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Evaluation scheme for *Blatta orientalis* and *Blattella germanica* in food units with HACCP implementation

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Abstract

Blattella germanica and *Blatta orientalis* are the most common insects found in food industry, houses, offices, hotels, schools, etc. The aim of this study is the evaluation of gel baits efficiency (2.15% imidacloprid) against *Blatta orientalis* and *Blattella germanica* in albanian food units. The study was carried out in Tirana from June 2012 to June 2013 in 14 infested supermarkets, 13 of which were treated with 2.15% imidacloprid while 1 served as control unit. Monitor traps and visual inspection were used to estimate pre and post-treatment insect's density. The latter in treated units was reduced compared to the control unit. There was a decrease since the 1st week while the total elimination was achieved by the end of week 9. The obtained results indicate that 2.15 % imidacloprid gel baits are more efficient to eliminate *Blattella germanica* and *Blatta orientalis*. However, these results contradict the fact that dust and spray insecticides are more effective. On the other hand, gel baits are considered a valuable choice in Albania also for the control and eradication of *Blattella germanica* and *Blatta orientalis* from infested area. It is regarded safe for humans and the environment compared to spray or dust insecticides.

Key words: Blatella, gel baits, insecticide, imidacloprid, HACCP

Abbreviations: Hazard Analysis Critical Control Point (HACCP), Integrated Pest Management (IPM), Standard Operating Procedures (SOP), Critical Control Point (CCP), Blattella germanica (B.germanica), Blatta orientalis (B.orientalis)

1. Introduction

Blattella germanica (B.germanica) and *Blatta orientalis (B.orientalis)* are the most common insects found in food industry, houses, offices, hotels, schools, etc. This class of insects is classified as harmful due to environmental pollution, economic damages and as potential vectors for the transmission of bacteria (Salmonella, Shigella, Escherichia coli O157, etc,) viruses, protozoa, helminthes, etc [3] causing gastroenteritis, dysentery, typhoid, hepatitis, toxoplasmosis, etc; diseases are developed as a result of food contamination with insects salivary gland secretion, or dissemination of the pathogens to foods while allergic diseases are developed as a result of allergens [23] (dried feces, body parts, etc) in the air which are inhaled by people through respiratory tract.

Effective control is based on early detection, right identification and effective treatment through methods/techniques based on Integrated Pest Management (IPM) ; IPM practices aims to suppress pest population below the health injury level, economic and environmental level [27]; IPM is based on pests exclusion, sanitation and selective selection of pesticides, leaving more space to the problem prevention [7].

Gel baits with imidacloprid, fipronil, etc (as active ingredient, elements of IPM practices) is more effective in cockroaches control because lethal dose is consumed in a single meal [19].

Gel baits advantages are: they do not act through contact, do not evaporate in the environment and are placed in precise locations inaccessible by animals and humans avoiding environmental pollution. In this procedure does not exist risk to animals, humans as well as bait consumption from non target species.

Target insects are fed continuously until the final consumption of the bait.

Gel baits offer long term protection since dose receipt time to death allows the insects to transport the bait in their nest where stools serve as food source for others insects starting a domino style death process. They have been the main methods for cockroach control in the United States for at least 5-8 years [15].

Spray or dust insecticides eliminate only visible insects and as long as the colony/nest remain unaffected the problem will continue.

Hazard Analysis Critical Control Point (HACCP) system and the European Regulation of Hygiene implementation in food industry was followed by the request for new techniques/schemes application for biological pests control as cockroaches, application and the implementation of which should be based on Integrated Pest Management (IPM) practices. On the other side a successful HACCP system is not accessible if it is not well designed and without the right operation of Standard Operating Procedures (SOP), which should be specific for proper tasks within the facility. Pest management/control is one of the specific functions where the SOP can be implemented [25]. Pest management is not part of the food chain, but is a way to reduce/eliminate pests that can cause hazard in foods. Pest control should act in whole food chain and it is not a Critical Control Point (CCP) [11], but is a manner to control and monitor a CCP (a point in food process to be controlled, monitor, take corrective action and document findings). In some storage areas where the presence of pests is determined "critical" to food safety by the HACCP system, the absence of pests becomes a CCP and pest management becomes the means of controlling and monitoring pests in that part of the food process [11].

Gel form insecticides for *B.germanica* and *B.orientalis* control has been study less and has few practical data for efficacy, toxicity to humans, environment or monetary cost, compared with the data and studies on spray/dust insecticides.

The aim of this study is the evaluation of gel baits efficiency (2.15% imidacloprid) against *Blatta orientalis* and *Blattella germanica* in albanian food units.

2. Material and methods

The study was conducted in Tirana during June 2012 to June 2013 in 14 infested supermarkets in different areas. Out of them, 13units were treated with 2.15% imidacloprid while 1 served as control.

2.1. Monitoring and pre-treatment infestation level evaluation

Monitor traps placed in preferred cockroaches' places were around 10. They were checked after 24 h for type and number of present insect, spatial distribution and insects' model movement during the displacement of various facilities. Visual inspection was conducted around 23:00 h because insects are more visible at night; . The duration of cockroaches counting was 5 minutes with switched on light at the time of counting [26]. Finally we arrived to calculate infestation level which was as follow : > 75 individuals counted – severe infestation, 25-75 individuals counted - moderate infestation, < 25 individuals counted – light infestation [19].

2.2. Facilities sanitation .

Sanitation is very important for the control of *B.germanica* and *B.orientalis* because these insects cannot live without food and water. Sanitation included cleaning, daily removal of waste, empting the sink and floor water collection pipes, removal of any potential source of food and water.

2.3. Insecticide treatment

13 supermarkets were treated with 2.15 % imidacloprid as follow for *B.germanica* in light infestation 1 drops*/ $m^{2,}$, in severe infestation 2 drops/m^2; while for *B.orientalis* the treatment was as follows in light infestation 2 drops*/$m^{2,}$; in severe infestation 3 drops/m^2 (drops weigh is about 0,03 g).

Drops replacement and control was carried out every week for 9 week.

Traps monitor and visual inspection were used for infested level evaluation, for 9 weeks. At the end of the period we found that the percentage infestation was reduced. The calculation was done using the following formula : % reduction =100 - (C1/T1*T2/C2) * 100 [18]. Where C1= the number of cockroaches in control unit, pre-treatment; T1= the number of cockroaches in treatment unit, pre-treatment; C2= the number of cockroaches in control unit, post-treatment; T2= the number of cockroaches in treatment unit, post-treatment.

3. Results and Discussion

The 13 infested supermarkets with *B.orientalis* dhe *B.germanica* were treated with 2.15 % imidacloprid for 9 weeks. Pre and post- treatment insects' number in the treatment and control units and percentage reduction in cockroach density for 9 weeks are presented in Tables 1 and 2.

The insects reduction observed during the first week was 33.5%, 24.3%, 24.0%, 25.0%, 36.0%, 19.0%, 22.0%, 26.0%, 32.2%, 43.1%, 25.0%, 39.0%, 12.5% , in 13 treated supermarkets in comparison with

control supermarket, while at the end of week 9 the percentage was 100 % in all treated supermarkets.

Foreign studies show that extensive use of insecticides has led to the development of resistance in German cockroach to a wide range of insecticides including organochlorines, organophosphates, carbamates and pyrethroids [1] and consequent control failures in some field populations have been reported.

The control of *B. orientalis* and *B.germanica* in Albania is usually performed with classical methods (dust/spray insecticides) without considering IPM practices.

The results of IPM practices conducted in this study show that 2.15 % imadocloprid gel baits are very effective for *B. germanica* and *B. orientalis* control and contradicts the facts that insecticides spray/dust are more effective

Table 1 Pre-treatment and post- treatment insects' average number with visual inspection and traps monitor

Unit	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***	***Control***
Pre-treatment insects' number	125	111	183	205	75	99	72	108	98	180	120	122	153	143
Post- treatment (week)														
1	90	91	151	167	52	87	61	87	72	111	98	81	145	155
2	80	66	93	135	41	70	49	70	60	90	77	73	128	160
3	40	34	50	70	19	41	27	37	30	38	40	33	82	121
4	35	22	35	51	15	38	24	24	24	25	28	27	63	156
5	27	15	23	49	10	29	19	20	23	16	17	20	39	231
6	13	8	12	26	6	18	13	10	12	9	9	12	18	258
7	5	3	4	11	2	7	6	4	7	3	3	5	6	239
8	1	1	1	4	1	2	2	1	2	1	1	1	2	229
9	0	0	0	0	0	0	0	0	0	0	0	0	0	145

Table 2 Percentage reduction of insects' density in treated units versus control unit

Unit	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***
Post- treatment (week)													
1	33.5	24.3	24.0	25.0	36.0	19.0	22.0	26.0	32.2	43.1	25.0	39.0	12.5
2	42.8	47.0	54.5	41.1	51.1	37.0	39.1	42.0	45.2	55.3	43.0	46.5	25.2
3	43.1	52.1	57.5	46.3	53.1	40.0	43.3	45.5	47.0	56.1	48.0	48.0	27.5
4	55.1	66.0	61.4	61.2	62.4	44.3	50.0	65.0	59.0	71.5	63.0	62.0	49.5
5	65.0	77.0	76.0	63.3	72.4	63.0	63.1	72.0	60.0	78.0	78.0	68.2	75.0
6	77.5	78.0	79.2	69.1	76.0	71.3	67.2	75.0	70.0	78.2	80.5	73.1	83.0
7	82.1	81.0	83.1	78.3	80.1	77.0	70.0	81.0	70.5	82.0	83.0	76.0	85.1
8	91.3	86.0	91.0	83.0	81.2	87.4	83.0	89.0	81.2	87.4	87.4	91.0	88.4
9	100	100	100	100	100	100	100	100	100	100	100	100	100

4. Conclusions

Ecological traps monitoring, sanitation and gel baits usage are some of the IPM most effective ways for cockroach control

5. References

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