Cattle Dung Breeding Diptera in Pastures in Southeastern Brazil: Diversity, Abundance and Seasonallity

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Diptera that breed in undisturbed cattle droppings in pastures present great diversity and abundance, and several species are of veterinary importance and may cause economic losses. To survey the diversity, abundance and seasonality of Diptera associated to this microhabitat, 83 samples of 10 dung pats each were taken from April 1992 to April 1994 in the vicinity of São Carlos, State of São Paulo, Southeastern Brazil. A total of 46,135 Diptera belonging to 20 families and at least 51 species were found to breed in the pats. The most abundant and diverse families were Sepsidae, Muscidae, Sarcophagidae and Sphaeroceridae. In general, the abundance was higher from October to March, the warm and wet months. The importance of some Diptera, both as horn fly enemies and as cattle dung decaying agents, is discussed.

Key words: Diptera - cattle dung - dung flies - diversity - seasonality - Brazil

Cattle dung pats naturally dropped in pastures are the microhabitat for an abundant and diversified arthropod fauna (Merrit & Anderson 1977, Anderson et al. 1984, Blume 1985, Cervenka & Moon 1991). The coprophagous community is represented mainly by Scarabaeidae (Coleoptera) and Diptera that are the most important decaying agents of the dung pats (Laurence 1955, Nibaruta 1982, Anderson et al. 1984, Cervenka & Moon 1991). Dung breeding Diptera are generally the most diverse group in cattle dung pats (Poorbaugh et al. 1968, Nibaruta 1982, Blume 1985, Cervenka & Moon 1991), and several species, such as the face fly *Musca autumnalis* (De Geer 1776) and *Haematobia* spp. (Diptera: Muscidae) are of veterinary importance (Lancaster & Meish 1986).

The recent introduction of the horn fly *Haematobia irritans* (Linnaeus 1758) into Northern Brazil, and its quick dispersion to practically the entire country, stimulated investigations on the arthropod community of cattle dung pats in pastures (Valério & Guimarães 1983, Fava et al. 1994, Flechtmann et al. 1995a,b, Mendes & Linhares 1999). Such community plays an important role in the dung pat decay process and in the natural control of dung breeding pests (MacQueen & Beirne 1975, Merrit & Anderson 1977, Roth et al. 1983, Anderson et al. 1984, Harris & Blume 1986, Hanski 1987, Fay et al. 1990). Information on arthropod dung community is important not only to biological and integrated control programs, but also to the implementation of control programs of pests that breed in cattle droppings. However, there are very few studies published on this subject in Brazil, restricted to a few localities (Oliveira et al. 1993, Souza e Silva 1993, Flechtmann et al. 1995a,b, Mendes & Linhares 1999). This paper presents data on diversity, abundance and seasonality of cattle dung breeding Diptera in the vicinity of São Carlos city, State of São Paulo, Southeastern Brazil.

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MATERIALS AND METHODS

The experimental sites were pastures of *Brachiaria decumbens* Saft. and *Andropogon gayanus* Kunth at Fazenda Canchim, a farm belonging to Empresa Brasileira de Pesquisa Agropecuária (Embrapa), located about 10 km northeast from São Carlos city. Ten naturally dropped cattle dung pats, approximately 24 h old, and the substract 5 cm underneath them were collected weekly during morning hours, placed in individual plastic containers and taken to the Entomology Laboratory of the Department of Parasitology, Campinas State University (Unicamp), about 150 km southeast of São Carlos. A total of 83 samples, yielding 830 pats, was collected from April 1992 to April 1993. In each sample, a quarter of four dung pats and the underlying substrate were placed into Berlese funnels to extract the Coleoptera and Macrochelidae mites, and the results will be published elsewhere. The remaining of the dung pats in the containers were covered with organza and kept at room temperature until the complete emergence of all Diptera. This procedure took approximately 30-40 days in the warm months and 40-50 days in the cooler months. Emerging Diptera and other arthropods were collected daily and placed in 70% alcohol for identification. The substract was then placed in water to extract, by flotation, any remaining viable pupa from which adults had not yet emerged. The collected pupae were kept in transparent gelatin capsules for adult emergence. Diptera identification were done using the identification keys of McAlpine (1981, 1987). The species were grouped into trophic groups following Valiela (1974) and Hanski (1987). To test for any correlation among family's abundances, the Pearson's correlation analysis was done using SAS® PROC CORR procedure (SAS 1987).

RESULTS

A total of 46,135 Diptera was obtained, belonging to 20 families and to at least 51 species. The most diverse and abundant families were Muscidae, Sepsidae, Sarcophagidae and Sphaeroceridae (Table). The oscillations in temperature and rainfall during the two experimental years determined a warm and humid period from October to March, and a cool and dry period from April to September (Fig. 1). When compared to the warm months, the emergence time during the cool period lasted 5 to 10 days longer. The

TABLE

Diversity and abundance of cattle dung breeding Diptera emerged from dung pats naturally dropped at "Fazenda Canchim" pastures in São Carlos, Southeastern Brazil from April 1992 to April 1994

Species	Troffic group	Total	%
Muscidae			
Biopirellia bipuncta	LDBD	1372	18.6
Bitorachochaeta atricornis		9	0.1
Bitorachochaeta leucoprocta		6	0.1
Brontaea debilis	PL	2,886	39.2
Brontaea sp.	PL	1,454	19.7
Cyrtoneurina geminata	LDBD	1,277	17.3
Cyrtoneurina rescita	LDBD	27	0.4
Haematobia irritans	SDBD	4	0.05
Morellia concacata	LDBD	27	0.4
Morellia paulistanensis	LDBD	87	1.2
Musca domestica		12	0.2
Muscina stabulans		2	0.02
Sarcopromusca pruna	LDBD	109	1.5
Stomoxys calcitrans		95	1.3
Total		7,367	100
Anthomyiidae			
Calythea sp.	LDBD	1,183	100
Sarcophagidae			
Chaetoravinia advena	LDBD	268	7.0
Hybopigia terminalis	LDBD	4	0.1
Hybopigia varia	LDBD	184	4.9
Lypoptilocnema crispula	LDBD	1	0.02
Oxysarcodexia avuncula	LDBD	2,378	64
Oxysarcodexia thornax	LDBD	148	4
Ravinia belforti	LDBD	8	0.02
Sarcophagula occidua	SDBD	724	19.5
Total		3,715	100
Calliphoridae			
Phaenicia eximia	LDBD	1	100
Fanniidae			
Fannia pusio	SDBD	18	85.7
Fannia sp.	SDBD	3	14.3
Total		21	100
Dolichopodidae	PL		
Condylostylus sp.		34	32
Chrysotus sp.		72	68
Total		106	100
Tipulidae	SDBD		
Teucolabis sp.		820	34.4
Limoniini sp. 1		1,567	65.6
Total		2,387	100
Sepsidae	SDBD		
Archisepsis scabra (Loew)		2,834	10.3
Microsepsis furcata (Melander & Spuler)		1,980	7.3
Palaeosepsis insularis (Williston)		12,870	47.3
Palaeosepsis pusio (Shiner)		9,627	35.1
Total		27,311	100
Sphaeroceridae	SDBD		
Coproica sp. ?		1,390	61.9
Sphaerocera sp.		206	9.2
Leptocera sp. ?		570	25.4
Other Sphaeroceridae (2 spp.)		80	3.5
Total		2,246	100
Stratiomyidae	LDBD		
Microchrysa sp.		441	69.7
Sargus sp.		192	30.3
Total		633	100
Asilidae	PL	37	
Bibionidae	PL	1	
Cecidomyidae	-	47	
Ceratopogonidae	PL	37	
Chloropidae	SDBD	22	
Mycetophilidae	SDBD	5	
Phoridae	PL	37	
Psychodidae	SDBD	95	
Sciaridae	SDBD	761	
Tachinidae	SDBD	1	
Total Diptera		46,013	

LDBD: large dung breeding Diptera; PL: predatory larvae; SDBD: small dung breeding Diptera

majority of the Diptera emerged within the first 20 days during the warm months and within the first 25 days in the dry period. The most abundant Diptera can be divided into three groups according to emergence time: (1) Sepsidae; *Brontaea debilis*, *Calythea* sp., *Haematobia irritans* (Muscidae); *Sarcophagula occidua* (Sarcophagidae) and part of the Sphaeroceridae that emerged during the first 10 days after the dung pats were collect from pastures; (2) the remaining Muscidae, Sarcophagidae and Sphaeroceridae that emerged between the 11th and the 20th days (3) Tipulidae, Sciaridae and Stratiomyidae that began to emerge after the 20th day. In general, the species presented greater abundance during the warm and humid period (Figs 2-5). The exceptions were *Biopyrellia bipuncta* (Fig. 2), *Calythea* sp. (Fig. 3) and *Coproica* sp. (Fig. 4) that were also abundant during the cold and dry period. The correlation coefficient was positive and significant for the most abundant families: Sepsidae vs. Sarcophagidae ($r = +0.56$; $p < 0.0001$); Sepsidae vs. Sphaeroceridae ($r = +0.53$; $p < 0.0001$); Muscidae vs. Sarcophagidae ($r = +0.73$; $p < 0.0001$).

DISCUSSION

As reported by other authors (Cervenka & Moon 1991, Souza e Silva 1993), some loss of small sized specimens occurred, mainly during the extraction from the pats, but apparently, this fact did not influence the results, because of the great abundance of these insects in the samples. Although many authors state that Diptera species usually visit and lay eggs in dung pats within the first 24 h of dung exposition, results of Barth et al. (1994) indicate that low abundance or absence of some species would be the result of breeding preference by such species for older dung pats. In addition, some species of Sphaeroceridae and Sepsidae may have more than one generation in the dung pat (Laurence 1955, Souza e Silva 1993). The successional pattern of adult emergence was similar to that found by Nibaruta (1982) and Souza e Silva (1993). However, our results on emergence times differed from those of Nibaruta (1982). The low abundance of *H. irritans* may be attributed to the genetic resistance of the host, cattle breeding management procedures, and to its natural enemies found in the dung. The significant Muscidae and Sepsidae diversities were also recently verified in this country by

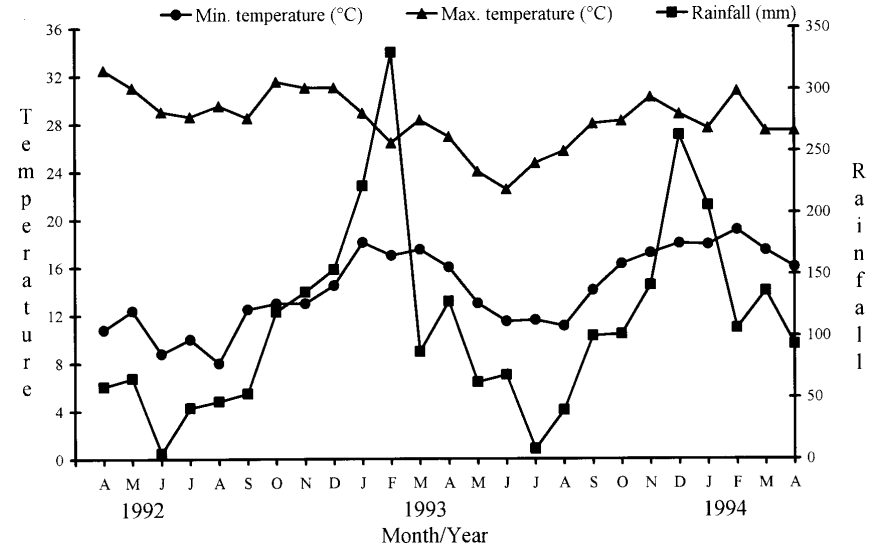

Fig. 1: monthly temperature and rainfall from April 1992 to April 1994 in São Carlos, São Paulo, Southeastern Brazil

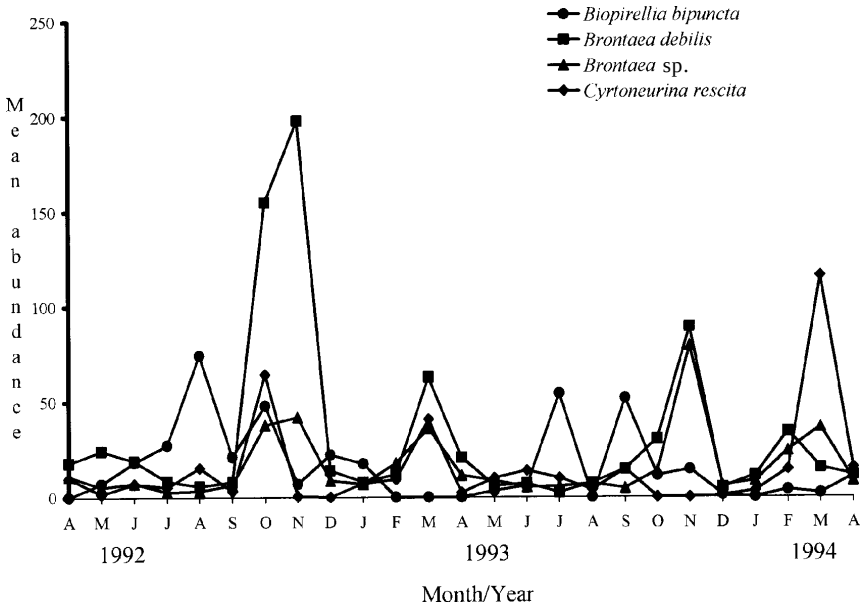

Fig. 2: seasonallity of *B. bipuncta*, *B. debilis*, *Brontaea* sp. and *C. rescita*, extracted from cattle manure collected at Fazenda Canchim pastures in São Carlos, São Paulo, Southeastern Brazil, from April 1992 to April 1994. Values are the average of two to four samples in each month.

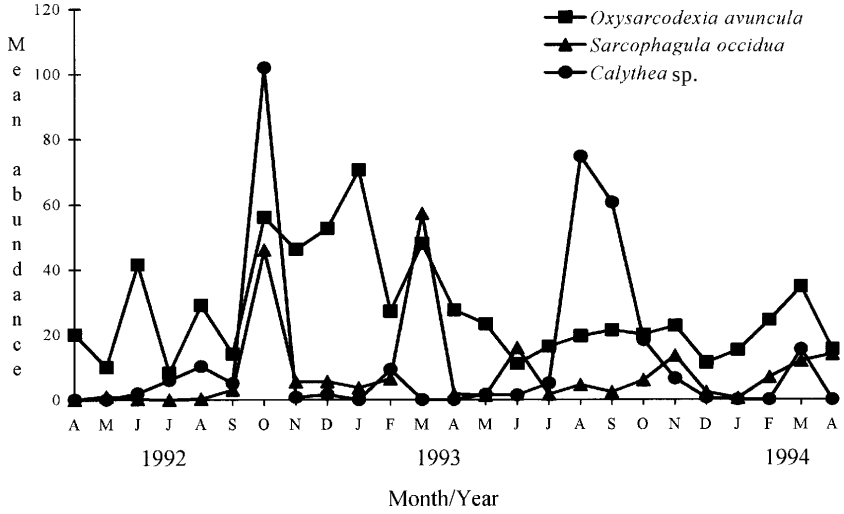

Fig. 3: seasonallity of *O. avuncula*, *S. occidua* and *Calythea* sp. extracted from cattle manure collected at Fazenda Canchim pastures in São Carlos, São Paulo, Southeastern Brazil, from April 1992 to April 1994. Values are the average of two to four samples in each month.

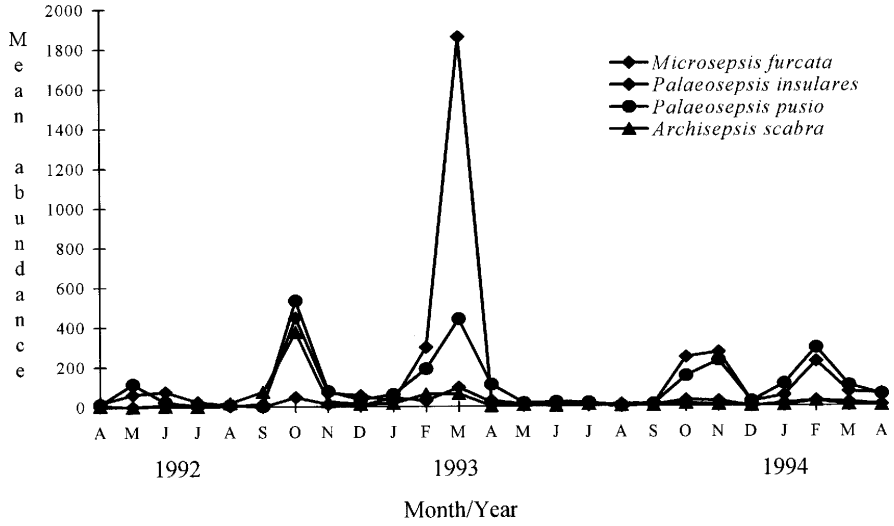

Fig. 4: seasonallity of *M. furcata*, *P. insularis*, *P. pusio* and *A. scabra*, extracted from cattle manure collected at Fazenda Canchim pastures in São Carlos, São Paulo, southeastern Brazil, from April 1992 to April 1994. Values are the average of two to four samples in each month.

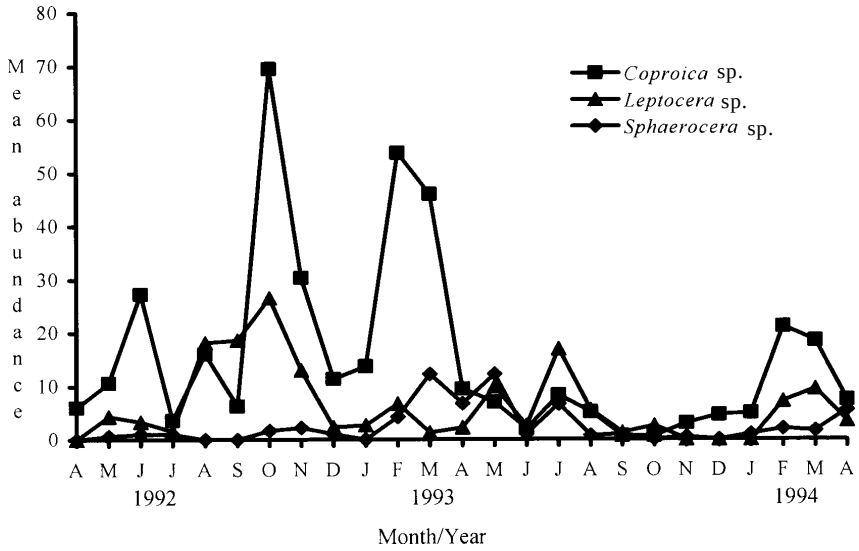

Fig. 5: seasonallity of *Coproica* sp., *Leptocera* sp. and *Sphaerocera* sp., extracted from cattle manure collected at Fazenda Canchim pastures in São Carlos, São Paulo, Southeastern Brazil, from April 1992 to April 1994. Values are the average of two to four samples in each month.

Oliveira et al. (1993), Souza e Silva (1993), and Flechtmann et al. (1995). Although the Sepsidae are generally abundant, they are not considered to be important *H. irritans* competitors or dung decaying agents. Their larvae are considered dung tunnelers, contributing to pat aeration, which can help dung colonization by other arthropods, and to dung loss of water. Therefore, they aid in the natural control of *H. irritans*. The correlation analysis suggests that the observed abundances of Sarcophagidae and *Brontaea* spp. may be enough to promote a statistically significant reduction in the abundances of other analyzed groups. Larvae of these two groups are known to be facultative predators in some situations (Harris & Blume 1986, Ferrar 1987, Hanski 1987). It is also important to point out the possibility that some adults of Diptera may act as transporters of *Dermatobia hominis* (Diptera: Cuterebridae) eggs (Artigas & Serra 1965, Oliveira 1986).

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