THE IMPACT OF IMIDACLOPRIDE, DESIGNED FOR SEEDS TREATMENT TOWARDS THE JAPANESE QUAIL (*COTURNIX COTURNIX JAPONICA*)

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Abstract: The imidaclopride known as an insecticide for seeds treatment, has an impact on the environment, and in order to avoid this risk factor it has to be established its toxicity towards birds. For this purpose, the present paper had as an objective to determine the avian dietary toxicity of imidacloprid on the Japanese quail – test bird for establishing the toxicity rate of plant protection products. The results of the experiment characterize the study product as being low toxic towards the Japanese quail.

Key words: imidacloprid, diet toxicity, Japanese quail

INTRODUCTION

The seeds treatment with plant protection products is a base criterion in obtaining good quality and quantity crops, can decrease the number of field treatments and can minimize the environmental pollution.

Beyond these positive elements, sometimes it may occurunwanted side effects, with immediate or long term expression towards non target organisms present in the environment.

Imidaclopride is a systemic insecticide, with contact and ingestion action. Applied on the seed, it infiltrates quickly and it is translocate into plants during the emergence and growing phases. It is compatible with the homologated fungicides designed for seed treatment.

In order to be placed on the market, a product for plant protection requires due to 1107/2008 Regulation, several ecotoxicological tests such as avian dietary toxicity test.

The avian dietary toxicity test gives information whether the plant protection products used for seed treatment have or not a negative impact toward birds, which are superior rang consumers in agro systems, with an important role in maintaining the pest population equilibrium.

In the perspective of an ecological agriculture, where the birds represent a true biological protection tool, the present paper aims to determine the imidaclopride toxicity towards the Japanese quail (*Coturnix coturnix japonica*) – test bird for establishing the toxicity rate/rank of plant protection products.

MATERIAL AND METHOD

As testing organism was chosen the Japanese quail (*Coturnix coturnix japonica*), because it was proven to be an adequate model in dietary toxicity studies and it is also recommended by the 205/1998 OECD.

The birds used during the experiment were young, from the same population and age group (+/- 1 day) respectively having 10-17 days at the beginning of the experiment, according to OECD instructions.

The birds were purchased from a local supplier, with weight between 60 and 100 grams, and in perfect health state.

The hatched quails were kept in groups of 10 in cages made from non-corroding wire net, with grillage on the floor and with a 3000 cm^2 surface.

Before the experiment, during the holding period, the birds were acclimated in the laboratory conditionsand basal diet for 7 days, without any restriction regarding the food and water.

During the acclimatization period, all the birds were observed regarding their state of health, and the abnormal ones were removed.

Before testing there was applied a randomization procedure, the birds were weighed and for each concentration level to be tested were allocated 10 birds. The birds were identified by foot ringing.

Preparing the experimental/testing diet

In order to determine the median lethal concentration (LC 50) the imidacloprid was tested in five concentrations chosen in geometric series, with a constant factor not exceeding 2.0 value.

Diet preparation for the five concentration levelsis descried below:

C1 concentration (1ml p.c./1000 mg food) * 2, meaning 2 ml p.c. per 2 kilo of food;

C2 concentration (1,4 ml p.c./1400 mg food) *2, meaning2,8 ml p.c. per 2 kilo of food;

C3 concentration (2,74 ml p.c./ 1960 mg) *2, meaning 5,48 ml p.c. per 2 kilo of food;

C4 concentration (3,84 ml p.c./ 3841 mg) *2, meaning 7,68 ml p.c. per 2 kilo of food.

The test substance was incorporated into the food by mixing with a blender, for 10-15 minutes in order to obtain an equal distribution of the substance. For each concentration it was used 10 ml distilled water for dissolving the test substance.

A group of 10 birds was used for each test concentration and also as control.

Each group of birds was fed for five days with 300 grams of test diet according to the specific concentrations followed by other tree days of normal diet. The control group was fed daily with normal diet.

Daily it was monitored the food consumption and the mortality. Also it was observed the individual weight and the average body weight in day 1, 5 and 8, also the description of the symptoms. All these data were recorded in tables below.

Dependent on the mortality percent, the median lethal concentration was calculated by the probit logarithmic analysis.

RESULTS

Analyzing the data from table 1, it can be observed the fact that there is a correlation between the concentration level of the test substance and the food consumption. The food consumption is reduced as long as the concentration level increases progressively during the 8 days of the trial.

The impact of the quantity of the test substance accumulated in the birds organism is reflected in a symptomatology pattern represented by regurgitation, anorexia, apathy, convulsions and death.

Also, in accordance with the tested concentration level and with the food consumption, there are modifications of the individual and average weight of test birds (Table 2). So, in the case of the first tree levels of concentrations, where the diet test substance is present in small quantity there are no significant changes regarding the weights (individual and average), recorded in day 5, respectively day 8 of the trial.

Regarding the effect of the last concentration levels on the individual and average weight, measured in same days, it was observed a major decrease comparative to the one determined at the beginning of the test. The explanation is given by the reduced food consumption, due to the raise of the substance quantity in the birds' diet.

The lethal effect, as it is shown in table 3, is direct proportional with the substance concentration level from the test diet. The mortality appears from the first observation day in the case of maximum concentration and from the second and third day regarding the other concentration levels, and it continues until day 8, the last day of the experiment. The mortality percent is also variable in accordance with the diet concentration. So, at the first two concentrations with a small quantity of substance, the mortality percent is between 10%-20%, 50% for the third concentration and it goes up to 80% even 90% percent for the last two concentrations.

Based on these mortality percent and using the probit dose logarithmic method it was calculated the median lethal concentration LC 50 (Table 4). The value of LC 50 was established at 1962mg/kilo level, value which characterizes the tested product as being low toxic towards the Japanese quail.

CONCLUSIONS

The results of this study characterize the insecticide as being low toxic for environment.
The insecticide imidachlopride used for seed treatment has dietary LC_{50} 1960 mg/kg.

REFERENCES

BAICU, T. (1978) Aprecierea valorii agricole a unui pesticidd, Analele ICPP Bucuresti, Vol.XIV, 186 – 198
BAICU, T. (1987) Principii de elaborare a sistemelor de combatere integrata, Analele ICPP Bucuresti, vol.XXI, 111-120
OECD NR.205/1984 „Testul de toxicitate aviara a hranei"
FINNEY, D.J. (1971) Probit Analiysis, 3rd ed.Cambridge University Press,London
PEAKALL, D.B., PIMENTEL, D. (1992) Methods to Asses Toxic Effects on Ecosystems, in Methods to Asses Adverse Effects of Pesticides obn Non-Target Organisms, Tardiff R.G.(Ed), SCOPE, 49
BLISS,C.J. (1938) Quart, J.Pharm.Pharmacol, II, p.192-216

Table 1

The food consumption evolution (g) as a result of the test diets

Birds no/ group	Conc. mg/kg diet	Days	1	2	3	4	5	6	7	8
10	1000	FI	300	300	300	300	300	300	300	300
		FLO	-	83	57	50	48	46	40	32
		FC	-	217	243	250	252	254	260	268
		Birds no.	10	10	10	10	10	10	10	10
10	1400	FI	300	300	300	300	300	300	300	300
		FLO	-	231	228	224	247	258	270	275
		FC	-	69	72	76	53	42	30	25
		Birds no.	10	10	10	10	10	10	10	10
10	1960	FI	300	300	300	300	300	300	300	300
		FLO	-	215	254	229	268	279	280	287
		FC	-	85	46	71	32	21	20	13
		Birds no.	10	10	10	10	10	10	10	10
10	2744	FI	300	300	300	300	300	-	-	-
		FLO	-	240	267	278	280	283	290	290
		FC	-	60	33	22	20	7	10	10
		Birds no.		10	10	10	10	10	10	10
10	3841	FI	300	300	300	300	300	300	300	300
		FLO	-	227	281	283	287	289	290	292
		FC	-	73	19	17	13	11	10	8
		Birds no.		10	10	10	10	10	10	10
10	Control	FI	300	300	300	300	300	300	300	300
		FLO	-	57	47	43	59	65	62	46
		FC	-	243	253	257	241	235	238	254
		Birds no.	10	10	10	10	10	10	10	10

FI – total amount of food
FLO – remained food
FC – consumed food

Table 2

Individual weight and average weight of birds

Conc. (mg/kg diet)	Group no.	Birds no	Daily weight (g)									
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**deaths (g)**
1000	I	1	109	-	-	-	132	-	-	151	-	0
		2	103	-	-	-	129	-	-	149	-	0
		3	128	-	139	-	-	-	-	-	-	1/139
		4	105	-	-	-	130	-	-	153	-	0
		5	103	-	-	-	138	-	-	157	-	0
		6	105	-	-	-	129	-	-	150	-	0
		7	80	-	-	-	104	-	-	125	-	0
		8	101	-	-	-	124	-	-	141	-	0
		9	125	-	-	-	142	-	-	159	-	0
		10	106	-	-	-	127	-	-	145	-	0
Average			**106,5**				**128,33**			**147,8**		
No. of birds			**10**				**9**			**9**		**1**
1400	II	11	108	-	-	-	130	-	-	151	-	0
		12	113	-	-	123	-	-		-	-	1/123
		13	102	-	-	-	112	-	-	130	-	0
		14	115	-	-	-	130	-	-	142	-	0
		15	130	-	-	-	140	-	-	147	-	0
		16	127	-	-	133	-	-		-	-	1/133
		17	132	-	-	-	141	-	-	148	-	0
		18	98	-	-	-	119	-	-	130	-	0
		19	100	-	-	-	115	-	-	131	-	0
		20	118	-	-	-	128	-	-	153	-	0
Average			**114,3**				**101,5**			**113,2**		
No. of birds			**10**				**8**			**8**		
1960	III	21	98	-	102	-	-	-	-	-	-	1/102
		22	110	-	-	-	-	108	-	108	-	1/108
		23	98	-	-	-	-	100	-	-	105	0
		24	93	-	-	-	-	96	-	-	106	0
		25	75	-	-	83	-	-	-	-		1/83
		26	102	-	-	91	-	-	-	-		1/91
		27	95	-	-	-	-	99	-	-	110	0
		28	103	-	-	-	110	-	-	-		1/110
		29	93	-	-	-	-	100	-	-	115	0
		30	88	-	-	-	-	95	-	-	110	0
Average			**97,9**					**99,66**			**109,2**	

Table 2 continued

Conc. (mg/kg diet)	Group no.	Birds no	Daily weight (g)									
			0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**deaths (g)**
No. of birds			**10**					**6**			**5**	**5**
2744	IV	31	74	78	-	-	-	-	-	-	-	1/78
		32	67	70	-	-	-	-	-	-	-	1/70
		33	102	-	-	-	92	-	-	-	-	1/92
		34	108	-	-	-	-	92	-	88	-	1/88
		35	96	-	-	-	-	90	-	87	-	1/87
		36	113	-	-	-	-	105	105	-	-	1/106
		37	103	-	-	-	-	92	-	90	-	1/90
		38	77	-	80	-	-	-	-	-	-	1/80
		39	69	-	-	-	-	65	-	-	62	0
		40	71	-	-	-	-	69	-	-	65	0
Average			**88**					**85,5**			**63,5**	
No. of birds			**10**					**6**			**2**	**8**
3841	V	41	84	87	-	-	-	-	-	-	-	1/87
		42	101	-	-	-	83	-	-	-	-	1/83
		43	97	-	-	-	85	-	-	-	-	//85
		44	105	-	-	-	-	73	-	49	-	1/49
		45	93	-	-	-	-	68	-	52	-	1/52
		46	110	-	-	-	-	-	69	-	-	1/69
		47	72	-	-	-	-	65	-	-	51	0
		48	101	-	-	-	-	68	63	-	-	1/63
		49	113	-	-	-	-	61	-	53	-	1/53
		50	104	-	-	71	-	-	-	-	-	1/71
Average			**98**					**67**			**51**	
No.of birds			**10**					**5**			**1**	**9**
Control	VI	51	93	-	-	-	-	98	-	-	114	0
		52	102	-	-	-	-	108	-	-	118	0
		53	111	-	-	-	-	110	-	-	121	0
		54	85	-	-	-	-	90	-	-	100	0
		55	93	-	-	-	-	102	-	-	111	0
		56	110	-	-	-	-	118	-	-	125	0
		57	107	-	-	-	-	113	-	-	121	0
		58	103	-	-	-	-	112	-	-	123	0
		59	87	-	-	-	-	120	-	-	130	0
		60	93	-	-	-	-	115	-	-	127	0

Tabel 3

Mortalities

Group no.	Doses (mg/kg diet)	No. Of birds	Mortality during treatment							Recovery period	Total mortality	
			0		1	2	3	4	5	6-8	N°	%
			1 h	2 h								
1	1000	10	0	0	0	1	0	0	0	0	1	10
2	1400	10	0	0	0	0	2	0	0	0	2	20
3	1960	10	0	0	0	1	2	1	0	1	5	50
4	2744	10	0	0	2	1	0	1	0	3	8	80
5	3841	10	0	0	1	-	1	2	2	3	9	90
Control	-	10	0	0	0	0	0	0	0	0	0	0

Table 4

Diet toxicity of the imidaclopride towards the Japanese quail

Group no.	No. of birds/ group	Dose mg/ Kilo diet	Dose log. mg/kilo diet	Lethality %	Probit	LC 50 mg./kilo diet
1.	10	1000	3,00	10	3,72	1962,82
2.	10	1400	3,14	20	4,16	
3.	10	1960	3,29	50	5,00	
4.	10	2744	3,43	80	5,83	
5.	10	3841	3,58	90	6,27	
6.	10	-	-	-	-	

LC_{90} = 3642,80
LC_{95}= 4334,76
Correlation coefficient R = 0,9919755
HI test = 0,2830658
Theoretical value for HI = 7,815