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ARTIGO ORIGINAL

Occurrence and seasonality of muscoids dipterous (Diptera, Calliphoridae) at Colégio Pedro II campus Niterói, Barreto, Niterói, RJ, Brazil

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RESUMO

Ocorrência e sazonalidade de dípteros muscóides (Diptera, Calliphoridae) no *campus* do Colégio Pedro II, Barreto, Niterói, RJ, Brasil. Este trabalho foi realizado por alunos do Ensino Médio do *campus* Niterói do Colégio Pedro II, no período de 2015 a 2016, com o apoio do Programa de incentivo a Projetos de Pesquisa de Iniciação Científica Júnior da Pró-Reitoria de Pós-Graduação, Pesquisa, Extensão e Cultura do Colégio Pedro II (PROPGPEC). Teve o objetivo de conhecer a entomofauna de Calliphoridae (Diptera) presente no bairro do Barreto, Niterói, RJ, Brasil, quantificando as espécies predominantes da localidade. Assim, contribuiu para que os alunos vivenciassem a aplicação do método científico. As moscas foram capturadas no campus Niterói do Colégio Pedro II, através de coletas semanais, com auxílio de armadilhas cilíndricas de metal, que continham sardinha como isca. Foram capturados, ao todo, 1.308 exemplares, preservados em álcool e, posteriormente identificados com o auxílio de chaves dicotômicas apropriadas. *Chrysomya Megachephala* (Fabricius, 1794) foi a espécie mais abundante. De uma forma geral, as espécies do gênero *Chrysomya* (Robineau-Desvoidy, 1830) mostram forte associação com o ambiente modificado pelo homem. Devido à grande capacidade competitiva com espécies autóctones e à importância médico-veterinária que apresenta, a continuidade dos estudos populacionais dessa espécie, ao longo do território nacional, pode contribuir com programas de controle e combate desses insetos.

Palavras-chave: Calliphoridae, Colégio Pedro II, Dípteros muscóides, Sinantropia

ABSTRACT

This study was carried out by a group of high school students of Colegio Pedro II, campus Niterói, from 2015 through 2016 and was supported by the Junior Scientific Initiation Program supervised by the Dean of Graduate Studies, Research, Extension and Culture of this same institution. The purpose of the program is to familiarize students with scientific research methods and analytical tools. The research presented in this article aimed at knowing the fauna of Calliphoridae (Diptera) in Barreto, a borough in the city of Niterói, Rio de Janeiro, Brazil, focusing on the quantity of predominant species found in the area. Flies were weekly captured at Colégio Pedro II campus Niterói, with the help of a cylindrical metal trap, containing sardine baits. The data collected consisted of 1308 specimens, which were properly identified using a stereoscopic microscope and properly dichotomous keys. *Chrysomya megacephala* (Fabricius, 1794) was the most abundant species collected. *Chrysomya* species (Robineau-Desvoidy, 1830) usually have a strong connection to the environment modified by man. They compete with native species and they have a medical and veterinary significant role. It is important that studies continue to be carried out across the Brazilian territory so that they could help create programs to control and fight these insects.

Keywords: Calliphoridae, Colégio Pedro II, Muscoids dipterous, Synanthropy

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INTRODUCTION

The purpose of a scientific initiation research is to allow students to familiarize themselves with scientific research methods and to learn how to use scientific analytical tools. Bearing this in mind, this study was carried out from 2015 through 2016, with the support of the Institutional Scholarship Program for Junior Scientific Initiation supervised by the Dean of Graduate Studies, Research, Extension and Culture of Colégio Pedro II (PROPGPEC).

The focus of this study was on the fauna of muscoids dipterous (Calliphoridae family) found at Colégio Pedro II campus Niterói, since the identification of many of this family species have medical and sanitary importance. Furthermore, they have a major forensic role. The Calliphoridae family has an invaluable role in the medical and veterinary area, as some of the species are vectors of pathogenic agents of several parasitic diseases (Queiroz et al., 2005). The forensic role also needs to be mentioned in this article because larvae of necrophagous species deposited on a dead body can help establish the postmortem interval (Salviano et al., 1996).

Three species of *Chrysomya* (Robineau-Desvoidy, 1830) were introduced in Brazil via ships coming from Africa and were moored in the south of the country (Guimarães et al., 1978). This genus of the Calliphoridae family was highlighted by Mello et al. (2007) as being a synanthropic genus in most Brazilian cities that had already been researched. According to Forattini (1992), the constant human environmental actions and rapid urbanization have changed the geographical space, enabling, therefore, new and diverse ecological niches that can be filled with native and exotic species. This is the case of *Chrysomya megacephala* (Fabricius, 1794), which is considered an "R" strategist, capable of colonizing different habitats and spreading themselves (Pianka, 1970). Several Brazilian researchers have reported the high frequency of this species in urban areas. *C. megacephala* has been collected by means of different types of bait and has been observed replacing indigenous species (D'Almeida & Lopes, 1983 and Carraro & Milward-de-Azevedo, 1999). According to Sordillo (1991), *C. megacephala* was the species of Calliphoridae with the biggest amount of samples collected from the three habitats studied in Rio de Janeiro city (forest, rural and urban areas). This species showed a huge variation of synanthropy, which suggested that it has a strong capability of adapting themselves to the human-changed environment.

Knowing the geographical distribution and seasonality of the Calliphoridae species will help identify the regions where public prevention, diagnosis, and treatment of several medical and veterinary diseases have to be implemented. D'Almeida & Fraga (2007) highlighted the importance of researching the population of calyptrate Diptera in Niterói city, Rio de Janeiro, due to the lack of scientific studies in

the area.

The purpose of this study is to analyze the Calliphoridae fauna found in the muscoids dipterous collected at Colégio Pedro II campus Niterói in order to engage high school students with researching practices in Biology. By doing so, these junior researchers will be able not only to interpret data and evaluate or plan scientific and technological interventions but also to understand the interaction between organisms and environment, in particular those related to human health.

MATERIALS AND METHODS

Flies were collected from March 2015 through February 2016 at Colégio Pedro II campus Niterói, in Barreto borough. According to the studies of Campos et al. (2012), "situated between the cities of Niterói and São Gonçalo by the Guanabara Bay margins and cut by the Governador Mario Covas Highway (BR 101), and by the old railway line of Leopoldina, the Barreto borough border the boroughs of Neves, Santana and Engenhoca". This borough is located in a suburban area that had once been an industrial district, thus showing now empty zones and different types of urbanization. This new urban landscape features big spaces for big supermarkets, big construction material stores, big grounds for the Carnival preparations, with their big parking areas, which are inhospitable areas.

During the weekly capturing of flies, the students used a handcrafted trap made of a cylindrical can with two diametrically opposed openings for the flies to get in. A sardine was placed inside the can to be used as a bait, as suggested by Nuorteva (1963) and previously used by D'Almeida & Fraga (2007) in their studies. The outside of the can was painted with mat black color as high temperatures (around 27º C) are more effective in attracting flies (Fraga & D'Almeida, 2005). A plastic black mesh cone with a 2cm-diameter top opening was fitted on the top end of the can. The opening of the cone was directed to the outside and was covered with a transparent plastic bag which was attached to the can by its base. This type of trap had been previously used by Sordillo (1991) and was hanged on branches of bushes around the campus, at 1.20 m from the ground.

The adult samples collected were preserved in bottles containing alcohol 70%. The samples were then categorized by the date they were collected until they were properly identified. The identification would later be done by using a stereoscopic microscope and applying the key to the species of Calliphoridae by Carvalho & Ribeiro (2000). Moreover, during the collection period, the maximum and minimum temperature data were obtained at accuweather electronic site (https://www.accuweather.com/). The best-conserved samples were pinned and added to the permanent collection of the Laboratory of Biology of Colégio Pedro II campus Niterói.

RESULTS

The specimens of Calliphoridae captured numbered 1308 and belonged to the following five species: *Chrysomya megacephala* (Fabricius, 1794), *C. putoria* (Wiedemann, 1818), *C. albiceps* (Wiedemann, 1819), *Lucilia cuprina* (Wiedemann, 1830) and *Chloroprocta idiodea* (Robineau-Desvoidy, 1830), as described in Table 1 and Figure 1.

Table 1. Individual and overall number of muscoids dipterous from the Calliphoridae family captured from March 2015 through February 2016 and their respective percentage by species

	Female	Male	Total	%
Crhysomya megacephala	458	165	623	47,6%
Chrysomya putoria	203	139	342	26,2%
Chrysomya albiceps	228	93	321	24,5%
Lucilia cuprina	20	1	21	1,6%
Chloroplocta idioidea	1	0	1	0,1%
TOTAL	910	398	1308	100%

In Figure 1, it can be observed that from all the specimens collected, almost 50% were *Chrysomya megacephala*, the most abundant of all. The quantity of *Chrysomya putoria* and *C. albiceps* captured were practically the same. Only a small number of *Lucilia cuprina* was collected and only one specimen of *Chloroprocta idioidea* was captured. Also, as it was noticed in Table 1, the quantity of female specimens collected was higher. The data presented 70% female and 30% male out of the total of the Calliphoridae caught. A very interesting fact was observed during the month of January 2016: all the females collected had their ovipositors extended.

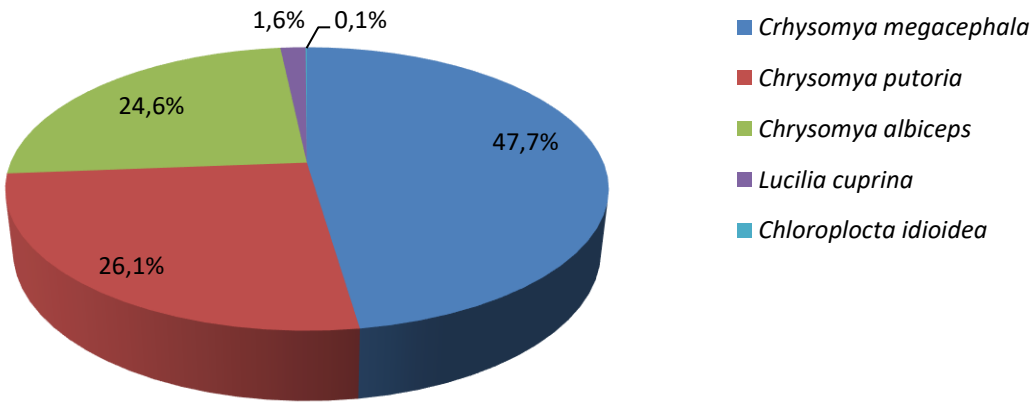

Figure 1. Percentage of Calliphoridae species captured from March 2015 through February 2016.

The species of Calliphoridae were more frequent during the months of March, April (fall), August and September (end of winter and beginning of spring) (Table 2 and Figure 2). These were the months when the average high temperatures were ranging between 27.6ºC and 30.2ºC and the lower average temperatures were varying between 18.1ºC and 22.8ºC (Table 3).

As observed in Table 2 and Figure 2, *Chrysomya albiceps* and *C. putoria* were the species most frequently captured, followed by *C. megacephala*. *Chrysomya albiceps* had a higher number of females compared to the males almost all year around. The *Chrysomya* species were captured almost every month with the exception of December. On the other hand, *Lucilia cuprina* was collected only in March and April, while *Chloroprocta idiode*a was only caught in March. However, the percentage collected for both species was really small compared to the others.

Table 2. Number of males (M) and females (F) of Calliphoridae species, by month, from March 2015 through February 2016.

	Chrysomya megacephala		***Chrysomya putoria***		***Chrysomya albiceps***		***Lucilia cuprina***		***Chloroplocta idioidea***	
	F	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Mar/15	131	27	38	20	47	13	15	1	1	0
Apr/15	139	63	42	22	46	14	5	0	0	0
May/15	14	3	6	7	10	3	0	0	0	0
Jun/15	9	5	5	6	0	3	0	0	0	0
Jul/15	11	5	1	1	9	0	0	0	0	0
Aug/15	33	12	21	13	31	15	0	0	0	0
Sep/15	71	35	76	61	74	41	0	0	0	0
Oct/15	5	0	3	4	3	0	0	0	0	0
Nov/15	4	4	4	3	1	1	0	0	0	0
Dec/15	0	0	0	0	0	0	0	0	0	0
Jan/15	30	8	4	1	2	0	0	0	0	0
Feb/15	11	3	3	1	3	3	0	0	0	0

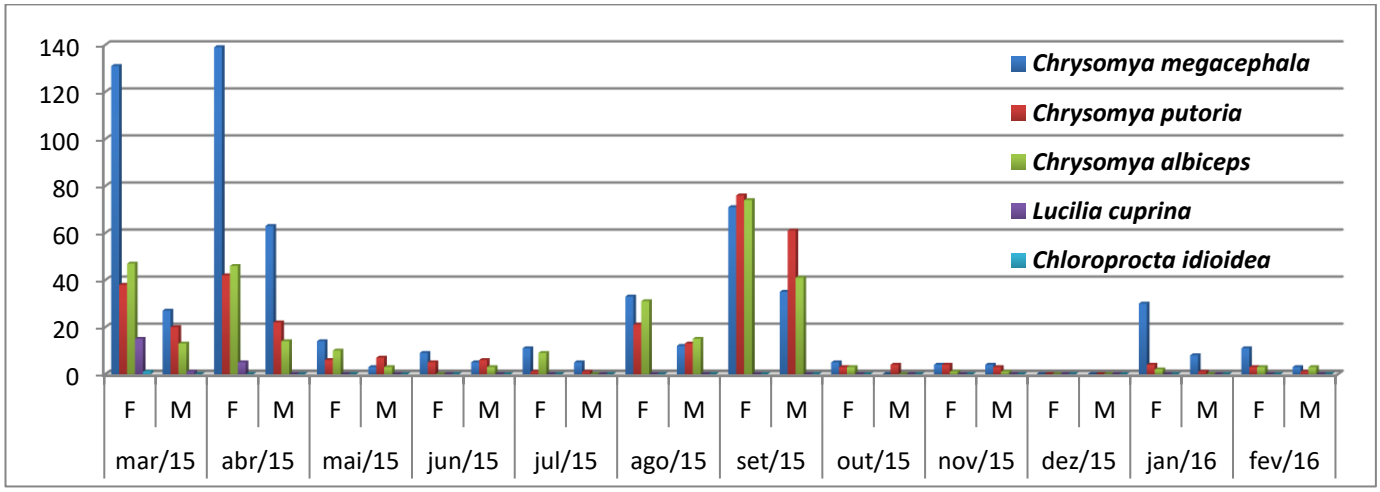

Figure 2. Monthly distribution of Calliphoridae species captured from March 2015through February 2016.

Table 3. Maximum average temperature and minimum average temperature registered from February 2015 through February 2016.

Months	Maximum Average Temperature	Minimum Average Temperature
Feb/15	32.8ºC	22.8ºC
Mar/15	30.2ºC	22.8ºC
Apr/15	28.6ºC	21.4ºC
May/15	26.9ºC	19.2ºC
Jun/15	26.4ºC	17.8ºC
Jul/15	26.9ºC	18.7ºC
Aug/15	28.4ºC	18.1ºC
Sept/15	27.6ºC	20.8ºC
Oct/15	29.1ºC	21.8ºC
Nov/15	28.7ºC	22.9ºC
Dec/15	32.2ºC	23.9ºC
Jan/16	30.1ºC	23.9ºC
Feb/16	33.3ºC	24.7ºC

Source: Meteorological data collected using the electronic site *accuweather* (https://www.accuweather.com/).

DISCUSSION

In one year, only five species of Calliphoridae were captured at Colégio Pedro II campus Niterói. The genus *Chrysomya* was predominant, representing 98.4% of muscoids dipterous studied. While Ferreira (1984) was carrying out studies on *Chrysomya* in Goiania – a city in the state of Goiás –, he observed that *C. albiceps*, *C. megacephala* and *C. putoria* can generally be found in urban areas, in different environments such as street-markets, garbage dumps, and public markets. In several occasions, the three species could be found sharing the same animal abdominal viscera or human feces. When analyzing the rate of synanthropy among several species of calyptrate Diptera from the Calliphoridae, Fanniidae, Muscidae e Sarcophagidae families, Sordillo (1991) observed that the Calliphoridae family was the one

with the highest number of individuals collected. The individuals of the genus *Chrysomya* were more attracted to the traps containing fish or chicken gizzard. According to Lima; Luz (1991), the species of *Chrysomya* were well adapted to the tropical regions where the environment was modified by men, and through the process of adaptation, these species of *Chrysomya* altered the fauna of the areas mentioned above.

The number of species collected at Colégio Pedro II campus Niterói was higher in March, April, August and September 2015, when the temperatures ranged between 18.1ºC (minimum) and 30.2ºC (maximum). In Vassouras – a city in the state of Rio de Janeiro –, Macedo et al. (2011) found a larger number of individuals of *C. megacephala*, when the temperature was between 21ºC and 25ºC. Souza & Linhares (1997) highlight that the population peak of the genus *Chrysomya* are normally registered in Brazil during the months when the temperatures are above 18ºC. Another factor that might contribute to the low number of individuals collected during summertime is that the school is closed for the summer holidays, hence fewer people around to generate organic waste.

Chrysomya megacephala was the most abundant species collected at Colégio Pedro II campus Niterói. This fact is consistent with other collections made by D'Almeida & Fraga (2007) at Universidade Federal Fluminense (UFF) – Campus Valonguinho – in Niterói. The same holds true in other areas of Rio de Janeiro state, such as: Seropédica (Carraro & Milward-deAzevedo, 1999); northern region of Rio de Janeiro city (Lopes, 2000); Paracambi (Mello et al., 2004); Baixada Fluminense (Rodrigues-Guimarães et al., 2008); Itaboraí (Batista-da-Silva et al., 2010) and Vassouras (Macedo et al., 2011). *Chrysomya megacephala* is the most synanthropic species found in most Brazilian cities where captures were made. Besides the cities mentioned above, this particular species was also registered in Campinas (D'Almeida, 1982); Belo Horizonte (Madeira, 1985) and Goiânia (Ferreira & Lacerda, 1988).

It is worth observing, however, the spots where the capturing is made in urban zones for, according to Sordillo (1991), they can influence the types of samples. The author put different types of bait in five areas of Rio de Janeiro city, where the collections were made, such as: (i) at the harbor zone; (ii) at the city bus terminal; (iii) in Salgueiro slum; (iv) at parking areas of Flamengo borough, which in the southern region of the city and (v) at the campus of the Rio de Janeiro State University. The species showed a high variation in the capability of being synanthropic (using a scale from -100 = no species found in the inhabited areas to +100 = high preference to areas very populated). In Salgueiro slum, where the level of anthropic pressure is higher, the index was -62.5, which represents a very low tolerance to inhabited areas. At the campus of the University, which is an open wooded area and with a little circulation of vehicles, the index was +44.6 showing a preference to inhabit areas. According to Povolny (1971), in their natural habit, *C. megacephala* is a hemisynanthropic species with eusynanthropic tendencies.

As far as baits are concerned, a very interesting fact was observed in January 2016: all female individuals of *C. megacephala* collected had their ovipositor exposed. As described by D'Almeida & Fraga (2007), the different types of baits used to capture the muscoids dipterous aiming at studying their population showed that baits are not only used as food but also as a substrate for oviposition and mating. According to Povolny (1971), *C. megacephala* adults tend to use animal carcasses to lay their eggs on.

Chrysomya putoria was the second most abundant species collected at Colégio Pedro II campus Niterói, which differs from Sordillo (1991), Rodrigues-Guimarães et al. (2008) and Batista-da-Silva et al. (2010) data. The researchers observed a lower number of individuals when compared to the other species of the same genus. The synanthropic index obtained by Sordillo (1991) for *C. putoria* and *C. megacephala* had a very similar variation. Population studies, carried out not long after the species were introduced to the country, showed that *C. putoria* was more abundant at the rural areas while *C. megacephala* was more common at the coast (D'Almeida & Fraga, 2007).

Chrysomya albiceps was the less abundant species observed at Colégio Pedro II campus Niterói. Differently, Sordillo (1991) showed that *C. albiceps* was the second more representative species observed, especially in the rural area. Therefore, the synanthropic index for *C. albiceps* varied between +4.8 (Flamengo borough) and +6.3 (at the bus terminal), showing complete independence from inhabited areas. The synanthropic index of the collections made solely at UERJ campus showed the preference for inhabited areas (+36.9), which coincided with the studies by Rodrigues-Guimarães et al. (2008). Back in the days when Seropédica was considered a rural area, Carraro & Milward-de-Azevedo (1999) found a large population of *C. albiceps*.

Although the population studies carried out in several Brazilian cities, such as Campinas (Linhares, 1981); Rio de Janeiro (D'Almeida, 1982; Sordillo, 1991) and Belo Horizonte (Madeira, 1985) reported a high synanthropic index of *Lucilia cuprina*, only a small number of these individuals was captured in a two-month period in campus Niterói. In D'Almeida & Fraga (2007) studies at the Valonguinho Campus of Universidade Federal Fluminense, they were also only able to collect a small number of individuals of *Lucilia cuprina*. This result was associated with its probable competition with species of *Chrysomya*. Sordillo (1991) underlined that *L. cuprina* preferred bovine liver and chicken gizzard baits, but these were not used in the study discussed in this article. This preference probably explains the small number of specimens captured at Colégio Pedro II campus Niterói.

In March 2015, only one female of *Chloroprocta idioidea* was collected. Rodrigues-Guimarães et al. (2008) collected *C. idioidea* in the forest area of the Baixada Fluminense region. In the population studies of Calliphoridae, carried out by Batista-da-Silva et al. (2010) in Itaboraí, it was also found that this species is typically forest-based.

CONCLUSION

Although there are some differences in the number of species collected in several Brazilian cities, the species of *Chrysomya,* as ratified by the study at campus Niterói, seem to be the species which better connect to the environment modified by men. The species of *Chrysomya* compete with native species and have a medical and veterinary significant role. It is important, therefore, that studies across the Brazilian territory continue to be carried out so that they can contribute with programs to control and fight these insects.

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