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CALYPTRATE DIPTERA (MUSCIDAE AND ANTHOMYIDAE) OF THE STATE OF RIO DE JANEIRO – I. SYNANTHROPY

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The synanthropy of Muscidae and Anthomyidae was studied in three ecologically distinct areas of the metropolitan region of Rio de Janeiro. Using baits such row fish, decomposing bovine liver, fresh human faeces and mashed banana it was found that Synthesiomyia nudiseta, Atherigona orientalis, *and* Musca domestica *are highly synanthropic in contrast with* Neomuscina pictipenis, Phaonantho devia *and* Morellia maculipenis *found exclusively in the forest.*

Key words: synanthropy – flies – Muscidae – Anthomyidae

Synanthropy shows different interpretations, from ecological (Hoare, 1955; Gregor & Povolný, 19580 to medical-sanitary agents (Mihályi, 1965). Some authors analyze the phenomenon from the ecological and sanitary point of view (Derbeneva-Ukova, 1962; Nuorteva, 1963; Gomes, 1986).

In the present study, it was adopted the conception formulated by Nuorteva (1963), which considers synanthropy the capacity that animals have to make good use of favorable conditions created by man. Gomes (1986) interprets this phenomenon as an adaptation of non desirable populations to natural biocoenosis.

Calyptrate diptera is an optimal model to study synanthropy, not only for it ecological importance, but also by medical-sanitary aspects, as vectors of etiological agents, such amoeba cysts, helminth eggs, pathogenic enterobacteria (*Salmonella, Shigella,* choleric vibrio, etc.), viruses and fungi (Greenberg, 1971). In Brazil, synanthropy in caliptrate diptera was studied by Ferreira (1978, 1979, 1983), Linhares (1979), Madeira et al. (1982), d'Almeida & Lopes (1983), d'Almeida (1984), Dias et al. (1984), Carvalho et al. (1984) and Almeida et al. (1985).

This paper gives continuity to previous studies developed with different families of calyptrate diptera (d'Almeida & Lopes, 1983; d'Almeida, 1984).

MATERIALS AND METHODS

Collection of specimens – (a) Traps: flies were collected with traps described by d'Almeida & Lopes (1983). (b) Baits: row fish, fresh human faeces and mashed banana mixed with sugar cane. (c) Collection periods: collections were performed during 20 days of each season of the year (Winter: 20.07 to 10.08.81; Spring: 20.10 to 10.11.81; Summer: 10 to 17.01 and 01 to 13.02.82 and Fall: 20.04 to 10.05.82), simultaneously in three distinct ecological areas: urban, rural and forest. In each area it was distributed eight traps, two traps with a kind of bait. The change of baits and the collection of flies were performed every 48 h.

Preservation and identification of specimens – Flies were killed with ether, counted, mounted in entomological pins and identified, by the use of taxonomical keys and compared with specimens previously classified by specialists from Museu Nacional do Rio de Janeiro.

Calculation of synanthropy – For the calculation of synanthropy, we used an index proposed by Nuorteva in 1963, and described by d'Almeida & Lopes (1983). This calculation was based in 13 or more specimens of flies.

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Description of collecting locations – Collections were performed in three distinct environments of Rio de Janeiro: urban zone – a home's backyard located at Ilha do Governador, a district which comprises 32 km^2 and covered, in the time of research, 171, 316 residents; rural zone – a farm located at the campus of Universidade Federal Rural do Rio de Janeiro (Itaguaí town), distant around 80 km from the city of Rio de Janeiro; and forest zone – the Parque Nacional da Tijuca (Rio de Janeiro city), in the area called Represa dos Ciganos, an humid tropical forest.

RESULTS AND DISCUSSION

In the three ecological areas studied, we collected 9,691 flies totalizing 47 species of Muscidae (9,657 specimens) and 2 of Anthomyidae (34 specimens). The species are cited below, and between parenthesis are the amount of specimens of each one, per ecological area (U = urban, R = rural, F = forest and T = total).

Muscidae: *Atherigona orientalis* (Schiner, 1868) (U = 2613, R = 1996, F = 547, T = 5156); *Ophyra aenescens* (Wiedemann, 1830) (U = 254, R = 705, F = 797, T = 1756); *Musca domestica* (Linnaeus, 1758) (U = 280, R = 1343, F = 1623); *Synthesiomyia nudiseta* (Wulp, 1883) (U = 156, R = 213, F = 2, T = 371); *Ophyra* sp. (U = 226, R = 57, F = 36, T = 105); *Neomuscina pictipenis* (Bigot, 1878) (F = 76); *Neomuscina* sp. (U = 12, R = 41, F = 9, T = 62); *Morellia* sp. (U = 17, R = 1, F = 7, T = 25); *Neomuscina atincta* (Snyder, 1949) (U = 24); *Morellia flavicornis* (Macquart, 1848) (U = 4, R = 2, F = 13, T = 19); *M. bipuncta* (Wiedemann, 1830) (U = 2, F = 15, T = 17); *Neomuscina instabilis* (Snyder, 1949) (R = 11); *Morellia ochricornis* (Wiedemann, 1830) (U = 3, F = 7, T = 10); *Neomuscina currani* (Snyder, 1949) (F = 7); *N. mediana* (Snyder, 1949) (F = 6); *Cyrtoneurina* sp. (R = 2, F = 4, T = 6); *C. prima* (Curi, 1990) (F = 6); *Philornis univittata* (Dodge, 1968) (F = 6); *Myospila obsoleta* (U = 4, F = 1, T = 5); *Morellia meridensis* (Macquart, 1846) (U = 5); *Graphomyia* sp. (R = 5); *Cyrtoneurina multomaculata* (Stein, 1904) (U = 2, F = 2, T = 4); *Neomuscina neosimilis* (Snyder, 1949) (f = 3); *Cyrtoneurina mellina* (Stein, 1918) (F = 2); *C. mimica* (Snyder, 1954) (U = 2); *Morellia nigricosta* (Hough, 1900) (F = 2); *Neomuscina similata* (Snyder, 1949) (F = 2); *N. stabilis* (Stein, 1911) (R = 2); *N. atincticosta* (Snyder, 1949) (U = 2); *Pseudoptilolepis fluminensis* (Albuquerque, 1934) (F = 2); *Cyrtoneurina varicolor* (Hough, 1900) (F = 1); *C. trita* (Stein, 1911); *Dasymorellia* sp. (F = 1); *Graphomyia analis* (Macquart, 1851) (R = 1); *Morellia humeralis* (Stein, 1918) (F = 1); *Neomuscina vitoriae* (Lopes, 1982) (R = 1); *N. capalta* (Snyder, 1949) (F = 1); *N. inflexa* (Stein, 1918) (F = 1); *Philornis glaucinis* (Dodge and Aitken, 1968) (U = 1); *Pseudoptilolepis* sp. (F = 1); *P. fulvapoda* (Snyder, 1949) (F = 1); *Smithomyia* sp. (F = 1); *Xenothoracochaeta* sp. (U = 1) and *Xenomorellia holti* (Mallach, 1923) (F = 1).

Anthomyidae: *Phaonanto devia* (Albuquerque, 1957) (F + 28); *Craspedochaeta punctipenis* (Wiedemann, 1830 (R = 6).

Figure 1 shows the relative frequency of the most abundant species of Muscidae and Anthomyidae capture in Rio de Janeiro. The relative frequency of the most abundant flies according to the ecological areas can be seen in Fir. 2 and a comparative picture of the collections performed in the three environments is shown in Fig. 3, where 17 species were captured in the rural, 19 in the urban and 34 in the forest area. Among them, 7 species were restricted to the rural area, 7 to the urban one, and 21 were exclusively found in the forest; 4 species were captured simultaneously in all 3 environments (*A. orientalis, M. flavicornis, O. aenescens* and *S. nudiseta*).

The synanthropy indexes for the most frequent species (n > = 15) are presented in the Table, as well as those obtained from other localities of Brazil. We observed, in Rio de Janeiro, a variation from 70.22 (*S. nudiseta*) to –100.0 (*N. pictipenis* and *P. devia*). The classification of the flies, according to Nuorteva (1963), is shown in Fig. 4, from high preferences to inhabited aeres (IS = + 100.0) to aversion to those areas (IS = – 100.0).

The most abundant fly was *A. orientalis,* a cosmopolitan species, with 53.20% of the captured specimens (Fig. 1). According to Linhares (1979), in Campinas, São Paulo state this species was the most frequent, and together with *M. domestica* contributed with 91.70% of the flies captured. Although this fly was uncommon in Curitiba, Paraná state, in all environments studied (Carvalho et al., 1984). In Rio de Janeiro, *A. orientalis* was the most frequent in the urban area, with 50,68% (fig. 2) and

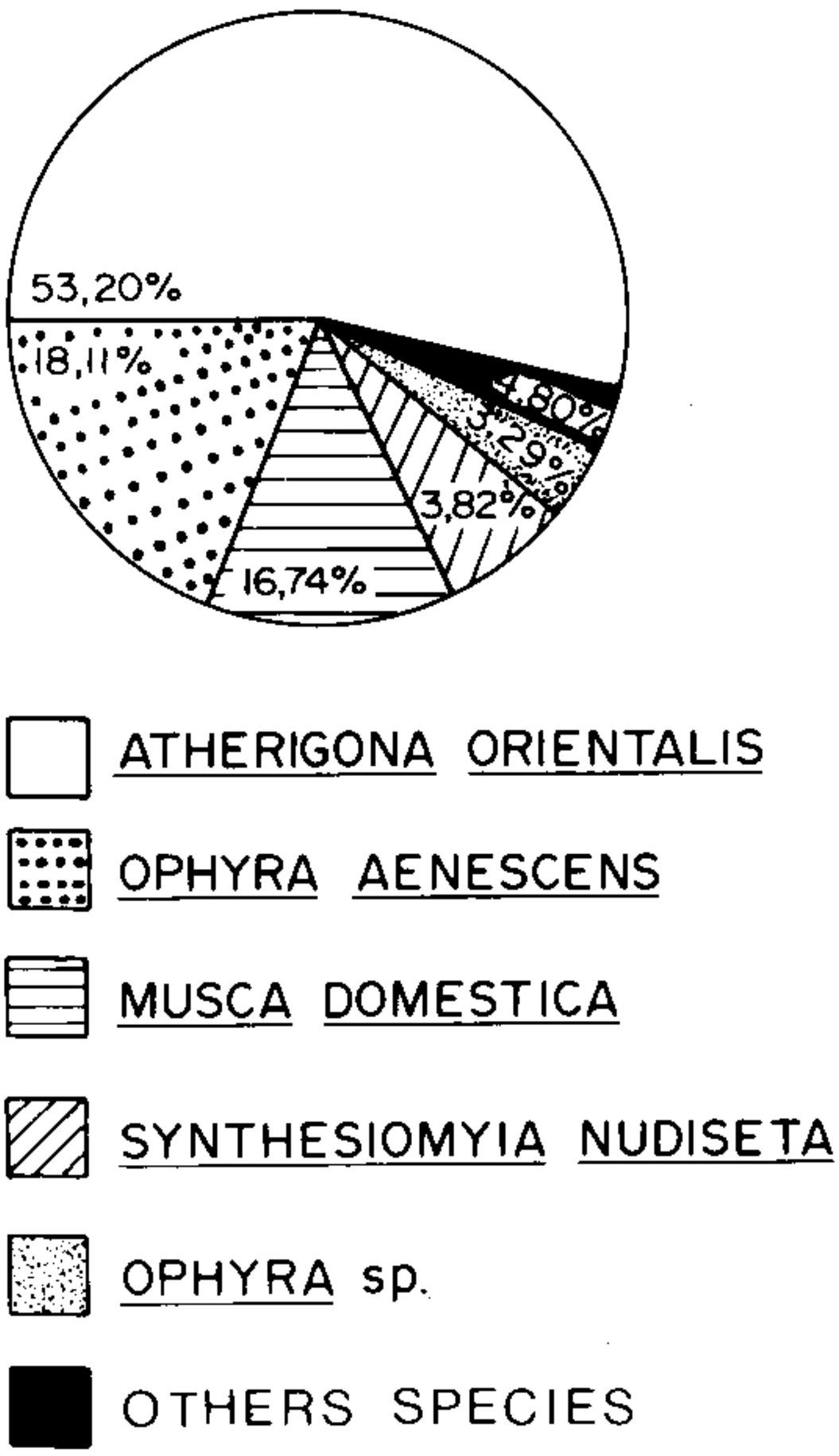

Fig. 1: relative frequency of the most frequent Muscidae species ($n \geq 300$ specimens) captured in Rio de Janeiro.

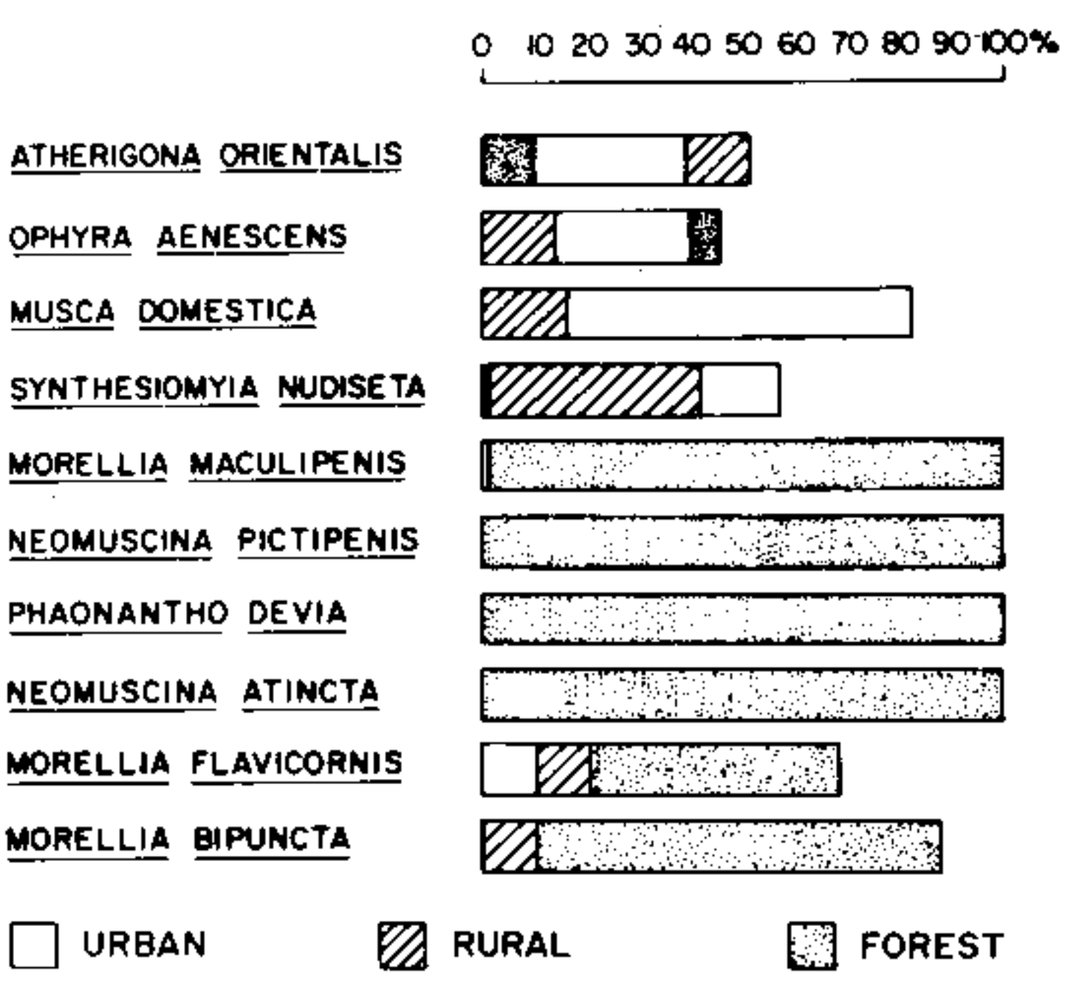

Fig. 2: relative frequency of the main Muscidae and Anthomyidae species ($n \geq 15$ specimens), in all three environments of Rio de Janeiro (urban, rural and forest).

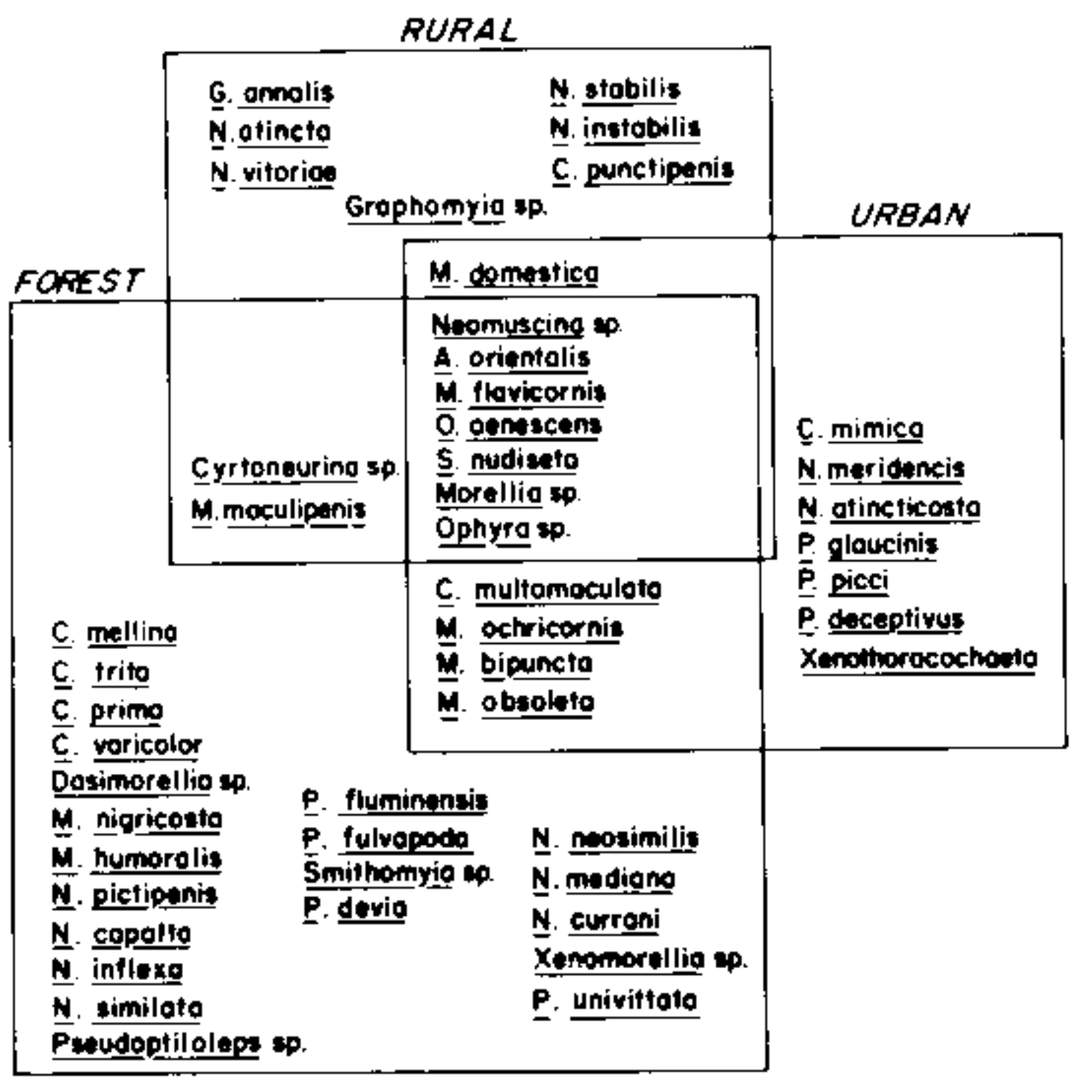

Fig. 3: Muscidae and Anthomyidae species collected in Rio de Janeiro, in all three ecological areas: urban, rural and forest (modified scheme from Carvalho et al. 1984).

preference for inhabited areas (IS = + 59,43). The same classification was obtained in Campinas by Linhares (1979) and it was one of the four species which occurred simultaneously in al 3 environments (Fig. 3). Povolný (1971) classified *A. orientalis* as hemisynanthropic and exophilic followed by Gregor (1975) who considered this fly as hemisynanthropic and weakly communicative in Cuba. In the present work it was the most frequent in urban and rural areas, among the species, collected with 72,86% and 45,25% respectively.

The second species in abundance was *O. aenescens* (18.11%), found with higher frequency in forest area (45.39%), captured simultaneously in all three environments (Fig. 3), and showing preference to uninhabited areas (IS = –10.46). In Campinas it was not frequent, but showed one of the highests synanthropy indexes (Table) by Linhares (1979). According to Gregor (1975), this species showed to be hemisynanthropic in Cuba, preferring the forest environments in concordance with results obtained in this study in Rio de Janeiro. In Curitiba, *O. aenescens* was extremely rare inside houses (Carvalho et al., 1984), although it was common in houses in Central America (Povolný, 1971).

Another abundant species in Rio de Janeiro was *M. domestica* (16.74%), captured with more frequency in the rural area (Fig. 2). In

TABLE

Comparison among synanthropy indexes of the main Muscidae and Anthomyidae species captured in the metropolitan region of Rio de Janeiro and those established for Campinas and Curitiba cities

Species	Synanthropy indexes		
	Rio de Janeiro/RJ[a]	Campinas/SP[b]	Curitiba/PR[c]
Atherigona orientalis	+ 59.43	+ 65.0	
Musca domestica	+ 58.64	+ 89.16	+ 33.28
Morellia maculipenis	– 98.56		
Morellia flavicornis	– 42.10		
Morellia bipuncta	– 76.46		
Neomuscina atincta	+ 50.0		
Neomuscina pictipenis	– 100.0		
Ophyra aenescens	– 10.46	+ 67.2	
Phaonanto devia	– 100.0	– 96.8	
Synthesiomyia nudiseta	+ 70.22	+ 59.4	

a: present study; *b:* from Linhares (1979); *c:* from Carvalho et al. (1984).

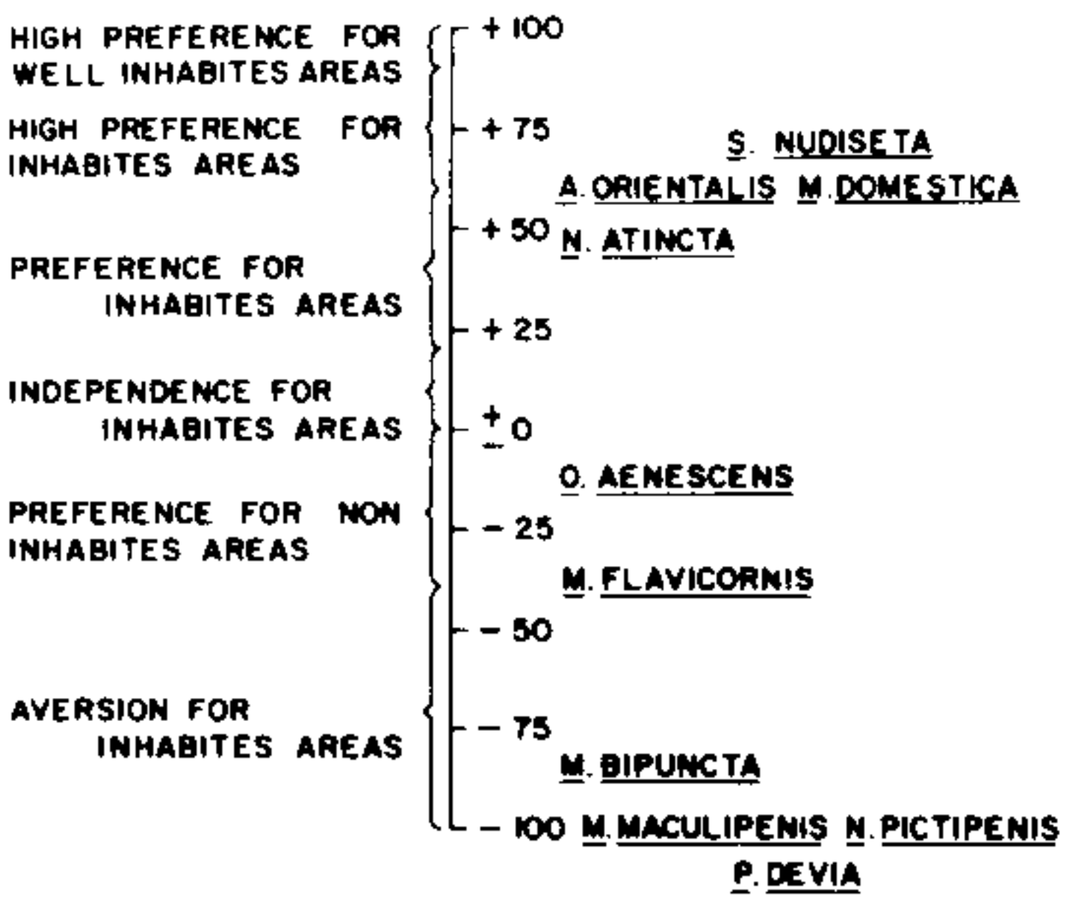

Fig. 4: synanthropy degrees (according to Nuorteva, 1963) of Muscidae and Anthomyidae, captured in Rio de Janeiro, in the period fro July, 1981 to May, 1982.

Campinas it prevailed in the urban areas (Linhares, 1979), showing to be more adapted to human environments (IS = + 89.16) than in Rio de Janeiro (IS = + 58.64) and Curitiba (IS = + 33.28). The close relation of *M. domestica* with man, by living endophilicaly, in addition to the great ability to develop in several type of substrates (d'Almeida, 1986), explains its abundance in anthropurgic environments.

According to Povolný (1971), *M. domestica* primitively was coprophagous of ruminating animals, but after the domestication of these mamals, it was possible the evolution to the present-day stage of synanthropy.

Synthesiomyia nudiseta, a species simultaneously captured in all three environments (Fig. 3), was more frequent in rural area (Fig. 2). This fly obtained the highest synanthropy index of this research. Similar of that obtained by Linhares (1979) in Campinas. According to studies of Gregor (1975) in Cuba, this muscoid is hemisynanthropic and communicative.

Ophyra sp., erroneously called *Psylochaeta chalibea* in the author's thesis (d'Almeida, 1982), occurs with more frequency in the urban area. The identification only for the genus level was adopted in consideration of the still persistent doubts in relation to the species, and by the impossibility of reexamining the original specimens.

The genus *Morellia* was more frequent in the forest area, a fact also observed by Linhares (1979) in Campinas. *M. macullipenis,* the most abundant of all *Morellia* was captured almost exclusively in the forest (Fig. 2). The asynanthropic character of these fly is clearly seen in the Table and Fig. 2. Kassai et al. (1990) obtained identical results for *M. bipuncta* and *M. humeralis* in São Paulo.

The genus that showed the highest number of species was *Neomuscina* (12 spp.), with a great predominance in the forest area (Fig. 2, 3). Among the species, *N. pinctipenis* was the most frequent, showing an aversion to inhabited areas (IS = – 100.0). Linhares (1979) reported this fly in a typical Planalto Paulista wooded area, and Carvalho et al. (1984) observed it in Araucária forest of Paraná state.

The genus *Neomuscina* may have medical-sanitary importance (Snyder, 1949).

The species of the genus *Cyrtoneurina* (6 spp.) occur with higher frequency in the forest, with exception of *C. mimica*, which despite few specimens, was observed only in the urban area.

Pseudoptiloleps and *Phillornis* were rate, the first found only in the forest. According to Carvalho et al. (1984), *Pseudoptiloleps* prevailed only in a wooded area known as "capão", typical of Planalto Paranaense, indicating a preference to uninhabited areas. *Phillornis* was distributed in urban and forest zones, and cause primary myiasis, in the subcutaneous tissues of young fowls (Guimarães et al., 1983).

Among the Anthomyidae, only *Phaonanto devia* showed a significant number of specimens, exclusively captured in forest (IS = – 100.0). The asynanthropic character of *P. devia* was marked by Linhares (1979) in Campinas. Oliveira (1986) observed that this fly in São Carlos, did not discriminate forests or rural installations. Other collected Anthomyidae was *Craspedochaeta punctipenis*, rare in Rio de Janeiro and frequent in Curitiba (Carvalho et al., 1984).

The ability of a species to occupy varied environments is important to its evolutive success, well evidenced in *A. orientalis*, a species introduced in Brazil and adapted to several ecosystems (Figs 2, 3). According to Gomes (1986) the synanthropy of a species is measured in the sense of its invasive tendency to open environment, and having as a climax the colonization of artificial ecotopes.

Linhares (1979), showed that the Nuorteva's synanthropy index, when used in tropical regions, needs to be accompanied of bionomic observations of the studied species.

In the synanthropy studies performed with caliptrate diptera, it has been observed differences in the synanthropic behavior of the captured species in varied ecosystems (Table). These differences are more evidencied in the forests, in particular in Rio de Janeiro, where captures were done at Parque Nacional da Tijuca, a representative area of humid tropical forest, and a confined formation different from forest zones, studied by other authors, where the open forest prevailed (Linhares, 1979; Carvalho et al., 1984). According to Gomes (1986) marked differences occur in the synanthropic behavior of *Panstrongylus megistus*, when compare the northeast and south regions of Brazil.

In relation to the rural areas, we can suggest that significant differences exist in the faunistic composition of the flies, when we compare areas that maintain fragments of primitive forest with those confined between cities. This was observed with opportunist species of *Drosophila* which invaded forest fragments proceeding from rural areas (Martins, 1989).

In urban areas, some factors preponderantly interfere on the distribution of calyptrate diptera and the sanitation is one of the most important ones. In the United States, Schoof et al. (1954) saliented that areas of smaller social-economical levels produce a higher number of flies than those with better sanitation. In Brazil this aspect is well evidenced in cities such as Rio de Janeiro, where the social-economical differences are great, allowing the assistance of districts with excellent sanitation and others with poor sanitary conditions, and propitiating the formation of various breeding sites of synanthropic flies. In the urban zone where the present study was performed, the building development were intense, substituting the natural green areas, which are nowadays restricted to the reserves maintained by the Navy and Aeronautics Ministries. These building development cause an environmental impact enough to interfere on population dynamics of flies.

In tropical countries where the differences among the ecological areas of captures are significant, we agree that bionomic data of the species must be associated to the synanthropy calculation, suggesting that other populational parameters are also evaluated (diversity, similarity, etc).

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