Revista Brasileira de Ciência Avícola
ISSN: 1516-635X
revista@facta.org.br
Fundação APINCO de Ciência e Tecnologia Avícolas
Brasil

Camargo Neto, AF; Tallarico, E; Capriogli, MA; Soares, VE; Meireles, MV; Silva, GS
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Revista Brasileira de Ciência Avícola, vol. 8, núm. 3, julio-septiembre, 2006, pp. 183-185
Fundação APINCO de Ciência e Tecnologia Avícolas
Campinas, SP, Brasil

Brazilian Journal of Poultry Science
Revista Brasileira de Ciência Avícola

ISSN 1516-635X Jul - Sep 2006 / v.8 / n.3 / 183 - 185

Seasonal Variation of *Alphitobius diaperinus* Population in Broiler Facilities in the Center-North Region of The State of São Paulo

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■ **Keywords**

Alphitobius diaperinus, broiler chickens, monitoring, seasonality.

ABSTRACT

The seasonality of *Alphitobius diaperinus* population was studied during different seasons during one year, in broiler facilities located in the center-north region of the State of São Paulo. Parasite counting was weekly carried out by the use of traps adapted from the modified model of Arends. During the experimental period, facilities were not submitted to chemical treatment, and the litter was changed between flocks. A lower number of adults and larvae was observed during autumn, with the peak registered in the summer. There was no significant difference between spring and winter averages (adults and larvae), and between spring and summer averages (adults). Average temperatures in the facilities varied from 23.4°C (winter) to 27.1°C (spring). The environmentally controlled systems used by the broiler industry provide an adequate habitat for *A. diaperinus* development. The continuous monitoring of the population of this parasite is essential for designing control strategies, and this can be accomplished by utilizing the traps used in the present experiment.

INTRODUCTION

Alphitobius diaperinus parasitism in poultry facilities has become a world-wide problem for the poultry industry (Paiva, 2000; Pfeiffer & Axtell, 1980; Salin *et al.*, 2003; Steelman, 1996).

The adverse factors resulting from such parasitism are indicated by the fact that this parasite can be a vector, a reservoir, or an intermediate host of important poultry pathogens, such as Cestoda parasites, *Eimeria* spp., *Escherichia coli*, *Salmonella* spp., *Aspergillus* spp., as well as of Marek´s disease, Gumboro disease, avian influenza, and Newcastle disease viruses (Arends, 1987; Safrit & Axtell, 1984). In addition, this beetle can be used as an alternative food item by chickens, interfering in the birds' development, and thereby causing lack of flock uniformity (Matias, 2000). Morevover, it can have direct action in poultry facilities by destroying equipments inside the poultry house (Turner, 1986)

The environmental conditions in controlled production systems of the poultry facilities (temperature, moisture, and feed present in the litter) provide a favorable habitat for the development and the survival of *A. diaperinus*. The beetles often gather in areas with higher temperature, suitable moisture, and available nutrients (Axtell & Arends, 1990).

Litter utilized for several grow-outs is a very favorable environment for *A. diaperinus* development, promoting a rapid increase in this beetle's population (Arends, 1987). According to Despins *et al.* (1989), *A. diaperinus* adults and larvae prefer to remain in manure habitats with 30 to 40% of moisture, and leave the manure when moisture level increases to 50 and 60%.

Arrived: October / 2005
Approved: May / 2006

The favorable temperature for the development and the survival of immature stages of *A. diaperinus* was 31°C (Chernaki & Almeida, 2001). Egg hatching or larval development occurred at 17°C, and development time (days) was lower for eggs, larvae, pupae, as well as from oviposition to adult emergence at 35° and 38°C (Rueda & Axtell, 1996).

Biosecurity programs implemented by poultry companies should include measures to control *A. diaperinus* development in poultry houses. Integrated management and chemical control of *A. diaperinus* have been recommended and adopted with the purpose of reducing its population, at a lower cost, lower risk, and higher efficiency.

Understanding the biology, the epidemiology, and the behavior of this parasite is essential to determine control measures in biosecurity programs, and it is a priority for research development.

Monitoring beetle populations in poultry houses is necessary in order to carry out limited control measures, and the use of tube traps is recommended (Axtell & Arends, 1990).

In the present study, the monitoring of *A. diaperinus* presence in poultry houses located in the center-north region of the State of São Paulo (municipality of Descalvado) was performed during the period of one year, with the determination of its seasonal variation in the autumn, winter, spring, and summer.

MATERIAL AND METHODS

Experimental facilities

This research was performed in naturally infested broiler houses located in the municipality of Descalvado, in the center-north region of the State of São Paulo. The presence of *A. diaperinus* was confirmed by counting adults and larvae in the litter (Thirty-six locations).

During the experimental period of one year, the facility housed six broiler flocks, with a production cycle of 42 days, and an average downtime of 12 days. The facility was not submitted to any chemical treatment during the experimental period, and the litter, consisting of peanut hulls, was changed between flocks.

Experimental evaluation

Traps were adapted from the modified model of Arends (Silva, 2001), and were used to monitor and to evaluate *A. diaperinus* presence. Thirty six traps were placed at different locations inside of the poultry house for homogeneous evaluation of the entire facility. At weekly intervals, the contents of the traps were collected and the number of adults and larvae of *A. diaperinus* was determined in the laboratory. The temperature inside the facilities was recorded on the same days of traps collections.

RESULTS AND DISCUSSION

The mean numbers of adults and larvae in the contents of the traps during the different seasons are presented in the Tables 1 and 2. There was a lower degree of infestation of adults and larvae in autumn, which showed lower average infestation ($p < 0.05$) as compared to the other seasons. The degree of parasitism was intensified in the subsequent months; however, averages corresponding to winter and spring were not statistically different ($p > 0.05$).

The peak of the infestation occurred during the summer (adults: 35,989 and larvae: 435,13 - means), when the larvae infestation was significantly ($p < 0.05$) higher as compared to the other seasons. However, means of adults were statistically equal during spring and summer ($p > 0.05$).

In the modern poultry industry, temperature and humidity levels are controlled and kept in uniform levels, resulting in a higher comfort for broilers of different ages, continuously providing an ideal habitat for the development of *A. diaperinus*. Chernack & Almeida (2001) evaluated the effect of constant temperatures (22°C, 25°C, 28°C, and 31°C) on immature stages of

Table 1 - Mean, standard deviation, and results of multiple comparisons of adult *Alphitobius* numbers diaperinus [data transformed in log(x+1)] in the different seasons. Descalvado, SP.

	Seasons			
	Autumn 26,3°C	**Winter** 23,4°C	**Spring** 27,1°C	**Summer** 25,6°C
Averages	5,43±9,01	19,59±21,86	29,26±34,13	59,09±53,76
Interval of Variation	0,00 - 41,25	0,00 - 66,25	1,33 - 156,25	0,13 - 264,44
Mean	2,0993±0,5112	8,5186±0,6297	16,4206±0,4760	35,9889±0,5169
Interval of Variation	0,0000 - 1,6258	0,0000 - 1,8277	0,3680 - 2,1966	0,0512 - 2,4240
∑ log (x+1)/36*	0.4912[C]	0.9786[B]	1.2411[AB]	1.5681[A]

*:Means followed by similar letters are similar by the test of Tukey ($p > 0.05$). LSD - Least Significant Diference=0.3292. CV- Coefficient of Variation=50.16.

Table 2 - Means, standard deviations, and results of multiple comparations larvae numbers of Alphitobius diaperinus [data transformed in log(x+1)] durinbg the different seasons. Descalvado, SP.

	Seasons			
	Autumn 26,3°C	**Winter** 23,4°C	**Spring** 27,1°C	**Summer** 25,6°C
Average	75,67±196,27	132,47±171,06	178,97±173,95	586,57±369,94
Interval of Variation	0,00 - 1091,92	0,42 - 841,67	4,67 - 738,08	20,25 - 1351,56
Geometric Mean	11,4862±0,7861	50,2819±0,7069	100,2755±0,5349	435,1275±0,4074
Interval of Variation	0,0000 - 3,0386	0,1513 - 2,9257	0,7533 - 2,8687	1,3274 - 3,1312
$\sum$ log (x+1)/36*	1.0964[C]	1.7100[B]	2.0055[B]	2.6396[A]

*:Means followed by similar letters are similar by the test of Tukey (p>0.05).LSD - Least Significant Diference=0.3292.

A. diaperinus, and observed parasite development in the four analyzed temperatures. At 22°C, longer duration of the development, and a lower parasite survival were observed. The temperature of 31°C was the most favorable for the development of immature stages, with higher survival. Rueda & Axtell (1996) observed that development duration (days) were shorter for eggs, larvae, pupae, as well oviposition to adult emergence time at 35° and 38°C.

In the present study, the largest variation in the room temperature was of 3.7°C, between the winter (23,4°C) and spring (27,1°C), which apparently did not interfere in the results. It is emphasized here that there was an expressive increase in *A. diaperinus* population during the winter, confirming that infestation is specifically related to the controlled environmental conditions in poultry houses. Such fact contradicts statements found in the literature, which suggest that the control of this parasite should be planned taking into account the climatic season, such as the winter, due to the fact that the temperature falls, and therefore there is a consequent decrease in the metabolic activity of this parasite.

In this context, monitoring of the local population is an essential tool for designing control strategies, which is consistent with the recommendations available in the literature (Leffer *et al.*, 2002). The control may be achieved by the use of the traps used in the present experiment.

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