# Quantitative description of calliphorid dipterans captured on the Campus of the Federal Rural University of Rio de Janeiro using sardine bait

VINICIUS MARINS CARRARO[1]
ELIANE M. V. MILWARD-DE-AZEVEDO[2]

**ABSTRACT:** Quantitative description of the species Chrysomya megacephala (Fabricius), C. albiceps (Wiedemann), C. putoria (Wiedemann) and Cochliomyia macellaria (Fabricius) (Diptera: Calliphoridae) are present according to month of collection. Collections were performed in two areas of the Campus of the Federal Rural University of Rio de Janeiro) from August 1993 to July 1994. Three traps baited with 100 g fresh sardines were used in each of two areas. The bait was left exposed for 168 hr and five successive collections were performed per week for three weeks per month. We collected a total of 69,690 muscoid; 64.74% were dipterans calliphorid. Chrysomya megacephala was the most frequent (40.7%) and presented a sampling peak in November. Chrysomya albiceps (25.9%) was more abundant in April; Cochliomyia macellaria (24.3%) presented two sampling peaks, one in October 1993 and the other in July 1994. Only 60 specimens of C. putoria were collected during the year of study.

**Key works:** Calliphoridae, *Chrysomya*, *Cochliomyia*, field population, quantitative description.

[1] *Faculdade de Filosofia Ciências e Letras de Volta Redonda/ FERP, CEP 27.130-000, Volta Redonda, Rio de Janeiro*
[2] *Departamento de Parasitologia Animal, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro, CEP 23890-000, Seropédica, Itaguaí, Rio de Janeiro, Brazil. E-mail: emilward@terenet.com.br Bolsista do CNPq*

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# INTRODUCTION

The species of the genus *Chrysomya* (Robineau-Desvoidy) were probably introduced on the South American continent in 1975-76. Increased trading between Brazil and Europe and the afflux of boats transporting refugees from Angola have been considered to be responsible for the introdutions of these species (IMBIRIBA *et al*., 1977; GUIMARÃES *et al*., 1978). In addition to refugees, these boats transported domestic animals and different types of foodstuffs, which are suitable substrates for the development of larvae, pupae and adults of these dipterans. IMBIRIBA *et al*. (1977) reported the occurrence of *Chrysomya* spp. in Paraná, and GUIMARÃES *et al*. (1978) later recorded their presence in São Paulo. GUIMARÃES *et al*. (1979) pointed out that *C. megacephala* (Fabricius) was present in Rio de Janeiro, *C. albiceps* (Wiedemann) in Mato Grosso and *C. putoria* (Wiedemann), the species that most rapidly dispersed over the Brazilian territory, was present at various locations along the Southeast and Northeast coast. These species are important pathogen vectors (GREENBERG, 1973; FURLANETTO *et al*., 1984) and are characterized by their significant ability to disperse and by their dietary adaptability. Their diet includes feces, meat (fresh, salted or putrid) and other substrates of animal and/or plant origin.

These dipterans are aggressive colonizers. FERREIRA (1983) inferred the probable dislocation of *C. macellaria* from Goiania after the introduction of *C. putoria* in that town. According to this investigator, there is empirical evidence showing that these species may be ecological homologues. BAUMGARTNER & GREENBERG (1985) also correlated the marked reduction in the population of *C. macellaria* in Peru to the competitive activity of *C. putoria* and *C. albiceps*. Competition between *C. megacephala* and *C. macellaria* probably caused the dislocation of the autochthonous species from the urban to the rural zone in Rio de Janeiro, as proposed by D'ALMEIDA & LOPES (1983). These discussions have been expanded by MENDES & LINHARES (1993) on the basis of a survey carried out in Campinas, SP. The hypothesis about the amensality existing between *C. macellaria* and *C. albiceps* was experimentally confirmed by AGUIAR-COELHO *et al*. (1995) and AGUIAR-COELHO & MILWARD-DE-AZEVEDO (1998). However,

according to these investigators, the competitive process observed between *C. macellaria* and *C. megacephala* was not asymmetrical: what occurred was simply depletion of available food resources (AGUIAR-COELHO & MILWARD-DE-AZEVEDO, 1995).

The objective of the present study was to describe quantitatively three species of the family Calliphoridae, *C. megacephala*, *C. albiceps* and *C. macellaria* occurring on the Campus of the Federal Rural University of Rio de Janeiro, RJ, in terms of months of collection over a period of 12 months, using traps baited with sardines.

# MATERIAL AND METHODS

The dipterans were collected in two areas located on the *Campus* of the Federal Rural University of Rio de Janeiro, Seropédica, RJ (22°41' latitude S, 43°41' longitude W, 33 m altitude) at the W.O. Neitz Experimental Station for Parasitologic Research (area 1), and in an area located at a distance of approximately 4 km from the previous area (area 2), corresponding to the former swine farm of the *Campus*. The dipterans were captured with the aid of traps similar to those described by FERREIRA (1978). Three traps per collection area were set up in a triangular formation at a distance of 10 m from one another.

One-hundred grams of sardines per trap were used as bait. Lots of fresh sardines were individualized in portions and then manually macerated and transferred to the traps. The substrate was moistened with a small amount of distilled water at 24 hour intervals.

The collections were made over a period of one year from August 1993 to July 1994. Each collection was performed between 12:00 and 16:00 hr at 24 hr intervals, Monday through Friday. A period of 168 h was considered to correspond to one sampling. Three samplings per month were carried out, with a total of 15 monthly collections. The captured dipterans were anesthetized with ether and then transferred to labelled glass flasks containing 70% alcohol.

Table 1 shows the climate data recorded during the experi-

mental period at the Experimental Station of Itaguaí/PESAGRO, located 4-6 km from the collection areas.

**Table 1 -** Climate data at the experimental station of Itaguaí/PESAGRO, Rio de Janeiro, between August 1993 and July 1994

| Months 1993/1994 | Temperatures (°C) | | | | Humidity Relative % | Nebulosity 0 a 10 | Wind (m/s) | Rain (days) | Evaporation (ml) | Insolation (ho) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Extremes | | | | | | | | | |
| | Maximum | Mínimum | Amplitude | Media | Media | Media | Media | | Total | Total |
| August | 25,5 | 15,2 | 10,3 | 19,3 | 67,7 | 5,9 | 2,8 | 2 | 132,9 | 172 |
| September | 25,4 | 17,1 | 8,3 | 20,5 | 75,3 | 8,1 | 3,1 | 13 | 133,5 | 77,5 |
| October | 29,4 | 18,7 | 10,7 | 23,1 | 66,7 | 5,2 | 3,4 | 6 | 84,3 | 194,6 |
| November | 30,8 | 20,3 | 10,5 | 24,5 | 53,7 | 5,5 | 3,3 | 9 | 174,9 | 218,5 |
| December | 30,6 | 21,7 | 8,9 | 25,0 | 68,3 | 7,6 | 3,0 | 11 | 143,7 | 155,4 |
| January | 29,4 | 20,6 | 8,8 | 24,3 | 75,3 | 7,5 | 2,5 | 18 | 102,1 | 157,8 |
| February | 34,9 | 23,0 | 11,9 | 27,9 | 59,3 | 4,8 | 3,2 | 5 | 131,2 | 264,8 |
| March | 29,4 | 21,0 | 8,4 | 24,3 | 75,7 | 7,7 | 2,4 | 14 | 98,2 | 139,0 |
| April | 27,8 | 19,4 | 8,4 | 22,9 | 75,7 | 6,2 | 2,5 | 9 | 51,4 | 174,3 |
| May | 27,7 | 18,5 | 9,2 | 22,2 | 75,0 | 4,4 | 2,2 | 7 | 69,5 | 195,3 |
| June | 24,6 | 14,9 | 9,7 | 18,9 | 72,0 | 4,2 | 2,8 | 5 | 59,9 | 215,5 |
| July | 25,3 | 14,3 | 11,0 | 19,2 | 68,7 | 3,0 | - | 3 | 104,8 | - |

# RESULTS AND DISCUSSION

A total of 69,690 muscoid dipterans belonging to three families, Calliphoridae, Muscidae and Sarcophagidae, were collected during the experimental period. The most representative sample consisted of specimens of the Calliphoridae family which corresponded to 64.7% of the community investigated, followed by specimens of the Sarcophagidae family (31.5%) and by a small number of muscids (3.7%) (Table 2). The bait attracted a markedly larger number of females among Calliphoridae (Table 3), which is in agreement with data reported by FERREIRA (1978), LINHARES (1991), D'ALMEIDA & LOPES (1983) and SORDILLO (1991).

**Table 2 -** Muscoid flies collected between August 1993 and July 1994, on the *Campus* of the Federal Rural University of Rio de Janeiro, Itaguaí, RJ

| Family | Collection areas | | Total | |
|---|---|---|---|---|
| | Area1 | Area2 | Nº | % |
| Calliphoridae | 34,160 | 10,957 | 45,117 | 64,74 |
| Sarcophagidae | 12,528 | 9,441 | 21,969 | 31,52 |
| Muscidae | 1,742 | 862 | 2,604 | 3,74 |
| **Total** | 48,430 | 21,260 | 69,690 | |

**Table 3 -** Adults of *Chrysomya megacephala, Chrysomya albiceps* and *Cochliomyia macellaria* collected, between August 1993 and July 1994, on the *Campus* of the Federal Rural University of Rio de Janeiro, Itaguaí, RJ

| Species | Male | | Female | | Male/Female |
|---|---|---|---|---|---|
| | N | % | N | % | N |
| *C.megacephala* | 5,087 | 23,71 | 16,370 | 76,29 | 21,457 |
| *C.albiceps* | 1,043 | 9,32 | 10,149 | 90,68 | 11,192 |
| *C.macellaria* | 3,425 | 32,63 | 7,073 | 67,37 | 10,498 |
| **Total** | 9,555 | | 33,592 | | 43,147 |

*Chrysomya megacephala*, r strategist species (*sensu* PIANKA, 1970; PRADO & GUIMARÃES, 1982), represented 30.8% of the cyclorrhaphic insects collected. A total of 12,035 individuals of this species were captured in November, a significantly larger number than recorded during the preceding month (5,037) (Figure 1). November was climatically characterized by low relative humidity and a high rate of sunlight incidence (Table 1). In contrast, the December collections only consisted of 324 individuals. The densities sampled during this period, which characterize the phenomenon of population

regulation of species presenting type r strategy, thus suggest that the possibly homeostatic increase observed in October was followed by considerable intraspecific competition in November and therefore by a significant reduction of the levels reached previously. CARRARO (personal communication [1]) observed that the *C. mecagephala* samples collected in November presented specimens of reduced size. The selective pressure imposed by insect rearing at high population densities produces a significant reduction in individual body mass. This variable, assumed to be above minimal values, permits adult formation. However, the reproductive ability of these adults will be significantly reduced and the dispersal behaviour will be modified (VON ZUNBEN, 1993; REIS *et al*., 1994; AGUIAR-COELHO & MILWARD-DE-AZEVEDO, 1998). Thus, we suggest that these mechanisms must be considered when an attempt is made to understand the phenomenon observed.

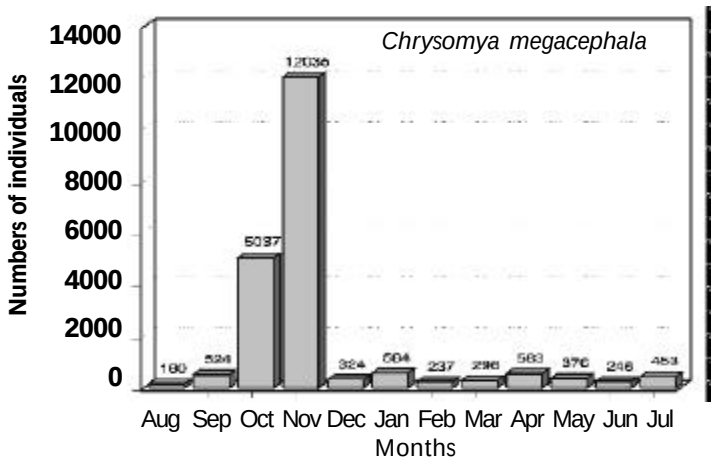


***Figure 1*** - Anual variation on capture of *Chrysomya megacephala* between August 1993 and July 1994, on the *Campus* of the Federal Rural University of Rio de Janeiro, Itaguaí, RJ.

[1] These specimens, however, were not measured or quantified (authors' note).

A total of 11,192 *C. albiceps* adults were collected (Table 3). This species was more abundant in April, whereas its population was markedly reduced in May, followed by a partial return to previous values in July (Figure 2). An expressive increase in the population of this species had been recorded in October and November of the previous year. According to PRADO & GUIMARÃES (1982), *C. albiceps* is characterized by low population densities in nature, as confirmed experimentally by ULLYETT (1950). Analysis of Figure 2 shows that the present data support this evidence. This behavior suggests that *Chrysomya albiceps* should be assigned to the group of k strategists (*sensu* PIANKA, 1970; PRADO & GUIMARÃES, 1982; QUEIROZ & CARVALHO, 1987).

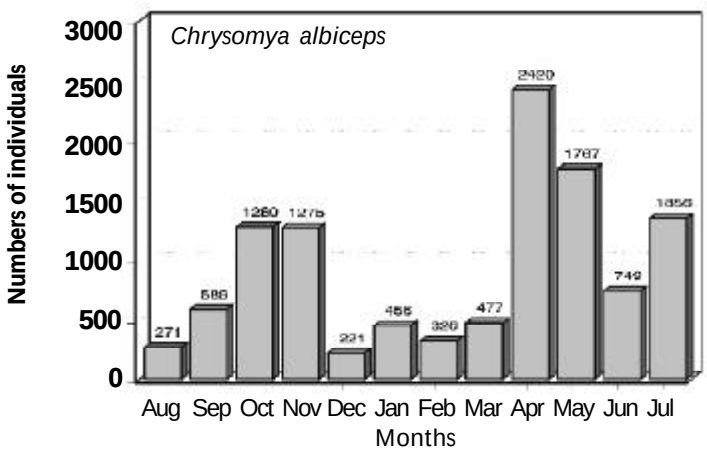


***Figure 2*** - Anual variation on capture of *Chrysomya albiceps* between August 1993 and July 1994, on the *Campus* of the Federal Rural University of Rio de Janeiro, Itaguaí, RJ.

A total of 10,498 specimens of *C. macellaria* were collected (Table 3). This species is considered to be a fugitive by AGUIAR-COELHO & MILWARD-DE-AZEVEDO (1996) (*apud* PIANKA, 1970). This calliphorid was more abundant in October and July, in partial agreement with data reported by LINHARES (1981) who captured the largest numbers of adults of this species

in October and February in Campinas. Figure 3 shows a marked fall in total number of individuals collected in November. The marked population increase of *C. megacephala* during this period (Figure 1) may have interfered with the dynamics of *C. macellaria*. Interaction between the two species may have negatively affected weight gain and the rate of adult emergence in the autochthonous species (AGUIAR-COELHO & MILWARD-DE-AZEVEDO, 1995; 1998). D'ALMEIDA & LOPES (1983) proposed a probable dislocation of *C. macellaria* species from the urban to the rural zone of Rio de Janeiro provoked by *C. megacephala*.

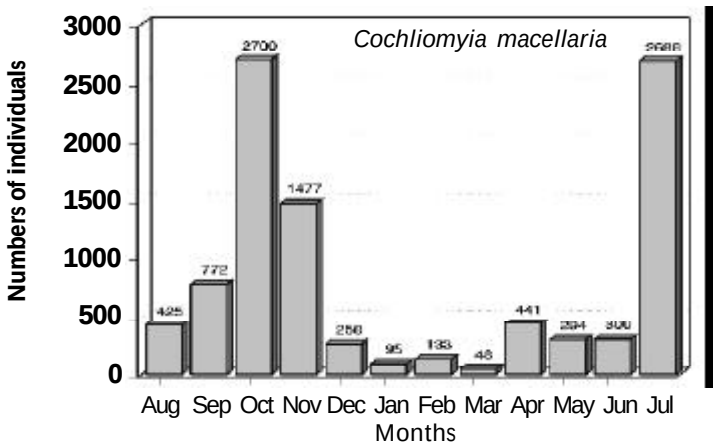


***Figure 3*** - Anual variation on capture of *Cochliomyia macellaria* between August 1993 and July 1994, on the *Campus* of the Federal Rural University of Rio de Janeiro, Itaguaí, RJ.

During the experimental period, July/1981 to May/1982, D'ALMEIDA & LOPES (*op cit*.) collected 287 specimens of *C. macellaria* in the UFRRJ campus. This parameter is inferior to that reported by OLIVEIRA *et al* (1982) who collected 21,000 specimens between 1978 and 1979. In the present survey, about 10,500 dipterans belonging to this species were found. The methodology and the tecniques used by the different works and the abiotic factors can partly be blamed for these numeric

discrepancies. It is known, however, that urbanization and the growth of human populations cannot be ignored when the hypothetic displacement of autochthonous species is discussed. *Cochliomyia macellaria* has been described by various authors as hemisynanthropic. In 1980, the estimated population of the actual Seropédica County which covers an area of 274 km$^2$ (at that time it was a District belonging to the Itaguaí Country), was 40,895 inhabitants; in 1996, a national population survey registered 54,937 inhabitants. The UFRRJ *Campus* is about 2 km away from the Seropédica nucleous. Opportunely, we pondered that for many decades the *Campus* has not corresponded to the demands which, according to NUORTEVA (1963), characterize a rural ecological area. He includes residential conglomerates which have been housing several families of teachers, employees, researchers and million of students. Therefore, this comment relativize the synanthropic index indicated to *C. macellaria* by D'ALMEIDA & LOPES (1983). The comparison among inventories carried out during one year can also lead, in our opinion, to wrong conclusions. However, the legitimacy and the importance of the periodical samplings of potentially pathogenic dipterans in endemic or non-endemic regions – in this argument, the demand of the implicit preventive character is observed – are discussible and should be motivated, inclusive by the organs responsible for research on human and animal health.

The amensality initially proposed for *C. macellaria* and *C. albiceps* is also a hypothesis that should not be ruled out. The population of *C. albiceps* quantified in November did not change, whereas the population of the autochthonous species was markedly reduced during the same period, as described earlier. The population level of *C. macellaria* may have been affected not only by the population increase of C*. megacephala* but also by the competition, probably of the beta and asymmetrical, represented by *C. albiceps*.

It is interesting, at this point, to discuss the present results in parallel to those reported by AGUIAR-COELHO & MILWARD-DE-AZEVEDO (1998). These investigators established associations between these three Calliphoridae species and noted that differences in growth occurred in the dipterans under study as a function of their separate growth, characterizing the presence not only of a type beta competition but also of

intereferent competition. In these interactions, species with selection characteristics of the k type are favored. The aggressive behavior of *C. albiceps*, also exhibited by the predatory activity of its mature larvae, should be considered in this process. Figure 2 permits us to infer that, while a marked increase in the number of *C. macellaria* individuals occurred in July, the population already presented a tendency to decrease, possibly supporting the speculations discussed above.

On the other hand, we may ask whether the population of *C. megacephala* was also reduced as a function of the population increase of *C. albiceps* in October and November, although the levels of *C. megacephala* were significantly higher during these two months than during the other periods.

The possible occurrence of asymmetrical competition between *C. macellaria* and *C. putoria* in various regions of South America was pointed out by FERREIRA (1983), BAUMGARTNER & GREENBERG (1985) and MENDES & LINHARES (1993). In the present survey, only 60 adults of *C. putoria* were collected, a sample that does not permit us to speculate about the possible effects caused by hypothetically existing interactions.

In extensive review, NORRIS (1965) proposed that blowflies may present more than one population increase during the year since climate directly affects the dynamics of these dipterans. Table 1 presents the climatic changes (also those that were atypical for this region) recorded throughout the experimental period. The use of sardine baits on the field for an interval of eight days was meant to recognize the potential attractiveness of the substrate as a function of its rate of decomposition (CARRARO & MILWARD DE AZEVEDO, unpublished data). Since the three species were monitored for one year, seasonality was not studied. The experimental design adopted definitely excluded analysis of seasonality and therefore did not satisfy the basic assumptions inherent in its interpretation. However, the present survey provided fundamental initial information about the behavioral rhythm of the species routinely monitored on the *Campus* of the Federal Rural University of Rio de Janeiro.

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