SCIENTIFIC NOTE

Staphylinidae (Coleoptera) Associated to Cattle Dung in Campo Grande, MS, Brazil

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Staphylinidae (Coleoptera) Associados a Fezes Bovinas em Campo Grande, MS

RESUMO - Este trabalho foi executado com o objetivo de determinar as espécies locais de estafilinídeos fimícolas, devido à importância destes predadores e ou parasitóides no controle natural de parasitos de bovinos associadas às fezes. Para tanto, massas fecais com 1, 2 e 3 dias de idade foram coletadas semanalmente em uma pastagem de *Brachiaria decumbens* Stapf, no período de maio de 1990 a abril de 1992. As fezes foram acondicionadas em baldes plásticos, opacos, com capacidade para 15 litros, contendo aberturas lateral e no topo, onde foram fixados frascos para a captura, por um período de 40 dias, dos besouros estafilinídeos presentes nas massas fecais. Após este período a massa fecal e o solo existente nos baldes eram examinados e os insetos remanescentes recolhidos. Foi coletado um total de 13.215 exemplares, pertencendo a 34 espécies e/ou morfo espécies. Foram observados os seguintes doze gêneros: *Oxytelus* (3 espécies; 70,1%); *Falagria* (1 sp.; 7,9); *Aleochara* (4 sp.; 5,8); *Philonthus* (3 sp.; 5,1); *Atheta* (2 sp.; 4,0); *Cilea* (2 sp.; 1,2); *Neohypnus* (1 sp.; 0,7); *Lithocharis* (1 sp.; 0,7); *Heterothops* (2 sp.; 0,6); *Somoleptus* (1 sp.; 0,08); *Dibelonetes* (1 sp.; 0,06) e, *Dysanellus* (1 sp.; 0,04). As sete espécies mais abundantes, constantes e ou freqüentes, seguidas, respectivamente, pelo percentual de indivíduos coletado, foram: *Oxytelus* sp.1 (38,8%); *Oxytelus* sp.2 (28,1); *Falagria* sp. (7,9); *Philonthus* sp.1 (4,1); *Atheta* sp.1 (3,7); *Aleochara* sp.1 (3,6) e *Oxytelus* sp.3 (3,2). Doze presumíveis espécies (3,6% do total coletado) foram identificadas apenas até família.

PALAVRAS-CHAVE: Insecta, coleóptero fimícola, pastagem, diversidade

ABSTRACT - This work was carried out in order to determinate the local fimiculous Staphylinidae species due to these predators and or parasites importance on the natural control of the dung associated bovine parasites. For that, fecal masses 1, 2 and 3 days old were weekly collected on a pasture of *Brachiaria decumbens* Stapf, from May 1990 through April 1992. The feces were conditioned in 15-liter opaque plastic buckets, containing lateral and top openings, where flasks were fastened for capturing Staphylinidae beetles present in these masses, during a 40-day period. After this period the soil and fecal masses from the buckets were examined and the remaining insects collected. A total of 13215 specimens were collected, belonging to 34 species. The following twelve Genera were observed: *Oxytelus* (3 species; 70.1% of the specimens collected); *Falagria* (1 sp.; 7.9); *Aleochara* (4 sp.; 5.8); *Philonthus* (3 sp.; 5.1); *Atheta* (2 sp.; 4.0); *Cilea* (2 sp.; 1.2); *Neohypnus* (1 sp.; 0.7); *Lithocharis* (1 sp.; 0.7); *Heterothops* (2 sp.; 0.6); *Somoleptus* (1 sp.; 0.08); *Dibelonetes* (1 sp.; 0.06) and, *Dysanellus* (1 sp.; 0.04). The seven most abundant, constant, and or frequent species, followed respectively by the percentage of collected specimens, were: *Oxytelus* sp.1 (38.8%); *Oxytelus* sp.2 (28.1); *Falagria* sp. (7.9); *Philonthus* sp.1 (4.1); *Atheta* sp.1 (3.7); *Aleochara* sp.1 (3.6), and *Oxytelus* sp.3 (3.2). Twelve species (3.6% of the collected specimens) were determined as far as family only.

KEY WORDS: Insecta, dung beetle, pasture, diversity

The horn fly, *Haematobia irritans* (L.) (Diptera: Muscidae), and the gastrointestinal parasite larvae use bovine feces as feeding substrate or vehicular agent. Besides the haemoparasites, these organisms, together with *Dermatobia hominis* (L. Jr.) (Diptera: Cuterebridae) and the cattle tick, *Boophilus microplus* (Canestrini) represent

the parasites that cause the highest losses to Brazilian cattle (Honer *et al.* 1990). The conventional chemical control of these parasites on the host implies in: increased production costs that burdens the different segments of the meat productive chain; increased risks on health safety due to the presence of residues of chemical products and their derivates at harming levels to human health on the several products of animal origin: and, systematic contamination of the environment.

There is an extensive literature on the diversity of fimiculous Staphylinidae as well as on the parasitic or predatory activity of the well-known species. *Aleochara tristis* Gravenhorst was found parasitizing *Musca autumnalis* De Geer in France (Drea 1966). In studies conducted at Uberlandia County, State of Minas Gerais, Brazil, Marchiori & Linhares (1999) observed that one species of fimiculous Staphylinidae, *Aleochara notula* Erichson, was behaving as a parasitoid. It is known that adult Staphylinidae act as predators on eggs or immature stages of their preys. The species of the genus *Aleochara*, however, while immature, also act as parasitoids attacking larvae and/or pupae of their preys.

In the State of Missouri, USA, Thomas & Morgan (1972) found that Staphylinidae are part of the most important predators of immature stages of the horn fly. Roth *et al.* (1983) report that Staphylinidae of the genus *Philonthus* can decrease the horn fly population. Davis *et al.* (1988) collected 100 different species of Staphylinidae in South Africa. Wright *et al.* (1989), in Australia, found that species of the genus *Aleochara* may predate or parasitize pupae of several fly species that develop on bovine feces, including *Haematobia irritans exigua* De Meijere. Staphylinidae predation, especially on fly eggs, is considered as responsible for important reductions on dipterous populations produced on fecal masses (Fincher 1995). In nine experiments carried out by Kirk (1992) in South France, the control exerted by the remaining fimiculous fauna on the fly *Musca tempestiva* (Diptera: Muscidae) ranged from 89% to 96% and the most abundant insects present were the Staphylinidae (12 species; being four species of parasitoids and the remaining ones were predators).

The biological control of bovine parasites associated to cattle dung is naturally occurring but its efficiency can be increased. In countries that are acquainted with *H. irritans* over a long period of time, like the USA (Meyer *et al.* 1991, Fincher 1992, 1995 and Hu & Frank 1997), the knowledge on the native fimiculous species of natural enemies of bovine parasites as well as on the evaluation of exotic species, aiming at mass rearing and release, are already quite advanced. Commercialization of some of these species is already occurring. The establishment of the exotic species *Coprophilus striatulus* in the Northeast regions of North America has been already reported (Hoebeke 1995). Rearing techniques were developed for *Creophilus maxillosus* L. due to its importance on predation of immature stages of flies (Greene 1996).

Studies on Staphylinidae that visit bovine feces, in Brazil, are scarce. Those conducted by Flechtmann *et al.* (1955a,b), Rodrigues & Marchini (1998), Guimarães & Mendes (1988), Almeida & Prado (1999), Marchiori & Linhares (1999) and Marchiori *et al.* (2001) should be pointed out.

The knowledge on the biology of natural enemies of important pests will allow their management in a way that a maximum benefit of their predatory or parasitic activities can be achieved. Rationalizing the use of sanitary chemical control agents, which would be lethal to them especially in periods of their highest occurrence, is a good example. In Brazil, such information is still scarce. The objectives of this research work were to determine the fimiculous Staphylinidae fauna present in the studied region as well as to survey the species with potential use in controlling bovine parasites. This is important considering the size of the bovine herd in the country and the problem represented by the volume of feces excreted by these animals on the pastures. These feces serve as vehicle or substrate for development of several parasites on bovines and/or other domestic livestock.

For the present work, weekly collections of freshly-excreted bovine feces pads were collected in pastures at the National Beef Cattle Research Center of the Brazilian Agricultural Research Corporation (Embrapa Beef Cattle), located in Campo Grande County, State of Mato Grosso do Sul, Brazil, from May 1990 through April 1992. In each sampling, always preformed between 8:00 and 9:00 AM, three freshly excreted fecal pads were collected in a pasture predominately covered with *Brachiaria ducumbens* Stapf grass, which had been permanently occupied with Nelore breed bovines. The fecal pads remained in the field during three different period of time: the first for one day, the second for two days, and the third for three days. These intervals provided chances of visitation to a higher number of species, which were benefited with the openings of galleries by other insects as the fecal masses were dehydrating. After each period, the feces were collected and placed on top of a 15-cm soil layer inside 15-liter lidded opaque plastic buckets, which were then maintained in the laboratory, according to the methodology described by Koller *et al.* (1999b). The buckets had two openings, one in the lateral and another on the top that communicated with flasks in which the insects were retained as they left the feces. Twice or three times a week, during a 40-days period, the insects from the capture flasks were transferred to another flask containing 70% ethanol. At the end of the 40-days period, and after thorough removal of the remaining insects, the content of the buckets was discarded.

The remaining fimiculous insects obtained during the Staphylinidae capture were subject of study by Koller *et al.* (1999a).

For analysis of the fauna, the following indexes were determined: abundance, constancy, and frequency. The abundance index was computed for each species captured and a dispersion measurement, obtained through calculation of the standard deviation, standard error of mean and confidence interval, was employed using the "t" test at 5% and 1% probability (Silveira Neto *et al.* 1976).

The constancy index is in percentage, and was obtained through the quotient between the number of collection of each species multiplied by 100, and the total number of collections performed (Silveira Neto *et al.* 1976). The frequency index was obtained through the quotient between the total individuals collected within a given species and the overall individuals collected, according to the formula proposed by Silveira Neto *et al.* (1976), and the confidence interval of the mean, at 5% probability, used by Fazolin (1991). In the determination of the fauna indexes, the morph-species identified only until family were not included due to the possibility of, eventually, some of them belong to the same species. Data on climate herein used were obtained at the meteorological station located at Embrapa Beef Cattle, 20º20'S; 54º37'W, and 530m altitude.

A total of 13,215 Staphylinidae were obtained (Table 1), totaling 34 species and/or morph-species, 12 of which represented 3.8% of the total captured and were identified only until family. The remaining 22 species belong to 12 different genera. The following genera as well as number of species and percent individuals within each genera were observed: *Oxytelus* (3 species; 70.1%); *Falagria* (1 species; 7.9%); *Aleochara* (4 species; 5.8%); *Philonthus* (3 species; 5.1%); *Atheta* (2 species; 4.0%); *Cilea* (2 species; 1.2%); *Neohypnus* (1 species; 0.7%); *Lithocharis* (1 species; 0.7%); *Heterothops* (2 species; 0.6%); *Somoleptus* (1 species; 0.08%); *Dibelonetes* (1 species; 0.06%); and, *Dysanellus* (1 species; 0.04%).

According to the indexes of fauna used (Table 2), the species classified as very abundant were *Oxytelus* sp. 1 and *Oxytelus* sp. 2, representing 38.8% and 28.1%, respectively, of the total Staphylinidae captured. In order of numerical importance these were followed by *Falagria* sp. (7.9%), which was classified as abundant in the first year of evaluations and common in the following year. These three species represented together 75% of the total Staphylinidae collected and were also the most frequent ones. Species such as *Philonthus* sp.1 (4.4%), *Aleochara* sp. 1 (3.6%) and *Lithocharis* sp. (0.7%), although presenting indexes of constancy similar to those of the species previously mentioned were only common and little frequent (Table 2).

In a general way, the population dynamics of the species obtained were similar to the dynamics of occurrence of the total Staphylinidae collected. Higher quantities were observed from June to August, in the middle of the dry season, which extends from May to September. The lower population levels occurred at the end of the dry season and initial half of the rainy season (Fig. 1).

Cabrera-Walsh & Cordo (1997) reported the presence of 31 species of fimiculous Staphylinidae, in studies carried out in Argentina and Guimarães & Mendes found 30 species at Uberlândia County, State of Minas Gerais, Brazil. This later figure is very close to the 34 species herein mentioned. Flechtmann *et al.* (1995a,b) observed 11 species at Silviria County, northeast region of the State of Mato Grosso do Sul and Marchiori *et al.* (2001) observed only four species at Itumbiara County, south of the State of Goiás.

Table 1. List of species of fimiculous staphylinid beetles obtained from cattle dung collected in a grass pasture area in the region of Campo Grande County, State of Mato Grosso do Sul, Brazil, from May 1990 to April 1992.

Species	Year I	Year II	Partial sum
Aleochara sp.1	320	152	472
Aleochara sp.2	105	33	138
Aleochara sp.3	61	94	155
Aleochara sp.4	3	5	8
Atheta sp.1	297	190	487
Atheta sp.2 ?	10	36	46
Cilea silphoides (L.)	58	38	96
Cilea sp. ?	34	28	62
Dibelonetes sp.	2	6	8
Dysanellus sp.	0	5	5
Falagria sp.	732	307	1039
Heterothops sp.1 ?	29	15	44
Heterothops sp.2 ?	21	16	37
Lithocharis sp.	49	38	87
Neohypnus sp.	60	29	89
Oxytelus sp.1	2394	2730	5124
Oxytelus sp.2	2012	1701	3713
Oxytelus sp.3	289	140	429
Philonthus flavolimbatus Erichson	28	43	71
Philonthus sp.1	362	214	576
Philonthus sp.2	10	12	22
Somoleptus sp.	1	9	10
Staphylinidae sp.1	143	75	218
Staphylinidae sp.2	123	89	212
Staphylinidae sp.3	10	19	29
Staphylinidae sp.4	15	1	16
Staphylinidae sp.5	0	10	10
Staphylinidae sp.6	1	3	4
Staphylinidae sp.7	2	0	2
Staphylinidae sp.8	1	1	2
Staphylinidae sp.9	0	1	1
Staphylinidae sp.10	1	0	1
Staphylinidae sp.11	1	0	1
Staphylinidae sp.12	1	0	1
Total sum	7175	6040	13215

Year I: May 1990 - April 1991; Year II: May 1991 - April 1992

Further specific studies may be conducted in order to determine the efficiency of parasitism and/or predation using the species that were here emphasized respecting the indexes of fauna presented.

Table 2. Indexes of abundance, constancy and frequency of fimiculous Staphylinidae obtained from cattle dung collected in a grass pasture area in the region of Campo Grande County, State of Mato Grosso do Sul, from May 1990 to April 1992.

Species	Abundance		Constancy		Frequency	
	Year I	Year II	Year I	Year II	Year I	Year II
Aleochara sp.1	c	c	21,2	13,2	4,65	2,6
Aleochara sp.2	c	c	25	5,7	1,53	0,57
Aleochara sp.3	c	c	7,7	3,8	0,89	1,61
Aleochara sp.4	d	-	1,9	-	0,04	-
Atheta sp.1	c	c	5,8	7,6	4,32	3,25
Atheta sp.2	d	c	1,9	3,8	0,15	0,62
Cilea silphoides (L.)	c	c	13,5	3,8	0,84	0,65
Cilea sp.	c	-	11,5	-	0,49	-
Dibelonetes sp.	d	c	1,9	1,9	0,03	0,1
Dysanellus sp.	-	c	-	5,7	-	0,09
Falagria sp.	a	c	21,2	13,2	10,64	5,26
Heterothops sp.1	d	-	9,6	-	0,42	-
Heterothops sp.2	d	c	9,6	5,7	0,31	0,27
Lithocharis sp.	c	c	17,3	9,4	0,71	0,65
Neohypnus sp.	c	c	11,5	1,9	0,87	0,5
Oxytelus sp.1	ma	ma	29	18,9	34,81	46,75
Oxytelus sp.2	ma	ma	26,9	20,8	29,26	29,13
Oxytelus sp.3	c	c	5,8	9,4	4,2	2,4
P. flavolimbatus Erich.	d	c	9,6	7,6	0,41	0,72
Philonthus sp.1	c	c	26,9	11,3	5,26	3,66
Philonthus sp.2	d	c	11,5	3,8	0,15	0,21
Somoleptus sp.	d	-	1,9	-	0,02	-

Year I: May 1990 - April 1991; year II: May 1991 - April 1992
va = very abundant; a = abundant; c = common; d = disperse
Indexes of fauna: abundance - test "t" at 5% probability (Silveira Neto *et al.* 1976); constancy (Silveira Neto *et al.* 1976); and frequency - formula proposed by Silveira Neto *et al.* (1976) and confidence interval of mean at 5% and 1% probability according to Fazolin (1991)

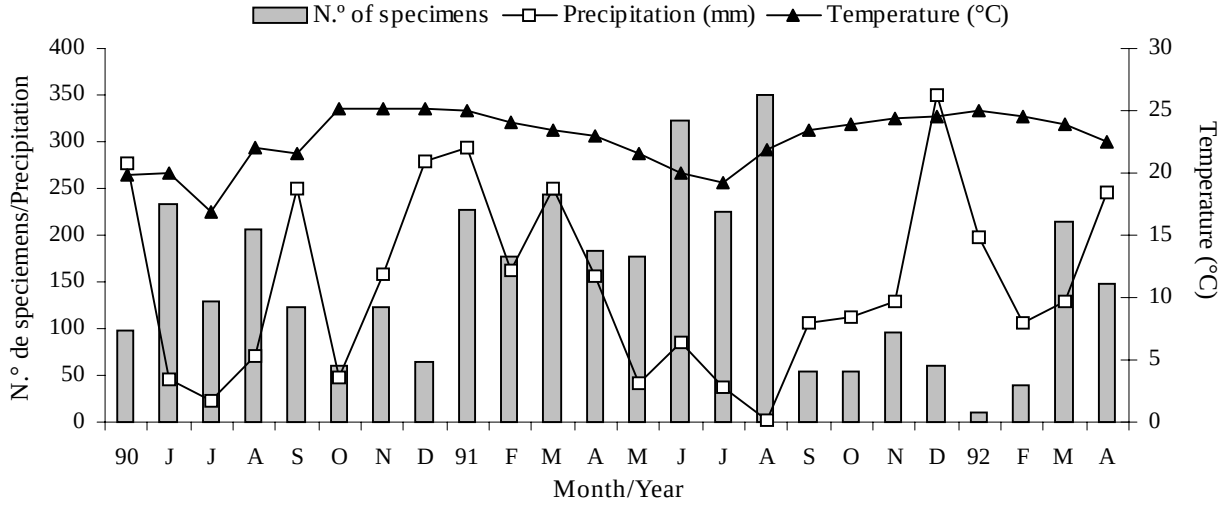

Figure 1. Average temperature, total precipitation, and mean monthly number of fimiculous staphylinid beetles obtained from cattle dung collected in a grass pasture area in the region of Campo Grande County, State of Mato Grosso do Sul, from May 1990 to April 1992.

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