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REPELLENT EFFECT OF CAPTAN 50% WP AND BAYFIDAN 25% EC FUNGICIDES AGAINST HOUSE SPARROW BIRD, *PASSER DOMESTICUS NILOTICUS* (L.) UNDER LABORATORY AND FIELD CONDITIONS

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ABSTRACT: The present study evaluated the repellent and toxic effects of two fungicides: Captan 50% WP and Bayfidan 25% EC, on the house sparrow, *Passer domesticus niloticus*, a major agricultural pest in Egypt. Laboratory and field experiments were conducted to determine the efficacy of these compounds in protecting wheat and broad bean crops from sparrow attacks. In laboratory trials, the repellency effect was assessed using non-choice and free-choice feeding methods, while toxicity was measured through LD_{50} values. The results demonstrated that both fungicides had a significant repellent effect, with Bayfidan outperforming Captan. Field trials confirmed the laboratory findings, demonstrating that Bayfidan offered better crop protection, with a protection index of 67.5% for wheat and 63.1% for broad beans. Captan was also effective but slightly less than Bayfidan. The study highlights the potential of using fungicidal compounds as eco-friendly bird repellents to minimize crop losses, reducing reliance on traditional avicides. It also emphasizes the importance of deciding hazard factors to ensure safe field application and risk minimization to non-target organisms. The findings provide a promising solution for bird management in agricultural fields and contribute to enhancing crop yield and sustainability.

Keywords: House sparrow, *Passer* spp, chemical control, fungicides, repellency effect, harmful birds.

INTRODUCTION

The Egyptian government started to find a solution to this problem of population management of harmful birds in agricultural areas by reclaiming desert areas and other control methods. Recently in Egypt, the house sparrow, *Passer domesticus niloticus* (L.), and crested lark, *Galerida cristata*, are considered the most economic vertebrate pests in agricultural land, particularly in the newly reclaimed areas. Currently, these pests are mostly controlled chemically by insecticides and synthetic avicides such as Methiocarb which had repellent action (Rachana and Mukesh, 2020 El-Deeb, 1990 and Khidr, 2001). The house sparrow bird, *Passer domesticus niloticus* (Passeriformes: Passeridae) is considered one of the most important agricultural pests in cultivated areas. Bird damage to cereal crops represents economic losses of 5- 10% of production (Omar, 2019). Birds consume many crops, especially cereal grains such as wheat and sorghum. El Deeb (1991) reported that birds damage the ripening stages of wheat and sorghum. However, the control of birds is more difficult because many birds are protected by international laws. Bird repellent methods are safe for the environment because they are based on the physical and chemical sense of target pests. This work aims to introduce some suitable, economical, and safe

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techniques to control house sparrow, *P. domesticus niloticus* and minimizing their damage to field crops.

MATERIALS AND METHODS

1-Tested compounds:

- **Captan 50 % WP:**
- **Trade name: Spartan 50**
- **Common name**: Captan 50 % WP.
- **Chemical name:**

N- (trichloro methylthio) — 4- cyclohexene- 1, 2- dícarboximide.

- **Uses**: Broad spectrum fungicide belonging to the Phthalimide group.

- **Bayfidan 25% EC:**
- **Trade name: Bayfidan**
- **Common name**: Triadimenol
- **Chemical name:**

B- (4-chIor-phenoxy) and (1, 1 –dimethyl ethyl) 1-H- 1, 2, 4 traízole - 1- ethanol.

- **Uses**: is a fungicide classified as Group 3, G1 according to its mechanism of action.

2- Laboratory experiments

The adult individuals of the house sparrow bird, *Passer domesticus niloticus*, were trapped by the Para trap and transferred to the laboratory. The trapped birds were caged individually in wire mesh holding cages (53x24x38 cm) of one bird/cage and were maintained on an ad libitum normal diet and water for two weeks. The unhealthy birds were excluded. Birds were weighed and given a reference number for each one. Ten birds were used for each test.

2-1- Non- choice feeding method

This method was conducted according to that described by Sheft *et al.* (1982), where 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 value was calculated according to the equation given by Bullard *et al.* (1983).

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

2-2- Free-choice feeding method

This method was conducted according to that described by Russell *et al.* (1989), where ten grams of treated and other untreated sorghum grains were offered daily to each bird in small, separated dishes for 4 successive days. The position of the two dishes was altered daily to avoid any bias to certain locations. Ten birds were used for each concentration. The consumed amount of treated and untreated grains was recorded. The repellency potential value was calculated according to the same equation mentioned above.

2-3- Determination of R_{50}

R_{50} value means that half 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. The treated sorghum grains were provided to each bird for 24 hours. Birds that ingested less than 40% of the provided food were deemed repulsed. The proportion of food consumption and the number of birds repelled from treated grains were assessed for each concentration. The estimated R50 values were calculated according to Weil (1952).

2-4- Determination of LD_{50}

Serial doses of tested compound were calculated & prepared as mg / kg body weight and were orally intubated to the birds. Five animals were used for each dose. Birds were fasted for 6 h at least before treatment. A parallel control test was conducted. Mortality percentages were recorded up to 48 hours after

treatment. LD_{50} values were calculated according to the methods of Thompson and Wiel (1952). Hazard factor was calculated from the following equation of Schafer *et al* (1983):

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

3 - Field studies

Chemical control means the protective potential of the Captan 50% WP and Bayfidan 25% EC fungicide to field crops (wheat and broad bean) from attacking of house sparrow birds during the ripening stage. This experiment was applied under field conditions of wheat and broad bean crops at Qalyubia governorate. Each compound was sprayed at a rate of 0.05% by a hand compression sprayer during the flowering stage of each crop. Each compound was applied on one feddan (4200 m^2) for each crop and replicated three times, in addition, another feddan was left untreated as a check. Bird damage assessment was carried out in treated and untreated areas every 15 days after spraying (El-Deeb, 1990). The protection index (PI) was calculated by the equation of Inglis and Isscson (1987) as follows:

$$\text{Protection Index (PI)} = \frac{A - B}{A} \times 100$$

Where: A & B= mean damage percentage in the control & treated area

RESULTS AND DISCUSSION

1- Repellency effect of Captan and Bayfidan fungicides against house sparrow under laboratory conditions:

Data in Table (1) shows the effect of Captan and Bayfidan fungicides on house sparrow bird repellents under laboratory conditions using one and two-choice feeding methods.

Table (1). Repellent effect of Captan and Bayfidan fungicide against house sparrow using non and free choice feeding methods.

Compound	Concentration %	Repellency %	
		Non choice feeding	Free choice feeding
Captan	0.004	63.4	62.2
	0.006	70.0	67.4
	0.008	72.0	68.6
	0.010	76.0	76.2
Bayfidan	0.010	63.0	60.4
	0.014	73.2	69.1
	0.021	80.4	77.8
	0.044	84.4	79.5

Results indicate that the tested concentrations of the evaluated fungicides exhibited considerable repellency effect. This effect was increased with increasing compound concentrations. Also, the repellency effect of the two compounds was higher in the case of non-choice feeding than in the free choice feeding method. Captan compound at 0.004, 0.006, 0.007 and 0.01% concentration caused (63.4% & 62,2%), (70.0% & 67.4%), (72.0% & 68.6%) and (76,0% & 76,2%) repellency with non and free choice feeding methods, respectively. The same pattern was observed for Bayfidan**.** Repellent compounds added to a food source, act through the taste system to produce a marked decrease in the utilization of that food by the target species. These results agree with Roger (1985), who separated repellents into two primary classes, where the animal reacts to the taste of the repellent alone, and secondary (conditional

aversion), where the animal uses the taste of the repellent as a cue later adverse effect. Many investigators have reported the phenomenon of repellency action of some tested compounds against bird species (Rachana and Mukesh, 2020), where they were repelled from feeding on a crop without killing them. However, the physiological and biochemical mechanisms responsible for their repellency are still thoroughly investigated (Khidr & Abo-Hashem, 2019; Khidr, 2006; Khalifa *et al.*, 2020).

Methiocarb is most likely responsible for its bird-repellent properties, which birds may detect and link with the chemical's taste or other sensory identification. Results gained from the present study are in harmony with those obtained by Abd El-Aal (1993), Gabr *et al.* (2001), Khidr (2001), and Khalifa *et al*. (2020).

The toxic effect (LD_{50}), and repellency effect (R_{50} repellency) of the tested fungicide are shown in Table (2).

The obtained data revealed that Captan fungicide was more toxic to house sparrows as its LD_{50} value was 0.74 mg/kg b. w., while it was 0.87mg/kg b.w. for Bayfidan. The repellency effect (R50) was 0.018 mg/kg grains and 0.056 mg/kg grains Captain and Bayfidan, respectively. Concerning the hazard factor (HF) it was 0.0075 and 0.020 for Captain and Bayfidan, respectively.

Table (2). Lethal effect (LD_{50}), repellency effect (R_{50}) of Captain 50%WP and Bayfidan25% EC against house sparrow, *Passer domestics niloticus* under laboratory conditions

Compound	LD_{50} mg/kg. b.w	R_{50} mg/kg .grains	Hazard factor
Captan	0.74	0.0056	0.0075
Bayfidan	0.87	0.018	0.020

In order to recommend the use of any chemicals as a repellent for the control process, some parameters should be studied, i.e. 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 non-target animals and its adverse effect on the environment.

These results are in harmony with those of Zidan *et al*. (1994) who found that Cyanophos and Fenthion showed a higher repellency action than Alpha - chloralose to house sparrows and stock pigeons. As for hazard factor value, it seems that the fungicides have a slight or no potentiality to cause acute avian episodes. The avicidal activity differed due to chemical type, mode of entry, and bird species.

2- The repellency effect of Captan and Bayfidan fungicides against house sparrows was studied under field conditions:

Data in Table (3) show that the repellency effect of Captan and Bayfidan differ according to crop species.

Bayfidan achieved the highest protection for the different crops, where it was 67.5% for wheat, and 63.1% for broad bean crops, respectively.

These findings agree with Nartin and Jackson (1977), Wilson (1993) & Gabr *et al.* (2001), and Khalifa. *et al.* (2020).

Table (3). Efficacy of Captan and Bayfidan fungicides as repellent compounds against house sparrow, *Passer domestics niloticus* under field conditions.

Crops	control	Captan		Bayfidan	
		Damage %	PI %	Damage %	PI %
Wheat	8.3	3.6	56.6	2.7	67.5

Broad bean	6.5	3.4	47.7	2.4	63.1

PI = Protection index

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التأثير الطارد لمبيدات الفطريات Captan 50% WP و Bayfidan 25% EC على عصفور النيل الدوري *Passer domesticus niloticus* (L.) تحت الظروف المعملية والحقلية

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الملخص العربي

تُقيِّم الدراسة التأثيرات الطاردة والسامة لمبيدين فطريين، هما Captan 50% WP وBayfidan 25% EC على عصفور النيل الدوري (*Passer domesticus niloticus*) في محافظة القليوبية، حيث يُعد هذا الطائر من الآفات الاقتصادية الضارة التي تسبب خسائر كبيرة للمزارعين، خاصةً في مرحلة نضج المحاصيل.

تم إجراء تجارب معملية وحقلية لتحديد فعالية هذه المركبات في حماية محاصيل القمح والفول من هجمات العصافير.

في التجارب المعملية تم تقييم التأثير الطارد للمبيدين باستخدام طريقتي التغذية الإجبارية (غير الاختيارية) والتغذية الاختيارية، كما تم قياس السمية من خلال حساب قيم LD_{50}. وأظهرت النتائج أن كلا المبيدين لهما تأثير طارد واضح، حيث كان Bayfidan الأكثر فاعلية من حيث الطرد والسمية.

وفي التجارب الحقلية، جاءت النتائج متوافقة مع النتائج المعملية، حيث حقق Bayfidan حماية عالية للمحاصيل من هجمات العصفور، بلغت ٦٧,٥٪ في القمح و٦٣,١٪ في الفول، أما Captan فقد أظهر أيضاً كفاءة جيدة في الحماية ولكن بدرجة أقل مقارنةً بـ Bayfidan.

تُظهر هذه الدراسة أن استخدام مبيدات الفطريات ذات التأثير الطارد للطيور يمكن أن يكون وسيلة آمنة واقتصادية لتقليل خسائر المحاصيل الناتجة عن الطيور الضارة بالمحاصيل، مما يقلل الاعتماد على المبيدات التقليدية للعصافير ويحد من الأضرار البيئية مقارنة بالطرق التقليدية باستخدام المبيدات السامة للطيور. كما تؤكد الدراسة على أهمية تحديد عوامل الخطورة لضمان التطبيق الآمن في الحقول وتقليل المخاطر على الكائنات غير المستهدفة. تقدم هذه النتائج حلاً واعداً لإدارة الطيور في الحقول الزراعية، مما يساهم في زيادة إنتاجية المحاصيل.

توصي الدراسة باستخدام هذه المبيدات كجزء من استراتيجية الإدارة المتكاملة للآفات لحماية المحاصيل من الطيور وزيادة الإنتاج الزراعي بطريقة مستدامة.

الكلمات المفتاحية: العصفور المنزلي، Passer spp، المكافحة الكيميائية، مبيدات الفطريات، تأثير الطرد، الطيور الضارة.