Ovipositional Substrates Used by Calyptrate Diptera in Tijuca Forest, Rio de Janeiro

Jose Mario d'Almeida

Laboratório de Biologia e Controle de Insetos Vetores, Depto. de Biologia, Instituto Oswaldo Cruz, Av. Brasil 4365, 21045-900 Rio de Janeiro, RJ, Brasil

Twenty seven species of calyptrate muscoids were reared from a forested area of Rio de Janeiro (Tijuca Forest). Substrates for obtaining flies were beef liver, fish, mouse, frog, shrimp, snail carcasses, human faeces, banana and papaya fruits. The most frequent species found were: Fannia *sp. (subgroup pusio) (49.9% on shrimp).* Hemilucilia flavifacies *(95.0% on liver),* Phaenicia eximia *(49.4% on mouse),* Synthesiomyia nudiseta *(100.0% on fish),* Ophyra aenescens *(100.0% on shrimp),* Oxyvinia excisa *(100.0% on faeces),* Euboettcheria collusor *(52.4% on faeces) and* Pattonella intermutans *(61.0% on frog).*

Key words: ecology - breeding substrates - flies

In the forest, the dipterous fauna is quite varied. While researching different ecosystems in Rio de Janeiro, d'Almeida (1982) found 115 species of muscoid flies from which, 26% were exclusively captured in forest areas.

Due to the scarce literature about breeding places of sylvatic flies, and following up previous work about substrates used for rearing calyptrate dipterous in diversified ecosystems (d'Almeida, 1986, 1988, 1989, 1993), it has been decided that a study such as this is essential. Therefore, the aim of this paper is to evaluate the use of a series of decaying substances as breeding places of these diptera.

MATERIALS AND METHODS

The research was developed in Tijuca Forest, (22° 57'S and 43° 17'W), which comprises an area of 3,300 ha within the city of Rio de Janeiro. According to Mattos et al. (1976), the climate in Tijuca Forest is different from the urban area of the city, which is AW Koppen type (tropical climate with rainy summer and dry winter). This area is situated in a mountainous region with altitudes that vary from 80 to 1,021m at the "Maciço da Tijuca". The mountains are oriented NE-SW, forming a natural barrier to the water vapour originated from the coast, providing high humidity and abundant rain, even in the winter. The flora is abundant and varied, although it has been the result of reforestment, mainly in the areas where water springs can be found. Presently, the Tijuca Forest is constituted of areas under steady natural regeneration, secondary formations, remainders of primary formations and degraded soil (Mattos et al. 1976).

These profiles were detected in two distinct sites of the forest: "Estrada da Vista Chinesa" a high area 413m above sea level, next to the "Departamento de Conservação Ambiental da Fundação Estadual de Engenharia do Meio Ambiente (FEEMA); and an area at the sea level, which corresponds to the part of the forest that borders on the Botanical Garden of Rio de Janeiro. The methodology used to obtain these profiles (type of traps, exposure period), and the larval development followed methodology used in d'Almeida (1988, 1989). The substrates used for testing were the following: fish (sardine), beef liver, mouse carcasses (albino from laboratory),frog and snail (Gastropoda) carcasses, shrimp, human faeces and fermented fruits such as banana and papaya. The oviposition trapping started in June 1991 and finished in November of the same year.

RESULTS AND DISCUSSION

Four thousand and thirty nine flies belonging to four families were captured. Among these, there were Sarcophagidae (eighteen species), Muscidae (five species), Calliphoridae (three species) and Faniidae (one specie).

In the Tijuca Forest, the Fanniidae species was responsible for the largest number of specimens (1863-46.1%), followed by other families: Calliphoridae (963-23.8%), Muscidae (705-17.4%), and Sarcophagidae (508-12.5%). Comparing this information to d'Almeida (1986, 1988) in rural and urban areas of Rio de Janeiro, the families with the largest numbers of reared specimens were Calliphoridae (38.8%) and Muscidae (38.4%). However, in the Zoological Garden of Rio de Janeiro, the Fanniidae were the most frequent (d'Almeida 1989).

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TABLE I
Distribution of species of calyptrate diptera in relation to types of substrates used in Tijuca Forest, Rio de Janeiro, Brazil

Species		FSH[a]		LVR		MSE		SNL		SHP		FRG		FCS		Total
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No
Fannia sp. (subgroup pusio)	(F)[b]	454	24.3	240	12.9	20	1.0	43	2.3	921	49.4	166	8.9	13	1.0	1863
Hemilucilia flavifacies	(C)	15	3.0	479	95.0	-		-		10	2.0	-		-		504
Phaenicia eximia	(C)	3	0.6	207	45.7	224	49.4	-		-		19	4.2	-		453
Synthesiomyia nudiseta	(M)	424	100.0	-		-		-		-		-		-		424
Ophyra aenescens	(M)	-		-		-		-		267	100.0	-		-		267
Oxyvinia excisa	(S)	-		-		-		-		-		-		181	100.0	181
Euboettcheria collusor	(S)	2	3.3	18	29.5	-		-		1	1.6	8	13.1	32	52.4	61
Patonella intermutans	(S)	1	18.6	-		22	37.3	-		-		36	61.0	-		59
Sarcodexia innota	(S)	1	2.9	19	55.9	-		-		-		-		14	41.2	34
Peckya chrysostoma	(S)	18	64.3	-		-		-		10	35.7	-		-		28
Oxysarcodexia admixta	(S)	-		-		2	7.7	-		-		-		24	92.3	26
Euboettcheria florencioi	(S)	-		17	100.0	-		-		-		-		-		17
Pattonella occiptalis	(S)	-		-		-		-		-		1	6.7	14	93.3	15
Adiscochaeta ingens	(S)	13	86.7	-		2	13.3	-		-		-		-		15
Euboettcheria subducta	(S)	2	15.4	2	15.4	-		-		-		9	69.2	-		13
Oxysarcodexia xantosoma	(S)	-		-		-		-		-		-		12	100.0	12
Oxysarcodexia diana	(S)	-		-		-		-		-		-		11	100.0	11
Oxysarcodexia sp.	(S)	-		-		-		-		-		-		10	100.0	10
Cariocamyia maculosa	(M)	-		-		-		8	100.0	-		-		-		8
Oxysarcodexia amorosa	(S)	-		-		-		-		-		-		7	100.0	7
Chrysomya megacephala	(C)	-		6	100.0	-		-		-		-		-		6
Oxysarcodexia angrensis	(S)	-		-		-		-		-		-		6	100.0	6
Euboettcheria anguilla	(S)	-		-		-		5	100.0	-		-		-		5
Oxysarcodexia thornax	(S)	4	80.0	-		-		-		-		-		1	20.0	5
Neomuscina sp.	(M)	-		-		-		-		-		-		4	100.0	4
Oxysarcodexia parva	(S)	-		-		-		-		-		-		3	100.0	3
Myospilla obsoleta	(M)	-		-		-		-		-		-		2	100.0	2

[a]: FSH - fish; LVR - liver; MSE - mouse; SHL - snail; SHP - shrimp; FRG - frog; FCS - faeces;
[b]: C - Calliphoridae; F - Fanniidae; M - Muscidae; S - Sarcophagidae

Table I shows the distribution of fly species according to the substrate used by them. *Fannia* sp. (subgroup pusio) were the most frequent specimen (46.1%). Shrimp was the ovipositional substrate prefered by them (49.4%).

The ovipositional substrate preference for the most frequent species (with 20 or more specimens) is presented in Table II. For statistic analysis, the Chi-square test was used. Among the substrates offered for rearing, shrimp developed the greatest number of specimens (29.9%) and faeces attracted the widest variety of species (55.5%). The Sarcophagidae were the most frequently reared in faeces. In a previous paper, Lopes (1973) stated that Sarcophagidae species prefer this kind of substrate to be reared, mainly the genus *Oxysarcodexia*. In the rural and urban areas, of Rio de Janeiro City, shrimp and liver were used as substrates for breeding (d'Almeida 1986, 1988). In the ovipositional traps baited with fruits in Tijuca Forest, muscoid flies did not develop, contrary to observations in other ecosystems (d'Almeida 1986, 1988, 1989, 1993). This may suggest that sylvatic muscoids reared in fruits, prefer those exclusively found in the forest, or that they were out competed by sylvatic acalyptrate muscoids (Drosophilidae).

Fannia sp. (subgroup pusio) was the most frequent species captured (46.1%), having shown preference for shrimp (49.4%); similar results were observed in the urban area of Rio de Janeiro and in the city zoo (d'Almeida 1988, 1989). However, in the rural area, fish was the favourite substrate (d'Almeida 1986).

Hemilucilia flavifacies was the second species most frequently bred (12.5%) and most abundantly developed on liver (Table I). According to Linhares (1979), and d'Almeida and Lopes (1983), this Calliphoridae showed dislike for inhabited areas in Campinas, State of São Paulo, and in Rio de Janeiro, respectively. In previous researches on favourite breeding substrates, performed in the zoo, d'Almeida (1989) was able to observe another species of this genus *H. segmentaria* breeding almost exclusively on liver. These results, added to that of baits attractiveness may suggest that the species of this genus seek liver as a breeding substrate.

As to the *Phaenicia eximia* preference for mouse carcass, this work (Table I) confirmed the results from previous research carried out in both rural and urban areas, in the zoo and at beaches of Rio de Janeiro (d'Almeida 1989, 1988, 1989, 1993). Lopes (1973) refers to *P. eximia* raising on fish in the State of Paraná and on mouse carcass in a forest area in Rio de Janeiro.

Among the breeding sites tested in Tijuca Forest, *Synthesiomyia nudiseta* developed in fish only. A similar result was obtained in the rural area of Rio de Janeiro (d'Almeida 1986). Nevertheless, liver was the prefered substrate in the urban area of Rio de Janeiro, in the zoo and at the beach (d'Almeida 1988, 1989, 1993).

Ophyra aenescens was reared exclusively on shrimp (Table I). A similar observation was done in the city zoo (d'Almeida 1989). According to d'Almeida (1986), this species developed on both liver and crab in rural areas, but in urban areas, only on fish (d'Almeida 1988). This variety of breed substrate prefferences was also observed in relation to the attractiveness of baits and synantropy in other states in Brazil (d'Almeida 1982, Linhares 1979). All these data strongly suggest that *O. aenescens* possesses great capaccity of colonizing a wide range of habitats and has an ecological versatility, that contributes to its geographic distribution, indicating it as very successful biological colonizer species.

TABLE II

Preferences of the most frequent species of calyptrate diptera in relation to substrates used for breeding in Tijuca Forest, Rio de Janeiro, Brazil

Species	Preference Order[a]						
Fannia sp. (subgroup pusio)	shp[b] -	fsh -	lvr -	frg -	snl -	mse -	fcs
Hemmilucilia flavifacies	lvr -	fsh -	shp				
Phaenicia eximia	mse -	lvr -	frg -	fsh			
Euboettcheria collusor	fcs -	lvr -	frg -	fsh -	shp		
Patonella intermutans	frg -	mse -	fsh				
Sarcodexia innota	lvr -	fcs -	fsh				
Peckya chrysostoma	fsh -	shp -					
Oxysarcodexia admixta	fcs -	mse -					

[a]: decreasing order from left to right. Less significant ($\alpha \geq 0.05$) are marked by an horizontal line
[b]: shp - shrimp; fsh - fish; lvr - liver; mse - mouse; snl - snail; srp - frog; fcs - faeces.

Faeces was the only substrate in which *Oxyvinia excisa* developed. This Sarcophagidae was captured by d'Almeida (1984) exclusively on faeces in Tijuca Forest. Linhares (1979) had identical observations in Campinas.

Despite the small number of samples of *Cariocamyia maculosa*, reared in gastropode snail (Table I), it is important to point out that this biological observation has never been made, and that papers published refering to this species are restricted to systematics (Snyder 1951, Albuquerque 1955) and refer only to the adults.

Comparing the results obtained in this research to the ones achieved in faunistic surveys carried out in the same site (d'Almeida 1982), it will be seen that only a few exclusively sylvatic species were reared on the substrates that were furnished. Maybe this is because sylvatic muscoids are extremely "demanding" regarding the choice of breeding substrates; thus, they only develop at specific breeding sites in the woods, that's the reason why they didn't seek the substrates tested in the research. The Mesembrinelinae, exclusively found in thick jungles, exemplify these features of sylvatic flies. Mello (1967) notes that the natural breeding-sites of these flies are unknown and the attempts to breed them in laboratory have failed on artificial media.

This work presents further information about jungle species which have been barely studied, and, in addition, it provides new data concerning the following Diptera: *Hemilucilia flavifacies* (Engel, 1931); *Oxyvinia excisa* (Lopes, 1950) and *Cariocamyia maculosa* (Snyder, 1951).

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REFERENCES

Alburquerque DO 1955. Fauna do Distrito Federal. XVIII. Descrição do holótipo fêmea de *Cariocamyia* Lnyder, 1951 e notas sobre o macho (Diptera, Muscidae). *Dusenia 6*: 41-46.

d'Almeida JM 1982. *Sinantropia em dípteros muscoides na área metropolitana do Rio de Janeiro*. MSc Thesis, Universidade Federal Rural do Rio de Janeiro, 193pp.

d'Almeida JM 1984. Sinantropia de Sarcophagidae (Diptera) na região metropolitana do Estado do Rio de Janeiro. *Arq Univ Fed Rur Rio de J 7*: 101-110.

d'Almeida JM 1986. Substratos utilizados para a criação de dípteros caliptratos em uma área rural do Estado do Rio de Janeiro. *Arq Univ Fed Rur Rio de J 9*: 13-22.

d'Almeida JM 1988. Substratos utilizados para a criação de dípteros caliptratos em uma área urbana do Município do Rio de Janeiro. *Mem Inst Oswaldo Cruz 83*: 201-206.

d'Almeida JM 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.

d'Almeida JM 1993. Capture of calliptrate flies with different breeding substrates on beaches in Rio de Janeiro, RJ, Brazil. *Mem Inst Oswaldo Cruz 88:* 215-220.

d'Almeida JM, Lopes HS 1983. Sinantropia de dipteros caliptratos (Calliphoridae) no Estado do Rio de Janeiro. *Arq Univ Fed Rur Rio de J 6*: 39-48.

Linhares AX 1979. *Sinantropia de dípteros muscóides de Campinas*. MSc Thesis Universidade de Campinas (UNICAMP), SP, 129pp.

Lopes HS 1973. Collecting and rearing Sarcophagidae flies (Diptera) in Brazil during forty years. *An Acad Bras Ci 45:* 279-291.

Mattos CCLV, Mattos MDLV, Laroche RC 1976. Aspectos do clima e da flora do Parque Nacional da Tijuca. *Brasil Florestal 7*: 3-12.

Mello RP 1967. Contribuição ao estudo dos Mesembrinellinae sul americanos (Diptera, Calliphoridae). *Studia Ent 10:* 1-80.

Snyder FM 1951. New Neotropical Muscidae (Diptera). *Am Mus Novit 1494*: 1-11