Ciência Rural
ISSN: 0103-8478
cienciarural@mail.ufsm.br
Universidade Federal de Santa Maria
Brasil

Moscarelli Pinto, Diego; Lessa Pinto Duarte, Juliano; Bretanha Ribeiro, Paulo; Silveira Júnior, Paulo
Collection of Coleoptera from a poultry farm in Pelotas, Rio Grande do Sul, Brazil
Ciência Rural, vol. 39, núm. 2, marzo-abril, 2009, pp. 319-324
Universidade Federal de Santa Maria
Santa Maria, Brasil

Ciência Rural, Santa Maria, v.39, n.2, p.319-324, mar-abr, 2009
ISSN 0103-8478

Collection of Coleoptera from a poultry farm in Pelotas, Rio Grande do Sul, Brazil

Flutuação de Coleoptera em granja avícola, em Pelotas, Rio Grande do Sul, Brasil

Diego Moscarelli Pinto[I] Juliano Lessa Pinto Duarte[II] Paulo Bretanha Ribeiro[III] Paulo Silveira Júnior[IV]

ABSTRACT

To evaluate the population fluctuation of Coleoptera from a poultry farm in Pelotas, Rio Grande do Sul, Brazil, two sampling methods were used: a tube-type trap and a sandwich trap. The analyses of polynomial regression were applied independent of the type of sampling method used. The experiment was carried out for twelve months, from April 2002 to March 2003, in a broiler barn aviary at the Conjunto Agrotécnico Visconde da Graça/UFPEL. A total of 43.945 Coleopterans were captured from the following species: ***Alphitobius diaperinus****,* ***Carcinops troglodytes****,* ***Euspilotus rubriculus****,* ***Gnathocerus cornutus****,* ***Mezium americanum*** *and* ***Somotrichus unifasciatus****. Among these,* ***Alphitobius diaperinus*** *was present in all months of the year, with larval population peak in February (235) and lowest capture in August (01). The adult population peak was in March (12,020) and the lowest capture in July (27). The remaining captured Coleopterans did not occur in all twelve months, however they also had population peaks in the months of February and March, which also were the months with the highest temperatures.*

Key words: *Coleoptera, aviary, population fluctuation.*

RESUMO

Para avaliação da flutuação populacional de Coleoptera, em granja avícola, em Pelotas, Rio Grande do Sul, Brasil, foram utilizados dois métodos de coleta: armadilha do tipo tubo e do tipo sanduíche, durante doze meses. A análise de regressão polinomial foi aplicada independentemente do tipo de método de coleta utilizado. O experimento foi conduzido durante 12 meses, de abril de 2002 a março de 2003, em um aviário de aves poedeiras do Conjunto Agrotécnico Visconde da Graça da Universidade Federal de Pelotas (UFPEL). Foram capturados 43.945 Coleopteros das espécies ***Alphitobius diaperinus****,* ***Carcinops troglodytes****,* ***Euspilotus rubriculus****,* ***Gnathocerus cornutus****,* ***Mezium americanum*** *e* ***Somotrichus unifasciatus****. Entre esses Coleopteros,* ***Alphitobius diaperinus*** *esteve presente em todos os meses do ano, com pico populacional de larvas em fevereiro (235) e menor índice de captura em agosto (01), sendo que o pico populacional de adultos foi em março (12.020) e o menor índice de captura ocorreu em julho (27). Os outros Coleopteros capturados não ocorreram durante os 12 meses de captura, porém, eles também tiveram pico populacional nos meses de fevereiro e março, que foram os de temperatura mais alta.*

Palavras-chave: *Coleoptera, aviário, flutuação populacional*

INTRODUCTION

The need to produce larger amounts of food necessitated the search for more intensive forms of production. One of the alternatives to increase food production of animal origin was the intensive management through confinement. But confinement also increased the concentration of animal excrement, creating in these places artificial ecosystems propitious to arthropod proliferation. Therefore some species of coleopterans became synantropic and because some of them are vectors of pathogens they are of great medical-veterinary importance (FRANCISCO, 1996).

[I]Programa de Pós-graduação em Fitossanidade, Universidade Federal de Pelotas (UFPel), Instituto de Biologia, Departamento de Microbiologia e Parasitologia, Campus Universitário, CP 354, 96010-900, Pelotas, RS, Brasil. E-mail: dimoscarelli@yahoo.com.br. Autor para correspondência.
[II]Programa de Pós-graduação em Parasitologia, UFPel, Pelotas, RS, Brasil.
[III]Departamento de Microbiologia e Parasitologia, UFPel, Pelotas, RS, Brasil.
[IV]Departamento de Matemática e Estatística, UFPel, Pelotas, RS, Brasil.

Received 06.18.08 Approved 08.19.08

According to ODUM (1988) poultry farms differ from natural ecosystems because they posses auxiliary energy that optimizes or replaces the solar energy input; present reduced diversity of organisms which maximizes the production of one food or product, and put the dominant animals under artificial not natural selection. Also according to ODUM (1997), a community is characterized by its dynamics, which means that as time flows the composition of species and the complexity of the community changes thus creating an increase in diversity. PINTO-COELHO (2000) described biodiversity as the study of the quantitative relations between species richness and abundance inside a community.

The diversity of arthropods found in accumulated dung in places where domestic birds are maintained is very large and these arthropods are mainly Coleopterans, dipterans and mites (AXTELL & ARENDS, 1990). Research is being done in order to understand poulatry farm agro-ecosystems and it indicates that some species of Coleopterans from the families Histeridae and Staphylinidae (PFEIFFER & AXTELL, 1980; AXTELL, 1986a; 1986b; AXTELL & ARENDS, 1990; BRUNO et al., 1993) and mites from the families of Macrochelidae and Uropodidae (AXTELL, 1986a; 1986b; GEDEN & AXTELL, 1988; AXTELL & ARENDS, 1990) are the main predators of eggs and larvae of dipterans. The study of the species that occur in environments modified by man assumes not only ecological but also sanitary importance because these species can be associated with many pathogenic organisms (MASCARINI, 1995).The objective of the present research was to estimate the population fluctuation of the most frequent Coleopteran species that occur in poultry farms in Pelotas, Rio Grande do Sul, Brazil.

MATERIALS AND METHODS

This research was conducted from April 2002 to March 2003 in a laying hen facility with capacity of 1.200 to 3.400 birds of the 'Isa Brown' lineage that were maintained at the Conjunto Agrotécnico Visconde da Graça (CAVG) farm, Universidade Federal de Pelotas, Rio Grande do Sul, Brazil. To collect the Coleopterans two methods were used: one using a tube type trap and the other using a sandwich type trap with corrugated paper inside. Sixteen traps were placed in groups of four in four different locations in the shed. Each group was composed of two tube type traps and two sandwich traps equidistant 30 cm one from each other.

The collections were made weekly and the content of each trap placed in identifiable plastic containers. The corrugated paper of each trap was replaced with a new one and the collected Coleopterans taken to the laboratory to be identified and quantified. The material collected as well as the date and observations of each trap were registered in a control table. The obtained results were submitted to an analysis of polynomial regression using the statistical program SANEST (ZONTA & MACHADO, 1984).

RESULTS AND DISCUSSION

Table 1 illustrates the monthly occurrence of collected Coleopterans. They had observed that only ***Alphitobius diaperinus*** (larvae and adults) (Coleoptera: Tenebrionidae) were present in all twelve months of collection. In figure 1 it is possible to observe that the monthly average temperature varied from 13.8ºC (September) to 24.7ºC (February) and that the monthly accumulated precipitation oscillated from 2.63mm (January) to 321.57mm (April). Considering the monthly distribution of coleopterans found the laying bird facility in Pelotas, RS we demonstrated that in the twelve months of collection there was a monthly variation in the number of captured species.

Alphitobius diaperinus (Tenebrionidae), which is a pest found in chicken bedding and also serves as a vector of pathogens to birds, was the most abundant species, with 41,027 specimens, representing 93.36% of all Coleopterans (Table 1). Similar results were obtained by FERNANDES et al. (1995), in Uberlândia, MG, who found ***A. diaperinus*** as the most abundant coleopteran in the investigational farm, totaling 1,713 out of 3,011 captured Coleopterans.

However PFEIFFER & AXTELL (1980) described ***A. diaperinus*** as the second most abundant species of the 120 Coleopteran species captured from farms of three regions of North Carolina. AAGENSEN (1988) in Bastos, SP and BRUNO et al. (1993) in diverse cities of São Paulo state registered *Alphitobius diaperinus* as the third most abundant Coleopteran in bird excrement on bird farms. BICHO (2001) using bird feces and tube-type traps or Arends determined ***A. diaperinus*** as the second Coleopteran species captured in a bird farm in Pelotas, RS.

The species ***A. diaperinus*** was present during the entire year and we were able to collect both larvae and adults. The highest number of collected larvae occurred in February (235) (Figure 2) when the monthly average temperature was also the highest (24.7ºC) (Figure 1). The lowest captures were in the months of August (01) and September (02) the months

Table 1 - Species of Coleoptera captured in a laying bird facility, April 2002 to March 2003, Pelotas, RS.

Order	Family	Species	Month (2002/2003) A	M	J	J	A	S	O	N	D	J	F	M	Total
Coleoptera	Tenebrionidae	***Alphitobius diaperinus*** (larvas)	69	98	51	03	01	02	50	52	134	193	235	203	1091
		Alphitobius diaperinus (adultos)	71	34	73	27	122	288	2036	1709	2935	9723	10898	12020	39936
		Gnatocerus cornutus	-	-	01	-	02	-	-	01	05	32	120	198	359
	Histeridae	***Carcinops troglodytes***	-	01	02	-	02	01	21	22	126	54	188	119	536
		Euspilotus rubriculus	-	01	-	-	-	01	66	22	07	08	72	42	219
	Ptinidae	***Mezium americanum***	-	-	02	01	-	01	09	14	37	66	121	116	367
	Carabidae	***Somotrichus unifasciatus***	-	02	-	01	02	04	23	32	101	184	472	337	1158

with the lowest monthly average temperature (13.8ºC) (Figure 1).

The highest number of adult Coleopterans captured occurred in March (12,020) (Figure 2), the month with the highest average temperature (22.2ºC), and the lowest capture was in July (27) (Figure 2) which had an average temperature of only 14.2ºC). The monthly fluctuation of the larval population of ***A. diaperinus*** can be observed in figure 2, and the analysis of regression of the quadratic model was significant 0.002% with coefficient of determination of 83.60%. The adjusted model was: $y_i=2.1730-0.4516x_i+0.0490x_i^2$, where i=1, 2,...11, 12 (order of the months).

The monthly fluctuation of the adult population of ***A. diaperinus*** can also be observed in figure 2. The analysis of regression of the quadratic model was significant 0.001% with coefficient of determination of 95.21%. The adjusted model was: $y_i=2.1730-0.4516x_i+0.0490x_i^2$, where i=1, 2,..., 11,12 (order of the months).

Carcinops troglodytes (Histeridae) which is considered a good predator of ***Musca domestica*** occurred in 10 of the 12 collection months with its population peak in February (188), the month with the highest average temperature (24.7ºC) (Figure 1). The lowest collection was during the months of May and September (01), and in April and June there were no ***C. troglodytes*** collected (Figure 2).

These results differ from those obtained by BICHO (2001) who evaluated the populations of arthropods on poultry farms of Pelotas, RS and described this species as the most abundant, occurring in the 12 months of collection with 6,444 captured specimens which represented 51.76% of the total. AAGENSEN (1988) and BRUNO et al. (1993) collecting Coleopterans from diverse poultry farms from cities in São Paulo State also described ***C. troglodytes*** as the

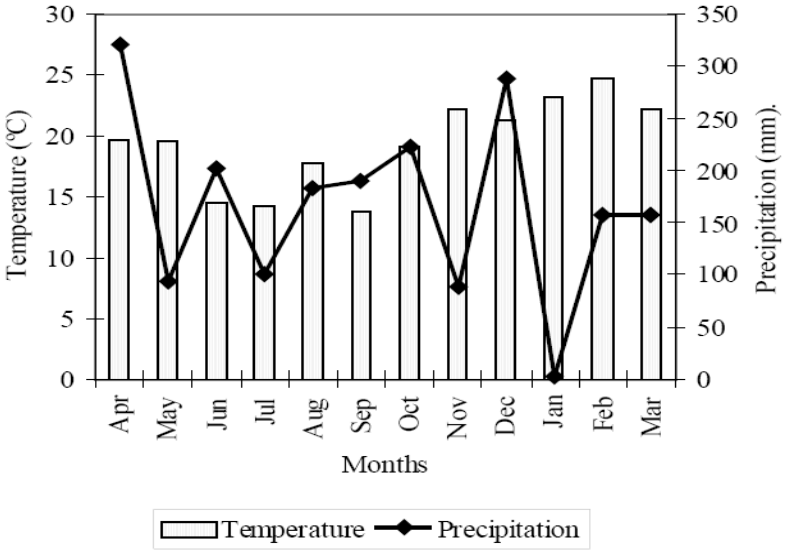

Figure 1 - Average monthly temperature and precipitation for the period of April 2002 to March 2003 in Pelotas, RS (Estação Climatológica do Conjunto Agrotécnico Visconde da Graça).

most abundant species there. GIANIZELLA & PRADO (1998), while sampling the histerid species on a farm in Monte Mor, SP captured 19,668 histerids with ***C. troglodytes*** representing 33% of the seven species encountered. According to LEGNER & OLTON (1970), ***C. troglodytes*** is also found in bird excrement in Costa Rica and Porto Rico.

The population fluctuation of ***C. troglodytes*** collected in the laying shed can be observed in figure 2. The regression model adjusted to the fluctuation was the quadratic, significant at 0.12% and with determination coefficient of 82.94%. The adjusted model was: $y_i=0.7478-0.0816x_i+0.0201x_i^2$, where i=1, 2, ..., 11,12 (order of the months).

The coleopteran ***Euspilotus rubriculus*** (Histeridae) occurred with highest frequency in February (72) when the highest average temperature was registered (24.7ºC). The lowest occurrence of this species was in the months of May and September (01), and in April, June, July and August there were none captured (Table 1).

These results differ from the ones obtained by BICHO (2001) where ***E. rubriculus*** occurred in all twelve months of collection presenting a population peak in April (41) and with lowest occurrence in October and November (01). This difference may be related to the methods utilized. According to LEGNER & OLTON (1970) some species of ***Euspilotus*** such as ***E. liticolus*** occur in a variety of excrement (e.g. chicken and equine in southern California and bovine in the south of Mexico and southern California). FERNANDES et al. (1995) and GIANIZELLA & PRADO (1998) reported the presence of ***Euspilotus*** spp. in chicken excrement on farms in Uberlândia, MG and São Paulo, SP.

The population fluctuation of ***E. rubriculus*** can be observed in figure 2. The adjusted model was the quadratic with significance at 6.40% and coefficient of determination of 55.69%. The adjusted model was: $y_i=0.6787-0.0017x_i+0.0073x_i^2$, where i=1, 2,..., 11,12 (order of the months).

Gnathocerus cornutus (Tenebrionidae) also had a population peak in February (301) with an average temperature of 24.7ºC (Figure 1). This Coleopteran began to appear with higher frequency after December when the average temperature was above 20ºC (Table 1).

BICHO (2001) monitoring the population of ***G. cornutus*** on a poutry farm in Pelotas collected this Coleopteran in accumulated bird feces and in tube type traps for eleven of the twelve months of the experiment with a population peak in March (249) when the average temperature was 14ºC. In this experiment there was also a higher capture of ***G. cornutus*** in the months which had average temperatures higher than 20ºC. This species was also collected by BRUNO et al. (1993) in poultry farms of various cities of the state of São Paulo but in lower quantities, only 09 specimens.

The population fluctuation of ***G. cornutus*** captured in the laying shed can be observed in figure

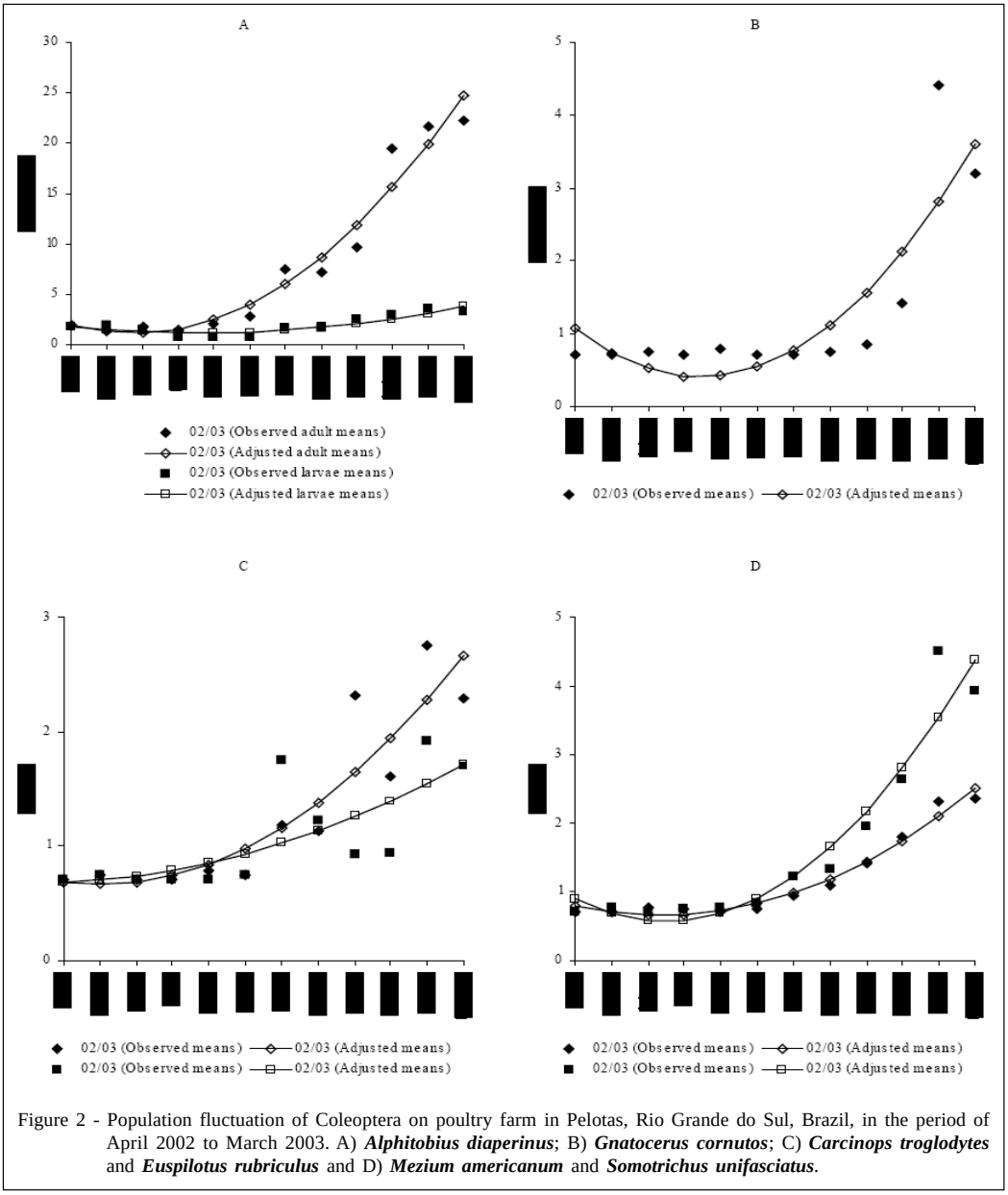

Figure 2 - Population fluctuation of Coleoptera on poultry farm in Pelotas, Rio Grande do Sul, Brazil, in the period of April 2002 to March 2003. A) ***Alphitobius diaperinus***; B) ***Gnatocerus cornutos***; C) ***Carcinops troglodytes*** and ***Euspilotus rubriculus*** and D) ***Mezium americanum*** and ***Somotrichus unifasciatus***.

2. The adjusted model was the quadratic with significance of 0.01% and a determination coefficient of 73.24%. The adjusted model was: y_i=1.506138-0.4977153x_i+0.05603979x_i^2, where i=1, 2,..., 11,12 (order of the months).

Mezium americanum (Ptinidae) during the experimental period was present in 9 of the twelve months with no captures in April, May and August. The highest collection was in February (121) and the lowest in July and September (01) (Table 1).BICHO (2001) captured 43 specimens of ***M. americanum*** in 8 of the12 months of collection with no capture in August, September, October and November. The population peak occurred in December when the average temperature was 22.6ºC. This is similar to our results where the highest collection was in the month with the higher average temperature (24.7ºC).

The population fluctuation of ***M. americanum*** captured in the laying shed is presented in figure 2. The adjusted model was the quadratic with

significance of 0.001% and determination coefficient of 97.20%. The adjusted model was: $y_i=0.9292-0.1650x_i+0.0247x_i^2$, where i=1, 2,..., 11,12 (order of the months).

Somotrichus unifasciatus (Carabidae) had a population peak in February (472) when the average temperature was 24.7ºC, and the lowest collection was in July (01). In April and June there were no captures of this Coleopteran (Table 1). According to BICHO (2001) ***S. unifasciatus*** occurred during the entire experimental period with population peak in January (222). The temperature interval in which the most captures occurred was between 20.8ºC and 23.3ºC, and this also happened in our work.

The population fluctuation of ***S. unifasciatusi*** can be observed in figure 2. The adjusted model was the quadratic with significance of 0.001% and coefficient of determination of 92.74%. The adjusted model was: $y_i=1.2090-0.3644x_i+0.0524x_i^2$, where i=1, 2,..., 11,12 (order of the months).

The polynomial regression analysis of all species indicated the quadratic model as the one which better adjusted to the population fluctuation data. In biology this model is largely used to explain the relationship between variables that expresses characteristics of systems of nature and are not accurate, as in this experiment, where the medium of capture oscillated during the experimental period especially due to the variations in temperature.

According to ODUM (1988) the extrinsic and intrinsic factors are the controllers of the annual fluctuations. These factors, especially temperature, explain the variation of the population fluctuation observed during the twelve months analyzed, showing that the biotic and abiotic requirements are properties of each species.

REFERENCES

AAGESEN, T.L. **Artrópodes associados a excrementos em aviários**. 1988. 38f. Dissertação (Mestrado em Entomologia) - Escola Superior de Agricultura Luiz de Queiroz.

ARENDS, J.J. **Control, management of the litter beetle**. Sydney: Poultry Digest, 1987. p.173-176.

AXTELL, R.C. **Fly control in confined livestock and poultry production**. Greensboro: CIBA-GEICY, 1986a. 59p. (Technical Monograph).

AXTELL, R.C. Fly management in poultry production: cultural, biological, and chemical. **Poultry Science**, Milwaukee, v.65, p.657-667, 1986b.

AXTELL, R.C.; ARENDS, J.J. Ecology and management of arthropod pests of poultry. **Annual Review Entomology**, Palo Alto, v.35, p.101-126, 1990.

BICHO, C.L. **Comunidade de artrópodes e flutuação populacional circanual de dípteros e coleópteros, em granja avícola, em Pelotas - RS**. 2001. 110f. Tese (Doutorado em Entomologia) - Universidade Federal do Paraná.

BRUNO, T.V. et al. Moscas sinantrópicas (Díptera) e seus predadores que se criam em esterco de aves poedeiras confinadas, no estado de São Paulo, Brasil. **Revista Brasileira de Entomologia**, Curitiba, v.37, p.577-590, 1993.

FERNANDES, M.A. et al. Ocorrência de artrópodes no esterco acumulado em uma granja de galinhas poedeiras. **Anais da Sociedade Entomológica Brasileira**, Londrina, v.24, p.649-654, 1995.

FRANCISCO, O. ***Alphitobius diaperinus*** **(Panzer) (Coleoptera: Tenebrionidae) associado a esterco em granjas de aves poedeiras: fenologia, estrutura etária e parasitismo**. 1996. 116f. Dissertação (Mestrado em Entomologia) - Universidade Estadual de Campinas.

GEDEN, C.J.; AXTELL, R.C. Predation by ***Carcinops pumilio*** (Coleoptera: Histeridae) and ***Macrocheles muscadomesticae*** (Acarina: Macrochelidae) on the house fly (Diptera: Muscidae): functional response, effects of temperature, and availability of alternative prey. **Environmental Entomology**, Lanham, v.17, p.739-744, 1988.

GIANIZELLA, S.L.; PRADO, A.P. Levantamento e sazonalidade de coleópteros (Histeridae) em criação de aves poedeiras. **Anais da Sociedade Entomológica Brasileira**, Londrina, v.27, p.551-555, 1998.

LEGNER, E.F.; OLTON, G.S. Worldwide survey and comparison of adult predator and scavenger insect populations associated with domestic animal manure where livestock is artificially congregated. **Hilgardia**, Berkeley, v.40, p.225-266, 1970.

MASCARINI, L.M. Aspectos biológicos de ***Muscina stabulans*** (Fallén, 1817) em condições de laboratório. 1995. 68f. Dissertação (Mestrado em Entomologia) - UNICAMP, Campinas, SP.

ODUM, E. **Ecologia**. Rio de Janeiro: Guanabara Koogan, 1988. 434p.

ODUM, E. **Fundamentos de ecologia**. 5.ed. Lisboa: Fundação Calouste Gulbenkian, 1997. 927p.

PFEIFFER, D.G.; AXTELL, R.C. Coleoptera of poultry manure in caged-layer houses in North Carolina. **Environmental Entomology**, Lanham, v.9, p.21-28, 1980.

PINTO-COELHO, R.M. **Fundamentos em ecologia**. Porto Alegre: Artmed. 2000. 247p.

WALKER, M.A. A pitfall trap study on Carabidae and Staphylinidae (Col.) in County Durham. **Entomology Month Magazine**, Iowa, v.121, p.9-18, 1985.

ZONTA, E.P.; MACHADO, A.A. **Sanest** - Sistema de análise estatística para microcomputadores. Registrado na Secretaria Especial de Informática sob nº.066060 - categoria A. Pelotas: Universidade Federal de Pelotas, 1984. 138p.