

# DIVERSITY OF CALLIPHORIDAE (DIPTERA) IN BRAZIL'S TINGUÁ BIOLOGICAL RESERVE

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## ABSTRACT

The Calliphoridae are flies of great ecological, medical and sanitary importance because they are decomposers of organic matter, mechanical vectors of pathogenic agents, and causers of myiasis. This paper attempts to ascertain the diversity of Calliphoridae in the Tinguá Biological Reserve and correlate meteorological data (temperature, relative humidity of the air, and precipitation) with the occurrence of these flies. The study was conducted at a site in the Tinguá Biological Reserve, located in the municipality of Nova Iguaçu, state of Rio de Janeiro, Brazil. Four traps were set up using chicken viscera as bait. The experiment was conducted over the period of May 2001 to April 2002, with two monthly collections. The captured flies were killed with ether and conserved in 70% alcohol and identified in the Laboratory of Diptera Studies (UNIRIO) and the Laboratory of Vector Insect Biology and Control (FIOCRUZ), both headquartered in the city of Rio de Janeiro, RJ, Brazil. A total of 1,987 insects were captured, 37.5% belonging to the family Calliphoridae, 29.4% to Muscidae, 16.0% to Sarcophagidae, and 17.1% to other families. The most representative species found was *Phaenicia eximia* (47.0%), followed by *Hemilucilia semidiaphana* (23.6%), *Mesembrinella bellardiana* (13.7%), *Hemilucilia segmentaria* (7.5%), *Chloroprocta idioidea* (4.9%), *Chrysomya albiceps* (1.2%), *Chrysomya megacephala* (0.9%), *Phaenicia sericata* (0.6%), *Eumesebrinella sp.* (0.5%), and *Chrysomya putoria* (0.1%). Large numbers of Calliphoridae were noted in May, June, September and January, coinciding with low rainfall and an average temperature of 21.8 to 27.0 °C. A negative correlation was found between the number of Calliphoridae captured and meteorological factors.

*Keywords:* population dynamics, biological reserve, Calliphoridae.

## RESUMO

### **Diversidade de califorídeos (Diptera) na Reserva Biológica do Tinguá, Nova Iguaçu, Rio de Janeiro, Brasil**

Os califorídeos são dípteros de grande importância ecológica e médico-sanitário, em virtude de serem decompositores de matéria orgânica, vetores mecânicos de agentes patogênicos e causadores de míases. O presente trabalho objetivou verificar a diversidade de califorídeos na Reserva Biológica do Tinguá e correlacionar os dados meteorológicos (temperatura, umidade relativa do ar e precipitação) com a ocorrência desses dípteros. O estudo foi realizado em uma localidade da Reserva Biológica do Tinguá, município de Nova Iguaçu. Foram instaladas quatro armadilhas de captura, utilizando como isca vísceras de frango. O experimento foi conduzido no período de maio/2001 a abril/2002, sendo realizadas duas coletas mensais. Os dípteros capturados foram sacrificados com éter, conservados em álcool 70% e sua identificação

ocorreu no Laboratório de Estudo de Dípteros (UNIRIO) e no Laboratório de Biologia e Controle de Insetos Vetores (FIOCRUZ). Foram capturados 1987 insetos pertencentes às famílias Calliphoridae (37,5%), Muscidae (29,4%), Sarcophagidae (16,0%) e outras (17,1%). *Phaenicia eximia* foi a espécie mais representativa (47,0%), seguida por *Hemilucilia semidiaphana* (23,6%), *Mesembrinella bellardiana* (13,7%), *Hemilucilia segmentaria* (7,5%), *Chloroprocta idioidea* (4,9%), *Chrysomya albiceps* (1,2%), *Chrysomya megacephala* (0,9%), *Phaenicia sericata* (0,6%), *Eumesembrinella sp.* (0,5%), e *Chrysomya putoria* (0,1%). Observou-se um maior percentual de fêmeas (70,6%). Constatou-se elevada incidência de califorídeos em maio, junho, setembro e janeiro, coincidindo com baixa precipitação e temperatura média entre 21,8 e 27,0 °C. Constatou-se uma correlação negativa entre o número de califorídeos capturados e os fatores meteorológicos.

*Palavras-chave:* Dinâmica Populacional, Reserva Biológica, Calliphoridae.

## INTRODUCTION

The Tinguá Biological Reserve contains a great diversity of plants and animals, and is an ideal shelter for populations of flies. However, this reserve is constantly invaded by hunters, squatters, and lumberers who modify the natural environment. This anthropic modification has affected the behavior of several species of flies and attracted synanthropic species, which colonize this new ecosystem. One may also see the transfer of wild species, since they possess a great capacity to adapt to the new conditions (Polvony, 1971).

The flies of the Calliphoridae family are ecologically important by aiding in the decomposition of organic matter in nature. However, from the standpoint of public health, they are considered the most dangerous vehicular flies of pathogenic agents, such as viruses, bacteria, fungi, protozoa, and helminths and by the action of larvae of some species that feed on living and dead organisms, causing myiasis (Zumt, 1965; Furlanetto *et al.*, 1984; Leclerq, 1990; Paraluppi *et al.*, 1996; Guimarães & Papavero, 1999). The rapid colonization of exotic species of the *Chrysomya* family is due to their high capacity of dispersion, a significant diversification of feeding habits, and high competitiveness (Guimarães *et al.*, 1983; Aguiar-Coelho & Milward-de-Azevedo, 1998; Marinho, 2000).

The present study attempts to verify the diversity of flies of the Calliphoridae family in the Tinguá Biological Reserve and to correlate it to meteorological factors (temperature, relative air humidity, and rainfall). This information is expected to shed further light on the population dynamics of these flies in the Atlantic forest and increase the

body of knowledge about the dispersion of exotic species of Calliphoridae in Brazil.

## MATERIAL AND METHODS

Flies were collected from May 2001 to April 2002 in the Tinguá Biological Reserve, a forested area closed to the public except for scientific activities (Permit nº 110/2000).

The reserve is located in the Serra do Mar mountain range, at a latitude of S 22° 28' - 22° 39' and longitude of W 43° 13' - 43° 34', 70 Km from downtown Rio de Janeiro, occupying areas in the municipalities of Nova Iguaçu, Duque de Caxias, Miguel Pereira and Petrópolis. The reserve covers an area of 2,000 hectares and has a perimeter of 150 Km. It is covered with vegetation and comprises the largest concentration of primary Atlantic Forest in the state of Rio de Janeiro. Its hydrological resources serve eight reservoirs that supply water to the Greater Rio and it contains a highly diversified fauna. The collection sites covered an area of approximately 8,000 square kilometers located about four kilometers from downtown Tinguá, in the municipality of Nova Iguaçu, RJ.

Four traps were installed (latitudes S 22° 35.153' and longitudes W 43° 26.316'; S 22° 35.186' and W 43° 26.358'; S 22° 35.189' and W 43° 26.386' and S 22° 35.133' and W 43° 26.277'), which were set up according to the protocol described by Ferreira (1978) with approximately 250 g of chicken viscera. The bait was purchased at a butcher's shop and kept refrigerated for 24-72 h before exposure. Two weekly collections were made and the traps were left exposed for periods of 28-30 h, at a height of 1.5 m from the ground.

The collected insects were killed with ether and preserved in 70% alcohol. The experiments, taxonomic identification and quantification were carried out in the aforementioned Laboratory of Diptera Studies and the Laboratory of Vector Insect Biology and Control.

The meteorological data was supplied by the Experimental Station of Itaguaí/PESAGRO-RIO, located in Seropédica, RJ (S 22° 45' and W 43° 41').

The results were analyzed statically by analysis of variance, followed by a Tukey-Kramer Multiple Comparisons Test. The level of statistical significance established by the present study was  $P < 0.05$ . A correlation between the number of *Calliphoridae* and meteorological data was also established by means of a Pearson correlation test.

## RESULTS

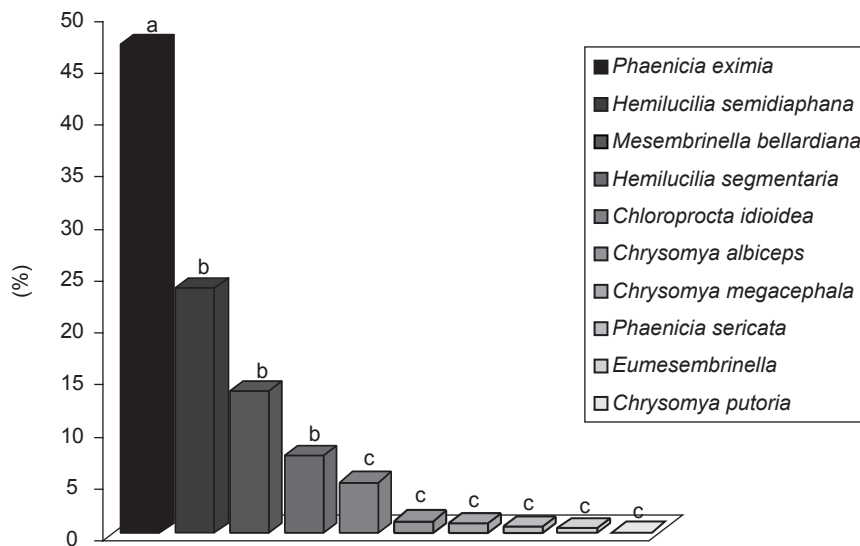
A total of 1,987 insects were collected, with the *Calliphoridae* family proving the most representative (37.5%), followed by *Muscidae* (29.4%), *Sarcophagidae* (16.0%) and others (17.1%). The *Calliphoridae* family was represented by the species *P. eximia* (47.0%), *H. semidiaphana* (23.6%), *M. bellardiana* (13.7%), *H. segmentaria* (7.5%), *C. idioidea* (4.9%), *C. albiceps* (1.2%),

*C. megacephala* (0.9%), *P. sericata* (0.6%), *Eumesebrinella* sp. (0.5%), and *C. putoria* (0.1%). Fig. 1 reveals a very significant difference between the occurrence of *P. eximia*, the most abundant species, and the other captured species.

*Calliphoridae* showed population spikes in May, June, September and January. The monthly distribution of the four most captured species in the Tinguá Biological Reserve indicated that the greatest abundance of *P. eximia* occurred in June, while the species *H. semidiaphana* showed a population spike in July, and *M. bellardiana* spiked in May and September. The greatest number of *H. segmentaria* was seen in May and June. A negative correlation was found between the total number of *Calliphoridae* collected and the meteorological data, such as temperature ( $r = -0.5031$ ), relative air humidity ( $r = -0.4151$ ), and rainfall ( $r = -0.6676$ ), as illustrated in Fig. 2.

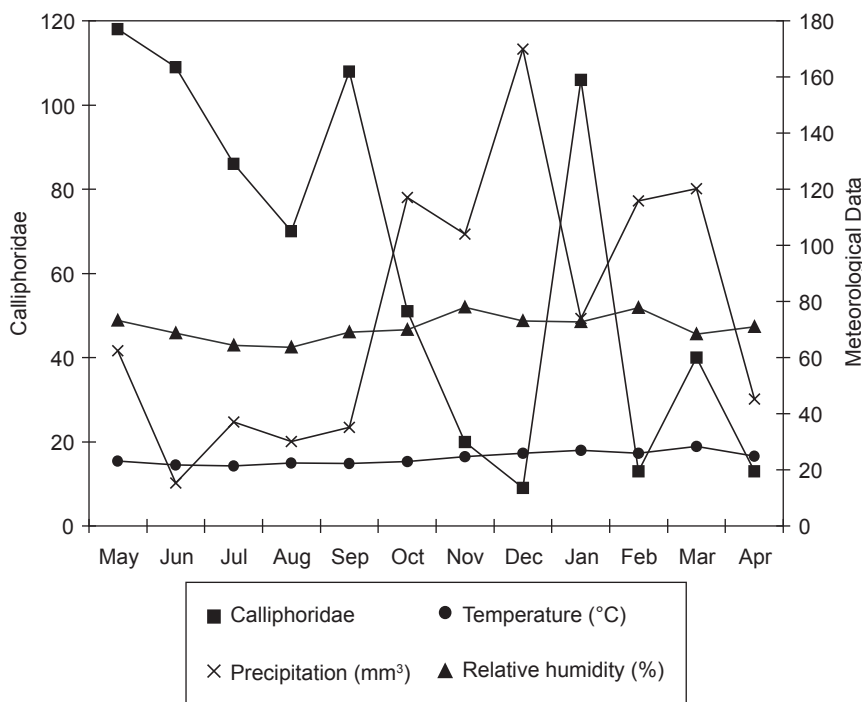
## DISCUSSION

The greatest occurrence in the Tinguá Biological Reserve was of the species *P. eximia*, which represented 50.0% of the *Calliphoridae* captured. Ferreira (1983) reported on the modification of the synanthropic index of *P. eximia* in Goiás, where he noted the appearance of



**Fig. 1** — Percentage of *Calliphoridae* species captured from May 2001 to Apr 2002 in the Tinguá Biological Reserve in Nova Iguaçu, RJ, Brazil.

a, b, c: Medians followed by the same letter do not differ from each other (Tukey-Kramer test, at a 5% significance level).



**Fig. 2** — Monthly meteorological data (temperature, relative humidity and precipitation) recorded at Tinguá Biological Reserve in Nova Iguaçu, RJ, Brazil. From May 2001 to Apr 2002.

*C. putoria*. In the first stage of his study, this species showed a preference for areas inhabited by man (IS = + 42.9), but later this index changed to + 12.2, with a greater occurrence in rural areas. A similar index of synanthropy was found by Ferreira (1978) in Curitiba, who reported the occurrence of this species in environments independent of human presence. In the forested area of Rio de Janeiro, which includes Tijuca National Park, *P. eximia* was found to represent 10.43%, translating into a synanthropic index of + 65.26 (D'Almeida & Lopes, 1983). In their synanthropic study, Ferreira & Barbola (1998) found that despite the large number of *P. eximia* captured, only 19.15% of this species was found in forested areas. These results suggest that this species is active in urban areas as well as in forested ones. *P. eximia* has provided information regarding behavioral changes influenced by competition with species introduced into Brazil (Paraluppi, 1996). This indicates that the largest niche for *eximia* is in urban areas, followed by forested areas (D'Almeida & Almeida, 1998).

The species *H. semidiaphana* was the second most common one (24.4%). D'Almeida

& Lopes (1983) stated that the species of the genus *Hemilucilia* are essentially Neotropical, and are found predominantly in forested areas. In a synanthropic study of Calliphoridae, Ferreira & Barbola (1998) found that *H. semidiaphana* predominated in forested zones, with a frequency of 79.59%. Paraluppi & Castellón (1994) captured a few individuals of the *H. semidiaphana* species in a forested area. Paraluppi (1996) made similar observations, with this species showing a capture percentage of 0.4% in a survey made in the region of the Urucu River.

*M. bellardiana* was found in indices close to those of *H. semidiaphana*, with *M. bellardiana* being the third most captured species (12.9%). In synanthropic studies in Rio de Janeiro, an index of synanthropy of - 100 for *M. bellardiana* showed this species' complete aversion for locations inhabited by man, since all the specimens were captured in a forested area (D'Almeida & Lopes, 1983). The results obtained in the present study showed a profile of occurrence of *M. bellardiana* in the forested areas of Rio de Janeiro with characteristics similar to those described by Mello (1967). This author

found that the Mesembrinellidae are restricted to dense humid forests and also stated that a tropical and reproductive preference is not known for this species, since the female produces only one larva at a time.

According to Linhares (1981), *H. segmentaria* is almost entirely restricted to forested areas with the SI of - 93.4. In a synanthropic study carried out in Rio de Janeiro, the IS value found was - 6.7, indicating this species' preference for forested areas (D'Almeida & Lopes, 1983). Upon analyzing the synanthropic indexes of some Calliphoridae species in Curitiba, Ferreira & Barbola (1998) found that *H. segmentaria* occurred only in eubiocenosis, original forest area, with an IS value of - 100. Although few examples of this species were found in urban, rural or forested areas in Manaus, *H. segmentaria* occurred most frequently in forested areas (Paraluppi & Castellón, 1994).

The Calliphoridae were most abundant in May, June, September and January. In May and June, rainfall was sparse and the average temperature was 23.1 °C in the former 4 months and 21.81 °C in the latter two, while the relative air humidity was 73.3%. In September, too, little rainfall occurred and the total rainfall was 35.2 mm<sup>3</sup>, the temperature was 22.2 °C and the relative air humidity was 69.0%. January saw the lowest rainfall of the summer months (73.9 mm<sup>3</sup>), an average temperature of 27.0 °C and relative air humidity of 72.4%. Grumichama (*Eugenia brasiliensis*) blossomed in September and guava (*Psidium guajava*) bloomed in January. Flies are attracted to the fruits of these trees, which are a source of food, and their presence aided the capture of Calliphoridae.

Although the frequency of young adult flies was greater in seasons of plentiful rainfall, which represents the greatest production of flies during the rainy seasons, the greatest population density occurred in the drier months, when the number of captures were analyzed seasonally (Paraluppi & Linhares, 1995). According to Paraluppi & Castellón (1993), the populations of Calliphoridae are sensitive to the pluvial factor and diminish in density, or at least in flight activities, seeking attractive sources during the rainy season. This is illustrated in Fig. 2, which shows high capture rates of Calliphoridae in the months of low rainfall.

Each species reacts in its own way to environmental conditions, and the population dynamics of Calliphoridae is influenced not only by climatic factors but possibly also by the presence of several types of substrates created and directly influenced by humans, which was noted in the forested area under study. Human invasion in the Tinguá Biological Reserve and the proximity of houses to the borders of the reserve alter the forest environment, and the production of garbage and refuse affects the diversity of species of Calliphoridae, notably the occurrence of synanthropic species in the forested areas.

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