POPULATION DYNAMICS OF CALYPTRATE DIPTERA (MUSCIDAE AND SARCOPHAGIDAE) AT THE RIO-ZOO FOUNDATION, RIO DE JANEIRO, RJ, BRAZIL

OLIVEIRA, V. C.,[1] D'ALMEIDA, J. M.,[2] PAES, M. J.[3] and SANAVRIA, A.[4]

[1] Laboratório de Biologia e Controle de Insetos Vetores, Departamento de Biologia, Instituto Oswaldo Cruz, Av. Brasil, 4365, CEP 21045-900, Rio de Janeiro, RJ, Brazil

[2] Laboratório de Entomologia Médica, Centro de Ciências e Saúde, Universidade Federal do Rio de Janeiro, Bloco I, 2º andar, s/39, CEP 21910-900, Rio de Janeiro, Brazil

[3]Departamento de Medicina Veterinária da Escola Superior de Agricultura de Mossoro, BR 110, Km 47, Bairro Costa e Silva, CEP 59625-900, Mossoro, Brazil

[4]Departamento de Epidemiologia e Saúde Pública, Universidade Federal Rural do Rio de Janeiro, BR 465, Km 47, CEP 23835-970, Seropédica, Rio de Janeiro, Brazil

Correspondência para: Vanderleia Cristina de Oliveira. Departamento de Biologia, Instituto Oswaldo Cruz, Av. Brasil, 4365, CEP 21045-900, Rio de Janeiro, RJ, Brazil
e-mail: vcris@ioc.fiocruz.br

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ABSTRACT

Twenty-seven species of calyptrate muscoids (Muscidae and Sarcophagidae) were collected from December 1993 to November 1994 with wind oriented traps (W.O.T.) baited with decomposing beef liver at the Rio de Janeiro Zoo. The most abundant species found were *Musca domestica* (57.84%), *Peckia chrysostoma* (28.16%), *Ophyra aenescens* (17.11%), *Oxysarcodexia thornax* (17.82%), *Synthesiomyia nudiseta* (13.05%), and *Oxysarcodexia diana* (14.52%).

Key words: ecology, flies, Muscidae, Sarcophagidae, zoological garden.

RESUMO

Dinâmica populacional de dípteros caliptrados (Muscidae e Sarcophagidae) na Fundação Rio-Zoo, RJ, Brasil

Vinte e sete espécies de dípteros caliptrados (Muscidae e Sarcophagidae) foram capturados no período de dezembro de 1993 a novembro de 1994, com armadilhas orientadas pelo vento (W.O.T.) contendo isca de fígado em putrefação, no jardim zoológico da cidade do Rio de Janeiro. As espécies capturadas em maior abundância foram *Musca domestica* (57,84%), *Peckia chrysostoma* (28,16%), *Ophyra aenescens* (17,11%), *Oxysarcodexia thornax* (17,82%), *Synthesiomyia nudiseta* (13,05%) e *Oxysarcodexia diana* (14,52%).

Palavras-chave: ecologia, Díptera, Muscidae, Sarcophagidae, zoológico.

INTRODUCTION

Muscoids dipterous have always been associated with human and domestic animals due to the abundance of food resources found in stables and domestic garbage. These flies are of major concern for veterinary medicine due to their capacity to act as a vector of several pathogenic organisms such as protozoa cysts, helminth parasites, enteropathogenic bacteria, and enterovirus (Root, 1921; Nuorteva, 1959; Greenberg, 1973).

Zoological gardens offer excellent conditions for breeding calyptrates dipterous due to abundant food resources and breeding places like feces and food leftovers of animal and vegetable origin (D'Almeida, 1989; Oliveira *et al*., 1999).

The objective of this study was to investigate frequency, abundance, and season of Sarcophagidae and Muscidae at the Rio de Janeiro Zoo (Rio-Zoo).

MATERIAL AND METHODS

To capture adult flies, six wind oriented traps (W.O.T.), described by Broce *et al*. (1977) and latter modified by Oliveira *et al.* (1982), were placed from 1.00 to 1.50 meters from the ground at three different spots inside the zoo: site 1, near the veterinary and biological facilities; site 2: next to the giraffe and zebra enclosure; and site 3, next to the repair shop and the deer park. All of the traps were set from December 1993 to November 1994. To attract adult flies, a plastic recipient (11 cm diameter $\times$ 7 cm height) containing 500 g of rotting beef liver (5 days old) was placed inside each trap. The bait was changed every week.

Three times a week, the traps were checked and all captured specimens were killed with aerosol insecticide (pyrethroid), removed from the traps, and taken in plastic bags to the Laboratory of Biology and Control of Vector Insects, Biology Department, Oswaldo Cruz Institute, Fiocruz. After being identified and quantified, all samples were deposited in the collection of that laboratory.

Each month the number of captured flies was correlated with temperature, relative humidity, and precipitation (correlation of Pearson), obtained from the Meteorological Station of the Federal University of Rio de Janeiro.

RESULTS AND DISCUSSION

The abundance and relative frequency of the captured species of Muscidae and Sarcophagidae are shown in Tables 1 and 2, respectively.

Among the muscids, *Musca domestica* (Linnaeus, 1758) was the most abundant species, totaling 54.84% (2,224 captured specimens). The population peaks occurred in April, May, and July (Fig. 1) and the species was most frequent during autumn (Table 1). Even though the differences among the sampling sites have not been analyzed, this species was more common at site 2, next to the giraffe and zebra enclosure. This could be related to its proximity to the Evaristo de Morais prison with its high population density and to an enormous quantity of elephant feces. Following Greenberg (1971), *M. domestica* was initially coprophagous and adapted to ungulate excrements. Later, with the synantropization process, it became adapted to several substrates. Nunes *et al.* (1991) and Keiding (1976) showed that this fly has ample geographic distribution and great epidemiological importance, due to its capacity to adapt to man-made conditions and use several substrates as food and breeding sites, as well as being a potential mechanical vector for a great number of pathogens.

TABLE 1

Relative and absolute frequencies of the Muscidae species captured with W.O.T. traps baited with rotting liver, from December 1993 to November 1994, at the Rio de Janeiro Zoological Garden.

Species	Season									
	Summer		Autumm		Winter		Spring		Total	
	N.	%	N.	%	N.	%	N.	%	N.	%
Musca domestica	527	23.69	1,195	53.73	439	19.73	63	2.83	2,224	57.84
Ophyra aenescens	205	31.15	347	52.73	68	10.63	38	5.77	658	17.11
Synthesiomyia nudiseta	80	15.93	154	30.67	214	42.62	54	10.75	502	13.05
Ophyra sp.	110	31.60	166	47.70	53	15.22	19	5.45	348	9.05
Atherigona orientalis	78	69.02	13	11.50	10	8.84	12	10.61	113	2.93
Total	1,000	26.00	1,875	48.76	784	20.39	186	4.83	3,845	

TABLE 2

Relative and absolute frequencies of the Sarcophagidae species captured with W.O.T. traps baited with rotting liver, from December 1993 to November 1994, at the Rio de Janeiro Zoological Garden.

Species	Season									
	Summer		Autumn		Winter		Spring		Total	
	N.	%	N.	%	N.	%	N.	%	N.	%
Peckia chrysostoma	298	34.93	80	9.37	275	32.23	200	23.44	853	28.16
Oxysarcodexia thornax	222	41.11	112	20.74	133	24.62	73	13.51	540	17.82
Oxysarcodexia diana	248	56.36	82	18.63	63	14.31	47	10.68	440	14.52
Sarcodexia lambens	33	11.49	31	10.80	169	58.88	54	18.81	287	9.47
Oxysarcodexia fluminensis	135	50.94	32	12.07	55	20.75	43	16.22	265	8.74
Pattonella intermutans	20	9.43	8	3.77	50	23.58	134	63.00	212	6.99
Ravinia belforti	65	38.92	37	22.15	24	14.37	41	24.55	167	5.51
Oxysarcodexia amorosa	36	46.75	5	6.49	25	32.46	11	14.28	77	2.54
Euboectheria collusor	11	22.91	6	12.50	7	14.58	24	50.00	48	1.58
Liophygia ruficornis	11	33.33	4	12.12	3	9.09	15	45.45	33	1.08
Helicobia terminalis	16	66.66	5	20.83	1	4.16	2	8.33	24	0.79
Lipoptilocnema sp.	7	23.16	4	16.66	6	25.00	7	29.16	24	0.79
Oxysarcodexia admixta	8	53.33	2	13.33	4	26.66	1	6.66	15	0.49
Sarcophagula sp.	7	53.84	4	30.76	2	15.38	–	–	13	0.42
Oxysarcodexia modesta	3	33.33	3	33.33	1	11.11	2	22.22	9	0.29
Oxysarcodexia intona	2	28.57	1	14.28	3	42.85	1	14.28	7	0.23
Helicobia sp.	4	57.14	–	–	2	28.57	1	14.28	7	0.23
Berceae cruentata	1	25.00	1	25.00	1	25.00	1	25.00	4	0.13
Oxysarcodexia xantossoma	1	–	–	–	–	–	–	–	1	0.03
Oxysarcodexia major	1	–	–	–	–	–	–	–	1	0.03
Oxysarcodexia augusta	–	–	1	–	–	–	–	–	1	0.03
Oxysarcodexia culminiforceps	–	–	–	–	–	–	1	–	1	0.03
Total	1,129	37.27	418	13.79	824	27.20	658	21.72	30.29	

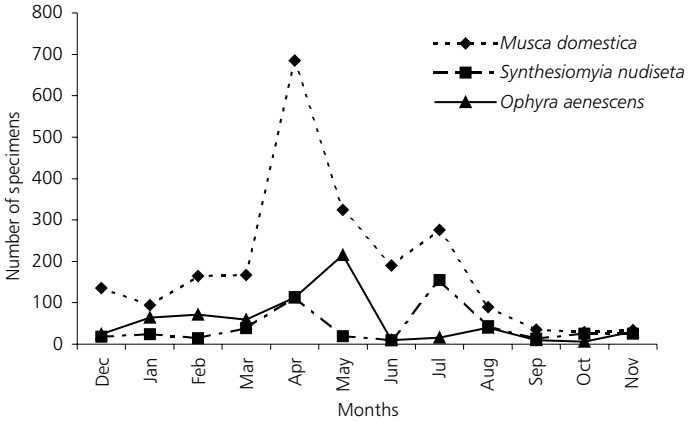

Fig. 1 — Monthly frequency of *Musca domestica*, *Synthesiomyia nudiseta*, and *Ophyra aenescens* captured with W.O.T. traps from December 1993 to November 1994 with wind oriented traps, baited with decomposing beef liver in the Rio de Janeiro Zoo.

Ophyra aenescens (Wiedemann, 1830) was the second in abundance with 658 collected specimens. The populational peaks were in April and May (Fig. 1) with a higher frequency in autumn (Table 1). Linhares (1979) found that O. *aenescens* had a high synanthropic index among the muscidae collected in Campinas, SP, and disagrees with d'Almeida (1983) who reported the preference of this fly for uninhabited areas of Rio de Janeiro. Bohart & Gressit (1951) reported the variety of substrates that can be used by this muscoid, including fresh human feces, carcasses, and rotting vegetables. Salviano (1996) found this species in the dead body of *Sus scrofa* in an urban Rio de Janeiro area and emphasized its importance in forensic entomology.

The synanthropic species *Synthesiomyia nudiseta* (Wulp, 1883) had 502 captured specimens and its population peaks were registered in April and July (Fig. 1), predominating during the winter (Table 1), which corroborates the results of Salviano (1996).

Only 2.93% of the collected muscids were of the *Atherigona orientalis* (Schiner, 1868) species (Table 1). This contrasts with the results of d'Almeida (1983 and 1988) who found a high abundance of this species in rural and urban areas of Rio de Janeiro. Probably the present result is due to the trap wire width that permitted the escape of the flies as well as to the bait type used. Povolny (1971) relates that *A. orientalis* can grow at several substrates ranging from carcasses and human feces to rotting vegetables and urban garbage. D'Almeida (1988) reported the species preference for vegetable substrates, especially fruits.

Among the sarcophagids, *Peckia chrysostoma* (Wiedemann, 1830) was the most common species with 853 specimens; it was more frequent during the summer (Table 2). D'Almeida (1983) also found a great abundance of this fly in the urban Rio de Janeiro area.

Eleven species from *Oxysarcodexia* genus were captured, making up 44.8% of total collected sarcophagids. Among the genus, the most abundant species was *O. thornax* (Walker, 1849) being the second most collected among the sarcophagids (540 specimens) (Table 2). The population peak of *O. thornax* was registered in January and February (Fig. 2). This species was also abundant in Curitiba, Belo Horizonte, Campinas, and Rio de Janeiro as described by Ferreira (1975), Dias (1983), Mendes (1991), and Salviano (1996), respectively. Both Mendes (1991) in Campinas and Dias (1983) in Belo Horizonte, observed the attraction of these flies to human feces and chicken guts. In Rio de Janeiro, D'Almeida (1983) found that the flies were most attracted to fish. Salviano (1996) reported the presence of 1st and 2nd instar larvae of *O. thornax* developing in accumulated feces in the anus of a carcass of *Sus scrofa*, although no larvae was found in the tissues. Following Lopes (1946), this genus is characteristic of the Neotropical region and the greatest number of species is found in Brazil where it develops preferentially in feces.

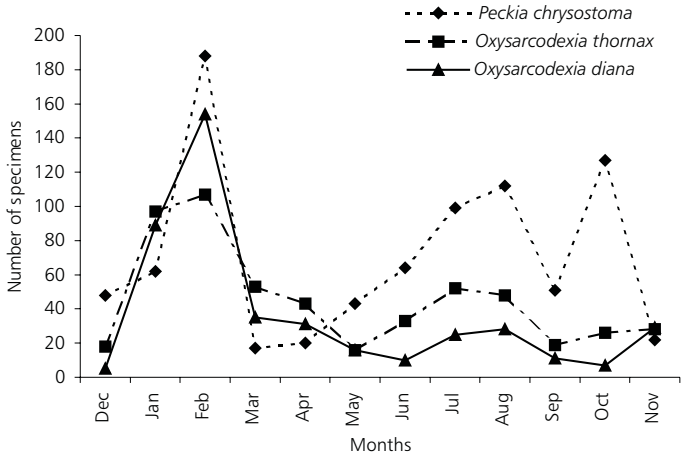

Fig. 2 — Monthly frequency of *Peckia chrysostoma*, *Oxysarcodexia thornax*, and *Oxysarcodexia diana* captured from December 1993 to November 1994 with wind oriented traps, baited with decomposing beef liver in the Rio de Janeiro Zoo.

Oxysarcodexia diana (Lopes, 1933) was the third most abundant species among the Sarcophagidae (Table 2). The population peak occurred in January and February (Fig. 2). D'Almeida (1983) showed that this dipteran has a greater preference for urban areas of Rio de Janeiro although, in Belo Horizonte, Dias (1983) did not find this result. Both of these authors observed that feces were the most attractive bait for this species. The abundance of this and other sarcophagids, like *O. thornax*, can be related to the high abundance of feces in animal enclosures which favor larval development.

Sarcodexia lambens (Walker, 1861) was also abundant in Rio de Janeiro, predominating during winter months (Table 2). In a study conducted in Rio de Janeiro (D'Almeida, 1983), this species occurred in greater abundance in urban areas and the most attractive bait was fish. However, in Campinas (Linhares, 1981) and Belo Horizonte (Dias,1983) the species was more abundant in uninhabited areas.

Pattonella intermutans (Thonson, 1869), a frequent species in Rio de Janeiro, was more abundant in the spring (Table 2). In Rio de Janeiro (D'Almeida, 1983) and in Belo Horizonte (Dias, 1983) this species was more common during the summer. According to D'Almeida (1983), this species shows an aversion to inhabited areas; its most attractive baits were fish and beef liver. Salviano (1996) emphasized the importance of this species for forensic studies in Rio de Janeiro State.

Fig. 3 shows the monthly climatological data observed during the study. With respect to the correlation between monthly frequency of species collected and weather factors, a significant positive correlation appeared between relative humidity and the abundance of *M. domestica* ($r = 0.54$; $n = 12$; $p < 0.05$) and *O. aenescens* ($r = 0.53$; $n = 12$; $p < 0.05$).

A positive correlation was also observed between *O. diana* and temperature ($r = 0.52$; $n = 12$; $p < 0.05$). However, the abundance of *P. chrysostoma* was negatively correlated with precipitation ($r = –0.59$; $n = 12$; $p < 0.05$). There were no significant correlation between the other species and weather factors.

M. domestica, *O. aenescens*, and *S. nudiseta* have a population peak in April (Fig. 1). There was a huge build-up of garbage during this month due to collecting difficulties in Rio de Janeiro. This underscores the relation between these muscoids and urban garbage.

Zoos have peculiar characteristics attractive to the dipterofauna since they resemble rural habitats due to the feces volume produced daily.

They also constitute ideal places not only for studying population dynamics studies but also for evaluating the epidemiological aspects of pathogenic transmission.

Acknowledgments — We thank the Rio-Zoo Foundation for the facilities used in this study.

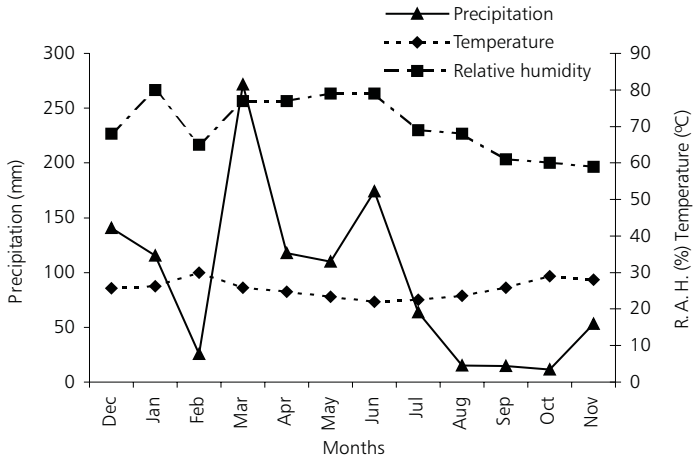

Fig. 3 — Monthly climatological data (temperature, relative humidity, and precipitation) observed from December 1993 to November 1994.

REFERENCES

BOHART, G. E. & GRESSIT, J. L., 1951, Filth-inhabiting flies of guam. *Bishop Mus. Bull., 204*: 152.

BROCE, A. B., GOODENOUGH, J. L. & COPPEDGE, J. R., 1977, A wind oriented trap. for screw-worm flies. *J. Econ. Entomol., 70*(4): 413-416.

D'ALMEIDA, J. M., 1983. *Sinantropia de dípteros caliptratos na área metropolitana do Rio de Janeiro.* Tese de Mestrado, Universidade Federal Rural do Rio de Janeiro. 193p.

D'ALMEIDA, J. M., 1988, Substratos utilizados para a criação de dípteros caliptratos em área urbana do Município do Rio de Janeiro. *Mem. Inst. Oswaldo Cruz, 83*: 201-206.

D'ALMEIDA, J. M., 1989, Substratos utilizados para a criação de dípteros caliptratos no Jardim Zoológico do Rio de Janeiro (Rio-Zoo). *Mem. Inst. Oswaldo Cruz, 84*: 257-264.

DIAS, E. S., 1983, *Levantamento taxonômico e sinantrópico da fauna de Sarcophagidae (Diptera) em Horizonte, Minas Gerais.* Tese de Mestrado, Universidade Federal de Minas Gerais, 91p.

FERREIRA, M. J. M., 1975, *Sinantropia de dípteros muscóides de Curitiba (Calliphoridae e Sarcophagidae).* Tese de Mestrado, Universidade Federal do Paraná, 106p.

GREENBERG, B., 1971, *Flies and disease: ecology, classification and biotic association.* Princeton Univ. Press, Princeton, 1. vol., n. 1, 856p.

GREENBERG, B., 1973, *Files and disease: biologia and disease transmission.* Princeton Univ. Press, Princeton, 1. vol., n. 1, 447p.

KEIDING, J., 1976, *The house fly biology and control*. World Heath Organization/UBC/76650, 82p.

LINHARES, A. X., 1979. *Sinantropia de dípteros muscóides de Campinas*. Tese de Mestrado, Universidade Estadual de Campinas, Campinas, São Paulo, 129p.

LINHARES, A. X., 1981, Sinantropy of Calliphoridae and Sarcophagidae (Diptera) in the city of Campinas, São Paulo, Brazil. *Rev. Bras. Entomol., 25*: 189-215.

LOPES, H. S., 1946, Contribuição ao conhecimento do gênero *Oxysarcodexia* Towsend, 1917 (Díptera, Sarcophagidae). *Bol. Esc. Nac. Vet., 1*: 62-134.

MENDES, J., 1991, *Relação entre atratividade por iscas e estágios de desenvolvimento ovariano em fêmeas de dípteros muscóideos sinantrópicos de Campinas, São Paulo.* Tese de Mestrado, Universidade Estadual de Campinas, 129p.

NUNES, M. S., MILWARD-DE-AZEVEDO, E. M. V., CARVALHO, E. H. P. S. & MELLO, R. P., 1991, Estudo comparado do desenvolvimento pós-embrionário de *Musca domestica* (Linnaeu) (Diptera, Muscidae), criada em fezes de animais domésticos, sob condições de laboratório. *Rev. Bras. Entomol., 35*: 203-221.

NUORTEVA, P., 1959, Studies on the significance of flies in the transmission to the occurrence of poliomyelitis in Finland. *Ann. Entomol. Fenn., 25*: 1-24.

OLIVEIRA, C. M. B., MOYA, G. E. & MELLO, R. P., 1982, Flutuação populacional de *Cochliomyia hominivorax* no município de Itaguaí, Rio de Janeiro. *Pesq. Vet. Bras., 2*: 193-142.

OLIVEIRA, V. C., D'ALMEIDA, J. M., PAES SANTOS, M. J. & SANAVRIA, A., 1999, Dinâmica populacional dos Dípteros Calliphoridae na Fundação Rio-Zoo, Rio de Janeiro, RJ, Brasil. *Entomol y Vect., 6*: 264-276.

POVOLNY, D., 1971, Synanthropy, pp.17-54. *In*: B. Greenberg (org.), *Flies and disease: ecology, classification and biotic associations.* Princeton, 1. vol. Univ. Press., Princeton.

ROOT, F. M., 1921, Experiments on the carriage of intestinal protozoa of man by flies. *Am. J. Hyg., 1*: 131.

SALVIANO, R. J. B., 1996, *Sucessão de Díptera Caliptrata em carcaça de Sus scrofa Linnaeus, Rio de Janeiro, RJ, Brasil.* Tese de Mestrado, Universidade Federal Rural do Rio de Janeiro, 158p.