Insects (Arthropoda: Insecta) collected on bovine feces after different times of field exposure in Itumbiara, South of Goias, Brazil

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Abstract

The collected of insects in cattle dung deposited in pasture were observed from Janaury to August 2001 in Itumbiara, Goiás, Brasil. Cattle dung pats were exposed at a pasture for 24, 48, 72, 96, 120, 144, 168, 192, 216 and 240 hours and were than taken to labortory separate from each other, for parasitoids extraction. A total of 100 dung pats were exposed at pasture. Were recovered 3229 Scarabaeidae, 3099 Diptera and 430 Hymenoptera (parasitoids). The most abundant species Diptera were Palaeosepsis spp. e Sarcophagula occidua and parasitoids: Paraganapis egeria and Spalangia drosophilae and Scarabaeidae: Ataenius aequalis e Aphdodius lividus. The periods of the highest population peak were: 24, 48 and 72 horas.

Key words: Insecta, Diptera, Scarabaeidae, parasitoids, cattle dung.

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Introduction

Among the insects, stands out the group of the muscideous dipterans from the families Calliphoridae, Sarcophagidae end Muscidae, which have great medical and veterinarian importance since they may be mechanical and biological vectors of microorganisms pathogenic to man and domestic animals. Besides, they are considered a problem for public health in many areas of the world once they may invade residences and working places becoming an annoyance for the population (GUIMARÃES et al., 1983).

The main pest-species that develop on this type of substrate are Musca domestica (L) and Stomoxys calcitrans (L), which develop mostly on feces of confined cattle, as well as

Musca autumnalis (De Geer) and Haematobia irritans (L). On this substrate, coprophagous coleopterans from the family Scarabaeidae are also found. These coleopterans disrupt the feces, aerating and mixing them with the soil, thus turning them unsuitable for colonization by several other insect populations (WINGO et al., 1974).

Together with flies, a diverse fauna of parasitoids which are responsible for the natural control of these dipterous, develops. Among the main natural enemies of flies are the parasitoids from the Braconidae, Chalcididae, Pteromalidae, Encyrtidae, and Figitidae families (MARCHIORI, et al., 2001). Since parasitoids occupy a superior trophic level, they act as determining factors on the population densities of their hosts due to the diversity of their physiological and behavioral adaptations. Besides, being natural enemies of pests they may be used in biological control programs.

The Scarabaeidae (Coleoptera) are generally coprophagous and inhabitants of excrements where many larvae and adults feed. They are considered very important for the control of sinanthropic flies that reproduce on bovine manure (FLETCHMANN & RODRIGUES, 1995; MARTINS & CONTEL, 1997a; MARTINS & CONTEL, 1997b; KOLLER et al., 1999; AIDAR et al., 2000) as well as in controlling bovine gastrointestinal parasite nematodes; besides improving soil structure and fertility (FLETCHMANN et al., 1995).

They present a typical behavior of burying small portions of fecal mass in the soil and build galleries causing soil aeration and drying and, concomitantly, burying larvae and eggs that by chance are present in the manure attacked by them (FLETCHMANN et al., 1995).

The objective of the present research work was to identify the arthropods collected on bovine feces after different times of field exposure in Itumbiara County, State of Goias, Central Brazil.

Material and Methods

The experiment was conducted at Chácara Vilela (Vilela Farm), located in the district of Village, five km away from Itumbiara (18°25'S; 49°13'W), at the Paranaíba river shore. The farm has approximately 29 hectares and 50 dairy "girolanda" bovine cattle heads. Fresh feces were collected immediately after being excreted in the corrals and mixed in two 20 liters plastic buckets.

Feces pads, of approximately two liter each, were then made and placed into 10 plastic

trays (40 cm in diameter and 12 cm in height) containing a 5 cm layer of soil from the same site. The trays were bottom-perforated to allow rainwater drainage. These so prepared trays were then placed at the soil line in the field at 9:00 o'clock AM for arthropods visitation.

At each one day interval, one pad was collected after 24, 48, 72, 96, 120, 144, 168, 192, 216, and 240 hours of field exposure and taken to the laboratory. These trays were covered with cheesecloth and maintained in the laboratory for pupae collection using the flotation method. Pupae were individualized into gelatin capsules (number 00) and maintained in the laboratory until parasitoids hatching. The experiment was carried out from January to October 2001.

Porcentage of parasitism was calculated using the formula: P= (parasitized pupae/ total pupae)x100. The preference of species for time of feces exposure was tested by the Chi-square test, at 5,0% probability.

A Berlese funnel, containing flasks filled with 70% ethanol for approximately five days, were used for Scarabaeidae collection. Collections were carried out on January 15th, February 10th, March 11th, April 10th, May 15th, June 10th, July 15th, August 15th, September 10th, and October 15th 2001.

Thus, 10 collections of 10 fecal pads for each time of exposure were performed totaling 100 bovine fecal pads collected. Scarabaeidae adults obtained by this procedure were counted and sent for identification. Dr. Fernando-Vaz-de-Mello, from the Federal University of Lavras, State of Minas Gerais, identified the Scarabaeidae. The preference of species by age of pads was tested by Chi-square, at 5.0% probability.

Results and Discussion

Palaeosepsis spp. (Diptera: Sepsidae) was the most abundant species, totaling 50.2% of the insects collected, followed by *Sarcophagula occidua* (Fabricius) (Diptera: Sarcophagidae) (Table 1). Although the horn fly was present in the studied area, pupae of this species were not found in the samples probably due to the use of chemicals for the control of ectoparasites.

The species *Brontaea debilis* (Williston) (Diptera: Sarcophagidae), *S. occidua* and *Palaeosepsis* spp. were found on feces samples of all times of exposure. SANDERS & DOBSON (1966) stated that the Sepsidae are the first flies to visit feces, although they

are probably not solely limited to fresh feces. The Diptera were more abundantly collected on feces of 72 and 144 hours of field exposure (16.6% and 13.6%, respectively). It was also found that the higher action of dipterans (52.4%) occurred on the fresher fecal pads with higher moisture content.

Concerning preference of species of flies for time of exposure of feces, the following results were obtained: *Brontaea quadristigma* Thonson (Diptera: Muscidae) preferred feces of 48, 168, 192, 216, and 240 hours; *B. debilis* preferred feces of 24 and 168 hours; *Cyrtoneurina pararescita* Couri (Diptera: Muscidae) preferred feces of 168, 192, and 240 hours; *Ravinia belforti* (Prado & Fonseca) (Diptera: Sarcophagidae) preferred feces of 120 and 168 hours; *S. occidua* preferred feces of 48, 72, 120, and 216 hours; *Archisepsis scabra* (Loew) (Diptera: Sepsidae) preferred feces of 192 and 216 hours; *Palaeosepis* spp. preferred feces of 96, 144, 144, 168, 216, and 240 hours; and Sphaeroceridae preferred feces of 24 and 192 hours of field exposure (I^2=1085.8; DF=56; P<0.0001).

Paraganaspis egeria (Hymenoptera: Figitidae) was the most frequent species (44,4%) followed by *Saplangia drosophilae* (Hymenoptera: Pteromalidae) (22,7%) of the parasitoids collected (Table 1). On Table 1 it can be perceived that the species *P. egeria* was collected in all feces exposure times, except for 216 h. These results are similar to those of MARCHIORI et al. (2001). It is believed that these two species are the most well adapted to pasture areas in Itumbiara Country.

It is also shown on Table 1 that the species *Trichopria* sp. (Hymenoptera: Diapriidae), Neralsia splendens (Hymenoptera: Figitidae), *P. egeria*, and *Aleochara notula* (Coleoptera: Staphylinidae) were collected in feces with 24, 48, and 72 h of exposure indicating that they probably are parasitoids of larvae of muscoids dipterans. According to DIAZ & GALLARDO (1995; 1996), *N. splendens* and *P. egeria* are parasitoids of first instar larvae of *Sarcophagula occidua* (Diptera: Sarcophagidae) in bovine feces. The Figitidae are parasitoids of Diptera and behave as primary parasitoids of dipterans larvae.

Species of *Spalangia* are predominantly associated to bovine dung and are parasitoids of Diptera pupae nurseries. In this experiment species of *Spalangia* occured in the feces after 96 h of exposure because these groups are parasitoids of dipterous pupae. This result indicates that in Itumbiara, pupae of muscoids dipterans may be found in bovine feces only after 96 h of field exposure. This is a very important finding since the adults of the horn fly preferentially oviposit on freshly-secreted fecal masses (GUIMARÃES, 1990).

With the results obtained up to the moment it was found that the larger action of the parasitoid species occurred in the fresher fecal plates (Table 1) with exposure times of 24 and 96 h. In the ecological succession of insects that occur in bovine feces, only the species found in fresher feces (24 and 48 h) would be more indicated for selection aiming a future horn fly control program.

As far as preference of species as related to time of exposure is concerned, the following results were achieved: *Trichopria* sp. preferred feces exposed for 72 and 192 hours; P. egeria preferred feces exposed for 24, 48, 72, 192, and 240 hours; *Triplasta atrocoxalis* for 72, 96, 144, and 198 hours exposed feces; *Spalangia cameroni* (Hymenoptera: Pteromalidae) for 72, 96 144 and 168 hours exposed feces; *Spalangia nigra* (Hymenoptera: Pteromalidae) for 72 and 240 hours of exposure; *Spalangia nigroaenea* (Hymenoptera: Pteromalidae) for 96h exposure; *Spalangia* sp. for 96 and 120 hours exposure; and *A. notula* for 24 and 48 hours of feces exposure in the field ($X2 = 277,4$; $DF = 108$; $P < 0.0001$).

In relation to time of exposure, the prevalence of parasitism observed was 17,5%, 15,1%, 9,0%, 52,5%, 18,4%, 9,1%, 5,3%, 12,0%, 2,0%, and 9,3% in feces with 24, 48, 72, 96, 120, 144, 168, 192, 216, and 240 h of exposure, respectively.

Ataenius aequalis Harold was the most abundant species (67.3%) followed by the species *Aphodius lividus* Balth (10.7%) among the Scarabaeidae collected (Table 1). It is believed that these species are the most well adapted to pasture areas in the Itumbiara area. These two species were also collected in an experiment carried out by MARCHIORI et al. (2001) at the same location, on feces exposed in the pastures for 196 hours.

It is shown on Table 1 that the majority of Scarabaeidae species (85.7%) and individuals (17.0%) presented peaks of occurrence on feces of 24 hours of exposure, except for *Aphodius nigrita* and *A. aequalis*, that had shown peaks on feces of 96 and 196 hours of exposure, respectively. This finding is important since adults of horn flies oviposit preferentially on fresh-excreted fecal masses (GUIMARÃES, 1990).

It was observed that the higher activity of the Scarabaeidae species occurred on the fresher bovine fecal pads (Table 1) with time of exposures of 24 and 48 hours. FLETCHMANN & RODRIGUES (1995), and FLETCHAMNN et al. (1995) had also achieved similar results. In the ecological succession of insects that occur on bovine feces, only

the coprophagous species found on fresher feces (24 and 48 hours) would be the most suitable for selection in designing a future program of control of flies (FLETCHMANN et al., 1995).

The following results were found in relation to preference of species for time of feces exposure in the field: *Agamopus viridis* (Boucomont), *Aphodius* sp. 1, *Aphodius* sp. 2, *Canthon lituratus* (Germar) and *Onthophagus hirculus* Mannerheim preferred feces of 24 and 48 hours; *A. nigrita* preferred feces of 24, 48, 72, and 96 hours; A. lividus preferred feces of 24, 48, 120, and 144 hours; *Ataenius sp.* 1 preferred feces of 120 and 168 hours; *A. aequalis* preferred feces of 120, 144, 168, 292, 216 and 240 hours; *Dichotomius bos* Mannerheim preferred feces of 24 and 72 hours; *Digitonthophagus gazella* Fabricius preferred feces of 24, 48,72, and 96 hours; and *Trichillum externepuctatum* Borre preferred feces of 24, 48, and 72 hours of field exposure (X2=1421,26; DF=99; P<0.0001).

Conclusion

There is a large diversity and abundance of arthrpods species that develop on bovine feces in the pastures of the region studied. These species presented population peaks on feces exposed in the field for 24, 48 and 72 hours.

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Table 1 - Number of arthropod collected in pasture in Itumbiara County, State of Goias, Central Brazil .

Ordem/Species	24	48	72	96	120	144	168	192	216	240		
DIPTERA												
Muscidae												
Erontaea quadristigma	-	06	-	-	-	02	11	12	16	09	56	1,8
Erontaea debilis	70	11	07	08	08	19	09	03	10	06	151	4,9
Cyrtoneurina pararescita	-	-	-	-	02	-	08	26	17	18	71	2,3
Sarcophagidae												
Ravinia beiforti	-	-	-	-	04	-	02	-	-	01	07	0,2
Sarcophagula occidua	108	231	224	107	201	56	54	142	13	77	1213	39,1
Sepsidae												
Archisespsis scabra	01	01	-	-	02	-	01	04	19	01	29	0,9
Palaeosepsis spp.	169	44	160	137	114	347	98	181	164	144	1558	50,3
Sphaeroceriade												
Sphaeroceriade sp.	10	-	-	-	-	-	-	04	-	-	14	0,5
Total	**358**	**293**	**391**	**252**	**331**	**424**	**183**	**372**	**239**	**256**	**3099**	**100,0**
HYMENOPTERA												
Diapriidae												
Trichopria sp.	-	01	05	02	02	-	01	07	02	-	20	4,8
Figitidae	-	-	-	-	-	-	-	-	-	-	-	
Kleidotoma nigra	-	-	-	-	-	01	-	-	-	-	01	0,2
Neralsia splendens	01	-	01	-	-	-	-	-	-	-	02	0,4
Paraganaspis egeria	57	31	31	06	09	10	03	25	-	19	191	44,4
Triplasta atrocoxalis	-	-	08	16	05	14	-	08	-	-	51	11,9
Triplasta coxalis	-	-	-	-	-	05	-	-	-	-	05	1,2
Pteromalidae:												
Spalangia cameroni	-	-	-	-	-	-	01	-	-	-	01	0,2
Spalangia drosophilae	-	-	-	53	25	09	04	05		02	98	22,8
Spalangia endius	-	-	-	03		-	-	-	-	-	03	0,7
Spalangia nigra	-	-	-	04	02	-	-	-	-	-	06	1,4
Spalangia nigroaenea	-	-	-	12	01	-	-	-	-	01	14	3,3
Spalangia sp.	-	-	-	08	14	-	-	-	03	01	26	6,0
COLEOPTERA												
Staphylinidae												
Aleochara notula	05	05	-	-	01	-	-	-	-	01	12	2,7
Total	**63**	**37**	**45**	**104**	**59**	**39**	**09**	**45**	**05**	**24**	**430**	**100,0**
Scarabaeidae												
Agamopus viridus	06	04	02	-	-	-	-	-	-	01	13	0,4
Aphodius sp.1	58	12	-	-	-	-	02	-	-	02	74	2,3
Aphodius sp.2	57	16	-	-	-	-	03	-	-	01	77	2,4
Aphodius negrita	11	13	15	18	01	01		02	-	02	63	2,0
Ataenius spl	-	-	-	01	05	01	18	02	-	-	27	0,8
Ataenius aequalis	121	266	182	224	192	232	216	287	259	227	2206	68,3
Canthon lituratus	10	06	-	-	-	-	-	-	-	-	16	0,5
Dichotomius bos	10	03	07	01	01	02	02	01	-	03	30	0,9
Digithonthophagus gazella	123	64	61	31	10	04	-	03	-	01	297	9,2
Euparia sp.	-	-	-	-	02	-	-	-	-	-	02	0,1
Onthophagus hirculus	11	10	03	-	02	02	01	04	-	06	39	1,2
Orthophagus ranunculus	04	-	-	-	-	-	-	-	-	-	04	0,2
Trichillum externepuntatum	26	07	04	-	-	-	-	-	-	-	37	1,1
	552	**494**	**300**	**282**	**261**	**247**	**245**	**320**	**284**	**244**	**3229**	**100**
TOTAL GERAL	**973**	**824**	**736**	**638**	**651**	**710**	**437**	**737**	**528**	**524**	**6758**	**100,**