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Research Article

Evaluation of Methiocarb 50%-WP as a Taste Repellent Against the House Sparrow (*Passer domesticus* L.)

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Abstract: Laboratory studies in cages and outdoor aviaries were conducted, using different concentrations of methiocarb 50%-WP to estimate the ideal dose needed to produce taste aversion in the house sparrow (*Passer domesticus*). Under a nochoice test, sparrows showed a clear difference in millet bait preference among various concentrations. Under choice tests, in cages and outdoor aviaries a clear repellency trend was recorded in both sexes with increases in poison concentration. However, female birds showed a higher repellency pattern than males. It was concluded that methiocarb grain bait at 0.1% proved to be highly effective in repelling sparrows and may function as an ideal crop protectant against bird invasion.

Key Words: House sparrow, methiocarb, taste repellent, cages, outdoor aviaries.

Methiocarb %50-WP'nin Serçeye (*Passer domesticus* L.) Karşı Uzaklaştırıcı Madde Olarak Değerlendirilmesi

Özet: Serçeye (*Passer domesticus*) uzaklaştırıcı etkisi yaratma amacıyla %50-WP'nin ideal dozunu bulmak üzere farklı konsantrasyonlar kullanılarak kafeslerde ve üstü açık kuş kafeslerinde laboratuvar çalışmaları yapılmıştır. Seçmesiz deneyde darı yeminde kullanılan çeşitli konsantrasyonlar arasında tercihlerde belirgin fark görülmüştür. Seçmeli deneylerde ise hem kapalı kafeslerde hem üstü açık kuş kafeslerinde her iki cinsiyette zehir konsantrasyonunun artması ile belirgin bir uzaklaştırıcı etkisi eğilimi görülmüştür. Ancak dişi kuşlarda, erkek kuşlarda oluğundan daha yüksek bir uzaklaştırıcı etki görülmüştür. Methiocarblı tahıl yeminin %0.1 oranında serçe uzaklaştırıcı olarak çok etkili olduğu, kuş istilasına karşı ideal bir hasat koruyucu olarak kullanılabileceği sonucuna varılmıştır.

Anahtar Sözcükler: Serçe, methiocarb, uzaklaştırıcı madde, kafes, açık hava kuşhanesi.

Introduction

The house sparrow (*Passer domesticus* L.) is the most destructive pest of cereal crops in the sub-continent, including Pakistan (1, 2, 3, 4). It inflicts heavy damage on wheat, millet and sorghum at varying levels (5). In wheat, the damage ranged from 2 to 11%, being more prominent at the maturity stage of the crop (6).

Methiocarb (3,5-dimethyl-4-methyl thiophenol methyl carbamate) is the most commonly used toxicant that functions as a bird repellent. The mechanism of repellency presumably involves food aversion learning (7,8). It is effective under certain circumstances in protecting a variety of ripening crops from granivorous birds (9, 10, 11, 12). In Pakistan, Bashir (13) evaluated the field efficacy of methiocarb as a bird repellent and achieved a 73% reduction in damage in ripening maize compared to untreated plots. A study was conducted (14) to estimate the minimum dose of methiocarb to produce taste aversion in rose-ringed parakeets (*Psittacula krameri*), and a minimum concentration as low as 0.0125% was found to be effective against parakeets.

The present laboratory study was designed to evaluate different concentrations of methiocarb treated millet bait in cages and then in outdoor aviaries under semi-natural conditions, which may lead to the synthesis of the best methiocarb formulation to be used as a taste repellent against bird pests in field conditions.

Materials and Methods

House sparrows were captured by a modified "Parotrap" initially designed for capturing parakeets

(15). Birds of both sexes were used but immature and unhealthy birds were avoided to lessen the possibility of any error in the experiment. Two types of housing facilities were provided for birds: 1) cages, and 2) outdoor aviary. Wire mesh cages each measuring 40x30x20 cm with a 30x17 cm opening on the top front were used for no-choice and choice tests. One sparrow was kept in each cage. They were provided with dry millet grain and water *ad libitum* before and after each treatment. Methiocarb 50%-WP was offered in four different concentrations (0.0125%, 0.025%, 0.05% and 0.1%) mixed with soaked millet grains.

Under the no-choice test, 10 birds (5 of each sex) were offered grains with each concentration at the rate of 10 g/day for 4 days. Under the choice test, treated grains of each concentration were offered to a group of 10 birds (5 of each sex) at the rate of 20 g/day along with the same quantity of untreated (plain) grain for 4 days. The positions of the feeding cups were changed daily in order to avoid place preference trend.

Three outdoor aviraies each measuring 365.8x348.0x348.0 cm were maintained. Two contained 5 house sparrows of either sex and the remaining contained 10 birds (5 male and 5 female), and they were offered 20 g of untreated and treated grains of each concentration daily for 4 days. The positions of feeding trays were changed daily to avoid place preference trend. Water was provided *ad libitum.* Mean daily consumption of grain bait/day/bird was calculated. Mean consumption values among treated and untreated grains were analysed by analysis of variance (ANOVA). Where significant effects were found, individual mean comparisons were made using Duncan's (16) multiple range test. Student's t test was used to compare the differences in intake between sexes.

Results and Discussion

No-choice test

Under the no-choice test, in cages, house sparrows consumed untreated grains at a higher rate than treated grains (Table 1). Significant differences in mean bait intake/bird/day were noted among various concentrations of methiocarb. In the case of male birds, a minimum intake of grain bait of 0.1% concentration was recorded to show the highest repellency. A similar pattern of repellency was observed in female birds. Sex-wise bait intake was recorded to be significant at 0.0125% concentration ($P<0.05$) while a non-significant difference was shown among the remaining bait concentrations and the untreated bait (control). Mean separation by Duncan's multiple range test revealed that in male birds mean bait intake/bird/day differed significantly between the lowest (0.0125%) and highest concentrations (0.1%). A similar pattern of bait intake (preference) was noted in female birds. The data showed a clear repellency trend in

Table 1. Results of 4-day no-choice feeding tests of Methiocarb 50%-WP in cages against house sparrow

Concentrations	No. of Bird (M/F)	Mean bait intake (g/bird/day)±SE		tc	df	P
		Male	Female			
Control	10(5/5)	a 6.12±0.48(61.2)	a 5.39±0.23(53.9)	2.8	4	P>0.05
0.0125%	10(5/5)	ab 5.23±0.23(52.3)	b 4.10±0.06(41.0)	5.4	4	P>0.05
0.025%	10(5/5)	bc 4.58±0.26(45.8)	c 3.50±0.22)(35.0)	3.1	4	P>0.05
0.05%	10(5/5)	cd 4.20±0.18(42.0)	c 3.24±0.15(32.4)	3.4	4	P>0.05
0.10%	10(5/5)	d 3.48±0.14(34.8)	d 2.38±0.15(23.4)	3.9	4	P>0.05

In parentheses are the percentages of the bait eaten by the sparrows of the offered bait
Means followed by the same letters are not significantly different at the 5% level by Duncan's Multiple Range Test.

methiocarb-mixed bait at the 0.1% level in the house sparrow.

Choice test

i) Cages: Under a 4-day choice test, male birds showed the highest consumption at the lowest concentration (0.0125%), resulting in the least repellency at this concentration (Table 2). However, the repellency line showed a gradual increase with the increase in poison concentration. Maximum repellency (21.33%) was shown by males at the highest concentration, i.e., 0.1% of methiocarb. A similar pattern of repellency was noted in female birds. It is interesting to note that female birds showed a higher repellency pattern than males at the bait concentrations given.

A significant difference in mean body intake was noted ($P<0.05$) among various bait concentrations offered to both sexes as revealed through Duncan's multiple range test. Mean consumption between treated and plain bait differed significantly ($P<0.05$) between sexes, as well as in concentration. Our results are in agreement with those of the study on rose-ringed parakeets (14), where a 0.1% concentration was proved to be the best repellent dose.

ii) Outdoor aviaries:

In outdoor aviaries, some birds were grouped according to sex and others were combined.

Under different poison bait concentrations, a significant difference in mean daily intake (Table 3) was observed in treated versus plain bait ($P<0.05$) in all the groups. A significant difference in mean bait intake/bird/day was noted ($P<0.05$) in different concentrations. The mean percentage preference of methiocarb treated grain decreased with increasing concentration in all three groups, showing a higher repellency trend with increasing amount of poison. Grains soaked in the methiocarb solutions were highly effective in repelling house sparrows at the 0.1% level. In a laboratory study on caged rose-ringed parakeets, *Psittacula krameri*, high repellency in parakeets at 0.1% has also been recorded (14). However, their response to methiocarb at levels less than 0.1% were variable. Under field conditions, it is reported that a 0.5% methiocarb treatment on corn seed reduced losses from boat-tailed grackles (*Eassidix mexinus*) by about 70% (17). Similarly, if 0.25% methiocarb is used as a taste repellent against blackbirds in sprouting rice, 1-7 times more rice plants were saved in treated than in untreated plots (18). It was also found that 8 times more rice seedlings were produced when the seeds were treated with 0.5% methiocarb than in plots with untreated seeds (19).

It is evident from the present and already reported tests, that the mechanism of methiocarb's repellency to birds is an initial post-ingestion disturbance, quickly

Table 2. Results of 4-day choice feeding tests of Methiocarb-50%-WP in cages against house sparrow

Concentration	Male		% Pref Treated bait	Female		% Pref Treated bait
	Mean bait intake (g/bird/day)±SE			Mean bait intake (g/bird/day)±SE		
	Treated	Plain		Treated	Plain	
0.0125%	a 5.12±0.39(25.6)	9.74±0.87(48.7)	34.04	a 4.86±0.44(24.3)	10.46±1.03(52.3)	32.35
0.025%	b 4.68±0.33(23.4)	11.86±0.94(59.0)	28.77	b 4.34±0.30(21.7)	11.96±1.09(69.8)	27.28
0.05%	c 4.02±0.32(20.1)	12.02±0.82(60.1)	25.42	c 3.92±0.35(19.6)	12.41±0.72(62.1)	24.23
0.1%	d 3.30±0.30(16.5)	12.70±0.71(63.5)	21.33	d 2.96±0.32(14.8)	12.80±0.50(64.0)	18.94

In parentheses are the percentages of the bait consumed by sparrows of the offered bait

Means followed by the same letters are not significantly different aat the 5% level by Duncan's Multiple Range Test.

Mean consumption of treated and plain bait significantly differed ($P<0.05$) between sexes and concentrations by Student's t test.

Table 3. Results of 4-day choice feedings tests of Methiocarb 50%-WP in Outdoor aviaries against house sparrow.

Concentrations	Male			Female			Male + Female		
	Mean bait intake (g/bird/day)±SE		% Pref of treated bait	Mean bait intake (g/bird/day)±SE		% Pref of treated bait	Mean bait intake (g/bird/day)±SE		% Pref of treated bait
	Treated	Plain		Treated	Plain		Treated	Plain	
0.0125%	a 6.92±0.16(34.5)	11.74±0.54(58.5)	37.48	a 7.14±0.50(35.5)	10.32±0.92(51.5)	40.81	a 7.62±0.23(37.5)	12.15±0.78(60.5)	38.30
0.025%	b 6.23±0.33(31.0)	11.94±0.55(59.5)	34.26	b 5.83±0.26(29.0)	11.95±0.56(59.5)	32.77	b 7.17±0.39(35.5)	13.64±0.78(68.0)	34.20
0.05%	c 6.15±0.31(30.5)	13.05±0.55(65.2)	31.86	c 4.84±0.42(24.5)	12.15±0.66(60.0)	28.83	c 5.14±0.14(25.5)	14.85±0.44(74.0)	25.63
0.1%	d 5.50±0.38(27.5)	13.20±0.76(66.0)	29.42	d 4.75±0.32(23.5)	12.70±0.66(63.5)	27.02	d 4.64±0.28(23.0)	15.72±0.57(78.6)	22.67

In parentheses are the percentages of the bait consumed by sparrows of the offered bait.

Means followed by the same letters are not significantly different at the 5% level by Duncan's Multiple Range Test.

Mean consumption in treated and plain bait significantly differed ($P<0.05$) between sexes and concentration by Student's t test.

followed by taste aversion. After consuming methiocarb, birds learn to avoid treated foods and find alternative food sources.

Investigators involved in laboratory and field tests on methiocarb have often observed extensive changes in the flight patterns and feeding habits of birds after a methiocarb treatment. It is concluded that methiocarb at a 0.1% concentration is a very effective bird repellent, and thus may be used as an ideal crop protectant.

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