THE EFFICACY OF 25% DIFLUBENZURON FED TO POULTRY TO CONTROL SYNANTHROPIC FLIES IN THE DUNG

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SUMMARY: Many fly species bred in dung accumulating underneath the chicken cages and they represent a serious risk for human and animal health since several of then can act as disease vectors. There are restrictions to the exclusive use for insecticides against fly proliferation since many of them can be toxic against natural predators of such flies and also because these can quickly develop genetic insecticide resistance. IGR becomes, therefore, one of the available alternatives because they can be employed in such a manner that fly proliferation is controlled without seriously affecting its natural predators. The activity of 25% diflubenzuron against synanthropic flies in chicken houses was assayed in the feed of commercial laying chickens (2g/Kg) in two chicken houses. In the first one the chickens received along 15 days the medicated ration and in the second one (control group) the untreated food, which was the same provided to the treated group after the initial fortnight. The experimental parameters, evaluated along 63 days were based on weekly sampling the feces under the chicken cages, for viability of fly larvae and rate of emergence of adults flies, both for treated and control groups. This rate of emergence before treatment (zero day) was equally high for both groups. The total inhibitory effect of diflubenzuron against larvae development lasted up to the 18th day after treatment when a few of them developed until the pupal stage but didn't resulted in adult emergence up to the 49th day. The feces from the treated chickens differed conspicuously from there of the control ones in appearance, since those were dry and good for sale while the control ones became liquefied and commercially valueless. The experimental data conduct to the conclusion that 25% diflubenzuron, at the rate of 2g/Kg in the food, can be recommended for the control of synanthropic flies in the feces of commercial egg laying chickens.

KEY WORDS: Diflubenzuron; Synanthropic Flies; Poultry.

INTRODUCTION

The technologic advancements introduced in the poultry industry allowed for a higher populational density of birds with an increased efficiency of production and a decreased operational cost. On the other hand, specially when breeding for egg production, the large number of chickens per square meter results in dung accumulation and attracts large numbers of flies which proliferate in this fecal substrate and become one of the most serious problems of contemporary aviculture, to which it causes considerable economic loss. Besides, specially in Summer, many of the involved species of flies may act as vectors of pathogenic organisms for domestic animals and for human beings.

The control of flies in dung deposits constitutes a difficult enterprise, due to the diversity of the existing types of installations, of the ways of management and of climatic variations all of which call for the elaboration of integrate programs of fly control. The sole use of insecticides employed by many producers meets with restrictions since most of the available insecticides can be also toxic to natural parasites and predators upon the flies and may quickly select these flies for insecticide resistance (AXTELL & ARENDS, 1990).

One of the existing alternatives for the control of these insects is the use of "insect growth regulators" (IGR) which affect exclusively the flies without any significant toxic damage upon their natural enemies.

IGR products have been developed which act effectively against fly larvae, specially upon their first instar, hindering their aptitude to moult to the next stage and disabling pupae eventually contacting the IGR product to reach the adult stage. Because of their safety and of the extreme easiness of their use.

IGR preparations can be added to poultry feed, which are ingested and later expelled with the bird's feces (GUIMARÃES, 1997).

Experiments conducted in which IGR (cyromazine) was added to the feed of laying chickens under different housing conditions resulted in quick decrease in the fly population and in the number of larvae in the excrements of the birds, while no adverse effect was detected upon their natural predator's populations (AXTELL & EDWARDS, 1983; MULLA & ALXELROD, 1983; QUISENBERRY & FOSTER, 1984; BAJOMI *et alii*, 1990; FARKAS, 1990).

BRAKE *et alii* (1991) found larvicide activity for several weeks after removal of the cyromazine from the feed of egg laying hens when yet at their growing stage.

MABBETT (1987), trying diflubenzuron and cyromazine in the feed against the common domestic fly (*Musca domestica* LINNAEUS, 1758) concluded that both these chemicals reduced the emergence of adult flies in 93,95% and 97,84%, respectively, from the feces of the treated birds. When these substances were powdered over bird excrements the fly number reduction was around 86,21% for diflubenzuron and 96,92% for cyromazine; the number of abnormal pupae also grew when these chemicals were mixed with the bird's feed or powdered over their excrements.

GIGA (1987) referred that both diflubenzuron and cyromazine were equally effective in controlling fly proliferation in bird feces when experimenting with *Musca domestica*: they were more effective when added to feed than when powdered over the feces. But, according to MABBETT (1987), the use of such active principles was more effective when applied over the feces than when added to poultry feed, in what concerned the emergence of *Musca domestica* adult flies.

Employing diflubenzuron to control *Musca domestica*, at the concentrations of 0,01% and 0,005% in poultry dung, AGUIRRE *et alii* (1991) observed that the emergence of flies were, respectively, 11,3% and 35,3% for the first and second employed rates, and also that the recovered pupae were abnormal.

According to KEIDNIG *et alii* (1992), moderate or high resistance of flies against IGR preparations may develop as consequences of the level of the selection pressure exerted, as for instance when these chemicals are added to the bird's feed, along their complete production cycle. They suggest the application the chemicals directly over the feces or the use of smaller drug rates in the feed.

The objective of this assay was the evaluation of the efficacy of diflubenzuron 25% when added to poultry feed at the rate of 2g/Kg to inhibit the larvae of synanthropic flies in industrial chicken houses.

MATERIALS AND METHODS

Two flies infested chicken houses harboring egg-laying chickens, belonging to a commercial egg production farm, were chosen for the experiment. Each pavillion harbored 320 chickens, in wire cages arranged in two rows 20m long.

Table 1 – Distribution of experimental groups.

Group	Treatment	IGR doses (g/Kg of feed)	Administration way
1*	Diflubenzuron 25%***	2,00	feed
2**	Control	—	—

* Pavillion 1; ** Pavillion 2; *** Champion Farmoquímico Ltda.

The dung area below the cages in each row was randomly subdivided, in each of the two pavillions into eight areas of 5m^2; in each of these eight repeated dung areas dropped the feces of 20 chickens, which were casually subject to the treatments, as presented in Table 1.

The Diflubenzuron was added to the feed at its preparation stage, that is to say, at the feed factory from where it was brought to the chicken farm.After the random distribution of the experimental groups the meal troughs for the group to be treated was filled with the medicated mixture and refilled as required in order that the chickens of the group consumed it *ad libitum* during a fortnight. After this time these birds had their food shifted to the untreated meal, which was the one received by the control group along the entire experimental time.

The evaluated experimental parameters, for each of fly species found in the dung, were: fly larvae viability (LV); rate of inhibition of fly emergence (EI). For the evaluation of viability of the fly larvae present in the chicken dung for each of the experimental repetitions, samples of 500 g of feces were taken, at the following times: zero day before treatment (0DBT), seven days during treatment (7DDT) and fourteen days during treatment (14DDT), and 4, 11, 18, 28, 36, 42, and 49 days after the 1 the last treatment day (4DAT, 11DAT, 18DAT, 28DAT; 36DAT; 42DAT and 49DAT).

The dung samples were put in adequate containers, which were then transferred to culture boxes (BELO, 1991) kept at room temperature during 15 days. After this time the emerged flies in each repetition were collected, identified and counted.

The inhibition of emergence rates were evaluated by means of the formula described by MULLA *et alii* (1975):

$$EI = 100 – T/C (100), \text{ where}$$

T = number of emerged flies in the treated group.
C = number of emerged flies in the control group.

An entirely random design was employed, with two treatments and eight repetitions for each treatment; for the analysis of variance the counts of emerged flies were transformed into log (x+1), for which the geometric averages were extracted (GOMES, 1987). The F values were considered significant when $p<0,05$ (SAS, 1989).

RESULTS AND DISCUSSION

The fly emergence rates at the zero day before treatment (0 DBT) were equally high in both experimental groups.

From after the begining of the treatment up to the last sampling day the number of emerged flies decreased significantly in the treated when compared to the control group, in which the counts of emerged flies kept very high. These results agree with the ones registered in the studied references, whose authors used IGR preparations in feed and observed a quick decline in the fly larvae population in the dung of treated birds (AXTELL *et alii*, 1990; FARKAS, 1990).

It was also observed that the fecal mass growing under the cages of the treated group kept visually drier and free of fly larvae or contained a very small number of them; while in the control group the feces seemed as liquefied.

On the 18th day after the end of the treatment a few fly larvae appeared on the feces of the treated group, but the samplings done at that day showed that these few larvae developed only to the pupal stage and did not release any adult fly. On the subsequent days, the larvae seen on the feces of treated birds tended to complete their life cycles and to fulfill a normal rate of emergence of the adult stage. The findings agree to those of MABBETT (1987), who also observed abnormal pupae and low emergence rate of adult flies, when diflubenzuron had been previously included in the feed.

In Table 2 are inscribed: average counts of emerged flies, their amplitude of variation and the percent of emergence inhibition.

The efficacy percentual rate of the tested drug was still rather high 42 days after the treatment interruption (91,95%),decreasing on the 49th day (88,73%). MABBETT (1987) and AGUIRRE (1991),

Table 2 – Average fly counts, its variation amplitude and rate of emergence inhibition from treated and control groups. *Geometric averages*.

Sampling	DIFLUBENZURON (25%)*		G2: CONTROL		rate of emergence inhibition
	Fly counts		Fly counts		
day	average	variation amplitude	average	variation amplitude	(EI)
D0 AT	780,7473	2,4330 - 3,1790	715,4689	2,4456 - 3,1082	—
D7 DT	0,0000	0,0000 - 0,0000	458,8996	1,8388 - 2,9703	100,00
D14 DT	0,5596	0,0000 - 0,8451	476,3104	2,4440 - 3,1855	99,88
D4 PT	0,0000	0,0000 - 0,0000	925,1050	2,7267 - 3,1489	100,00
D11 PT	0,0000	0,0000 - 0,0000	1030,5540	2,8426 - 3,1706	100,00
D18 PT	0,0000	0,0000 - 0,0000	839,2128	2,4048 - 3,8908	100,00
D28 PT	4,5807	0,0000 - 1,9912	392,0281	1,9138 - 3,0565	98,83
D35 PT	27,4278	0,0000 - 3,0473	537,7891	1,8195 - 2,9562	94,90
D42 PT	13,4523	0,0000 - 2,7490	167,0638	0,6990 - 3,2312	91,95
D49 PT	86,9138	0,9542 - 3,1694	770,9975	2,2672 - 3,2874	88,73

*: Geometric average=antilog[1/n $\sum$ log(x+1)]-1

Table 3 – Medium values and results obtained in the variance analysis for emergency of flies [data transformed in log(x+1)] of the groups treated and control.

TREATMENT	Medium number of flies / Day of sampling									
	D0 AT	D7 DT	D14 DT	D4 PT	D11 PT	D18 PT	D28 PT	D35 PT	D42 PT	D49 PT
DIFLUBENZURON (25%)*	2,89a	0,00a	0,19a	0,00a	0,00a	0,00a	0,75a	1,45a	1,16a	1,94a
CONTROL	2,86a	2,66b	2,68b	2,97b	3,01b	2,92b	2,59b	2,73b	2,23b	2,89b
TEST F	0,11	444,57	264,48	3018,06	6062,2	282,44	49,52	10,58	4,84	7,68
Pr > F(2)	0,7462	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0058	0,0451	0,015
CV	7,98	18,97	21,29	7,28	5,14	23,8	31,44	37,54	57,23	28,19

(1) averages followed by at least a letter in common doesn't differ to each other for the test F.
(2): significância probability associated to the value of F
CV: Coefficient of Variation (%).

who found 93,95% and 88,70% respectively reported similar results. It was also observed from the 7th day during treatment to the 18th after the end of the treatment the inhibition rate of emergence was kept at the 100% level.

In Table 3 are displayed the results of the statistical analysis.

The decision of closing the experiment on the 63rd day counted from its beginning (D49PT), when the difference of fly counts between treated and control groups was still significant, was based on the observation that many of the larvae from the treated group were able to complete their biological cycle and developed normal – looking adult flies, even if their emergence rate kept still 88,73% lower than those from the control group. Another reason to end the experiment was that around the 63rd day the volumes of dung below the cages were rather high and that those from the treated group were dry, allowing them to be sold, a common destination of the dung at commercial enterprises and one of their income sources.

The emerged flies were classified as *Chrysomya putoria* (WIEDEMANN, 1818).

Diflubenzuron 25% was effective in inhibiting synanthropic fly larvae in the dung from egg laying chickens at a commercial poultry farm. Its effect was long lasting, suppressing for over 18 days the development of such larvae (100% efficacy) and later inhibiting, for as long as 49 days after the interruption of administration of the drug in the food, the irruption of the flies from the pupae (88,73% efficacy), which showed morphological abnormalities. The dung from treated birds showed better commercial conditions than the dung from control chickens.

SUMÁRIO

Muitas espécies de moscas que se criam no esterco acumulado sob gaiolas de poedeiras representam séria ameaça para a saúde animal e também humana, pois estas podem ser vetores de microrganismos patogênicos, além de causarem transtornos ao serem carreadas para áreas urbanas. O uso exclusivo de inseticidas é restrito, pois a maioria são também tóxicos a predadores naturais e, além disso, o desenvolvimento de resistência aos inseticidas é rápido. Uma das alternativas encontradas é a utilização de reguladores de crescimento, que agem sem afetar os inimigos naturais. A atividade do Diflubenzuron (25%) no controle de moscas em aviários foi avaliada, sendo aplicado via ração (2g/Kg) de poedeiras comerciais em fase de produção. O experimento foi conduzido em dois galpões de aves (galpão 1: Grupo Tratado; galpão 2: Grupo Controle) de postura (ovos comerciais) e com duração de 63 dias, dos quais, durante 15 dias, o grupo tratado recebeu ração com medicamento. Após este período as aves voltaram a receber ração sem qualquer aditivo para controle de moscas. Os parâmetros avaliados foram: viabilidade de larvas de dípteros (colheitas de fezes, sob as gaiolas, de oito repetições/grupo em intervalos de sete dias) e taxa de inibição de emergência (baseada no número de moscas emergidas nos grupos controle e tratado). O número de moscas emergidas, antes do tratamento, foi elevado nos dois grupos. O efeito da aplicação do Diflubenzuron (25%) foi prolongado, sem o aparecimento de larvas nas fezes até 18 dias do tratamento. Após este período, ocorreu redução da emergência de moscas até 49 dias pós-aplicação. O Diflubenzuron (25%) possibilitou, ainda, que as fezes se mantivessem secas tornando-as viáveis à comercialização. Em síntese, pode-se recomendar o Diflubenzuron (25%), na dose de 2g/kg ração, para o controle de moscas sinantrópicas em aviários destinados a aves de postura.

PALAVRAS-CHAVE: Diflubenzuron; moscas sinantrópicas; poedeiras.

ACKNOWLEDGEMENTS

The authors are indebted to Mr. Fortunato Alexandre Ferreira for his, Laboratory Expert, and to the “Frei Arnaldo Maria de Itaporangi Rural School” Votuporanga County, São Paulo State, Brazil, for their efficient help.

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