was observed with Pirimicarb, Diazinon, Chloropyrifus and Cyphenothrin compounds. Pirimicarb was the most repellent one whereas it achieved 95 and 93% repellency for non and free feeding, respectively with the highest concentration followed by Chloropyrifus (93 and 86%), Diazinon (92 and 85%) and Cyphenothrin (91 and 84%) while Propineb was the lowest repellent one (80 and 73%) with high concentration. Many investigators have reported the phenomenon of repellency action of some tested compounds against bird species. Schafer (1981) mentioned that physiological effect

caused by Methiocarb is probably responsible for its repellency to birds. Birds can detect this effect and associated with the taste or some other sensory identification of the chemical. Results gained from the present study are in harmony with those obtained by Abd El – Aal (1993), Gabr *et al.*(2001) and Khidr (2001).

The toxic effect (LD_{50}), repellency effect (R_{50}) and hazard factor (a repellency – toxicity index) of the tested pesticide compounds were shown in Table 2 . The obtained data revealed that Diazinon compound was more toxic to house sparrow as its LD_{50} value was 1.41 mg/kg. b. w., followed by Chloropyrifus 1.78, Cyphenothrin 2.82 and Pirimicarb 4.47 while Propineb was the lowest toxic one with LD_{50} 7.08 mg/kg. b.w. Regarding the repellency effect, it is obvious that house sparrow was more susceptible to Pirimicarb as R_{50} value was 0.014 mg / kg grains followed by Diazinon 0.033, Propineb 0.035, Chloropyrifus 0.042 while Cyphenothrin achived the highest R_{50} value 0.58 mg/kg grains. Concerning the hazard factor (H.F), it could be arranged the compounds according to H. F value in a descending order as follows : Cyphenothrin 0.21 > Chloropyrifus 0.024 > Diazinon 0.023 > Propineb 0.0049 > Pirimicarb 0.0031. It is mean that Cyphenothrin compound was well accepted toxic potential for causing acute poisoning episode while rest of the tested compounds were with little or no potential to cause acute avian poisoning episode.

In order to recommend the use of any chemical as a repellent for control process, some parameters should be studied, LD_{50} and R_{50} values to determine the hazard factor before it can be applied in the field to avoid the toxic effect on the non target animals and its adverse effect on the environment. Zidan *et al.* (1994) found that Cyanophos and Fenthion showed a higher repellency action than Alpha – chloralose to house sparrow and stock pigeon. From the hazard factor value, it seemed that the three compounds have a slight or no potentiality to cause acute avian episode. The avicidal activity differed due to chemical type, mode of entry and bird species.

2- Field Studies the repellency effect of tested pesticide compounds against house sparrow was studied under the field conditions for protecting crops from the bird attack.

Data in Table 3 showed that repellency effect of tested compounds was differed according to chemical structure and crop species. Pirimicarb achieved the highest protection for the different crops, 69% for wheat, 64% for broad bean, 72.8% for sunflower and 63.6% for sorghum. Propineb ranked the second order showing 55.3, 61.3, 70.7 and 59.1% protection for the same crops, respectively followed by

Diazinon and Chloropyrifus while Cyphenothrin compound was the lowest protecting one as it caused only 30.1, 32.0, 12.0 and 31.8% protection for wheat, broad bean, sunflower and sorghum, consecutively. Field results were in harmony with those obtained from laboratory, whereas Pirimicarb (carbamate compound) was the first repellent one with low toxic effect and hazard factor. Discussing the aforementioned results it could be concluded that the variation in repellency efficiency in relation to crop species and pesticide type. This findings agree with Martin and Jackson (1977), Wilson (1993) and Gabr *et al.* (2001).

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Table 1. Repellent effect of some pesticides against house sparrow using non and free choice feeding methods .

Chemical group	Coumpound	Concentration %	Repellency %	
			Non choice feeding	Free choice feeding
Carbamate	Propineb	0.024	63	58
		0.029	71	65
		0.042.	77	70
		0.050	80	73
	Pirimicarb	0.012	70	64
		0.014	86	80
		0.020	91	87
		0.024	95	93
Organo phosphorus	Diazinon	0.025	52	48
		0.030	82	75
		0.036	85	77
		0.043	92	85
	Chloropyrifus	0.034	64	60
		0.041	80	73
		0.049	83	76
		0.059	93	86
Pyrethroids	Cyphenothrim	0.33	75	69
		0.48	80	73
		0.69	87	80
		1.00	91	84

Table 2. Lethal effect (LD_{50}) , repellency effect (R_{50})and hazard factor of some pesticides against house sparrow.

Compound	LD_{50} mg / kg. b.w	R_{50} mg / kg grains	Hazard factor
Propineb	7.08	0.035	0.0049
Pirimicarb	4.47	0.014	0.0031
Diazinon	1.41	0.033	0.023
Chloropyrifus	1.78	0.042	0.024
Cyphenothrin	2.82	0.58	0.21

Table 3. Efficacy of some pesticides as repellent compounds against house sparrow to protecting field crops.

Crops	% Damage untreated	Propineb		Pirimicarb		Diazinon		Choropyrifus		Cyphenothrin	
		% Damage	% P.I	% Damage	% P.I	% Damage	% P.I	% Damage	% P.I	% Damage	% P.I
Wheat	10.3	4.6	55.3	3.2	69.0	5.2	49.5	6.3	38.8	7.2	30.1
Broad bean	7.5	2.9	61.3	2.7	64.0	3.5	53.3	3.8	46.7	5.1	32.0
Sunflower	9.2	2.7	70.7	2.5	72.8	6.3	31.5	7.4	19.6	8.1	12.0
Sorghum	6.6	2.7	59.1	2.4	63.6	2.9	56.1	3.1	53.0	4.5	31.8

P.I = Protection index

اختبار التأثير الطارد لبعض المبيدات ضد عصفور النيل الدوري لحماية المحاصيل الحقلية

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أجريت بعض التجارب المعملية والحقلية لدراسة التأثير الطارد وكذلك التأثير السام لعدد خمسة مبيدات تمثل المجاميع الكيميائية المختلفة ضد عصفور النيل الدوري بهدف حماية المحاصيل الحقلية من هجمات هذا الطائر وذلك بمحافظة بنى سويف.

أشارت النتائج المعملية أن مركب بريميكارب (مجموعة الكرباميت) هو الأعلى في التأثير الطارد يليه كلوروبيروفوس ثم ديازينون (مركبات فوسفورية) ثم سيفينوثرين (مركب بيرثرويدز) ، بينما كان مركب بروبينيب (كرباميت) أقلهم تأثيرا طاردا في كلا من اختباري التغذية الاختيارية وآلا اختيارية. كذلك أظهرت قيم التأثير الطارد للنصف R_{50} والجرعة المميتة للنصف LD_{50} أن مركب بريميكارب هو الأعلى فى التأثير الطارد ومبيد ديازينون هو الأكثر سمية للعصافير، بينما كان بروبينيب أقل المركبات سمية وتأثيرا طاردا في نفس الوقت. وبالنسبة للتجارب الحقلية كانت النتائج متوافقة مع النتائج المعملية حيث حقق مبيد بريميكارب أعلى نسبة حماية لمحاصيل القمح والفول البلدي وعباد الشمس والذرة الرفيعة من هجمات الطائر.