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Abundance and seasonality of *Cochliomyia macellaria* (Diptera: Calliphoridae) in Southern Pantanal, Brazil

Sazonalidade de *Cochliomyia macellaria* (Diptera: Calliphoridae) no Pantanal Sul-mato-grossense, Brasil

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Abstract

Cochliomyia macellaria (Diptera: Calliphoridae), known as the secondary screwworm, occurs in the Americas and has medical-veterinary and forensic importance. This study aimed to describe the seasonal fluctuation of this species in the Pantanal region, Central-Western Brazil. From December 2004 to November 2007 fly catches using four wind-oriented traps baited with decaying bovine liver were carried out at the Nhumirim ranch, Nhecolândia subregion, Southern Pantanal. Traps remained active throughout the study period and collections were carried out on a weekly basis. A total of 159,397 Calliphoridae were caught and *C. macellaria* (57.33%) was the most abundant species. *C. macellaria* occurred all over the year showing a bimodal behavior with peaks in May-July (late autumn/early winter) and October-December (spring).

Keywords: Secondary screwworm, population dynamics, secondary myiasis.

Resumo

Cochliomyia macellaria (Diptera: Calliphoridae), conhecida como mosca-varejeira, ocorre no continente americano e apresenta importância médico-veterinária e forense. O presente estudo teve como objetivo conhecer a flutuação sazonal dessa espécie na região do Pantanal. De dezembro/2004 a novembro/2007 foram realizadas coletas de dípteros na fazenda Nhumirim, sub-região da Nhecolândia, Pantanal sul-mato-grossense. Foram utilizadas quatro armadilhas orientadas pelo vento, iscadas com fígado bovino deteriorado. As armadilhas permaneceram ativas durante todo o período de estudo, e coletas foram realizadas semanalmente. Foram capturados 159.397 califorídeos, sendo *C. macellaria* (57,33%) a espécie mais abundante. *C. macellaria* foi observada em todos os meses do ano, apresentando comportamento bimodal com picos populacionais em maio/julho (final de outono/início de inverno) e outubro/dezembro (primavera).

Palavras-chave: Mosca-varejeira, dinâmica populacional, miíase secundária.

Introduction

Cochliomyia macellaria (Fabricius, 1775), known as the secondary screwworm, is widely distributed in the Americas, occurring in tropical and subtropical Western Hemisphere from Southern Canada to Patagonia, including the Galapagos Islands and West Indies (FERREIRA, 1983; GUIMARÃES; PAPAVERO, 1999).

This fly has a significant medical and veterinary importance causing secondary cutaneous myiasis and vectoring eggs of *Dermatobia hominis* (human bot fly), which causes significant economic losses to livestock in Brazil (GRISI et al., 2002).

Due to the scavenger habits of its larvae, *C. macellaria* has considerable ecological importance in the removal of carcasses and organic wastes in nature. It is also useful in forensic entomology in criminal investigation, providing pre- and post-mortem information (CATTS; GOFF, 1992).

After the introduction of *Chrysomya* flies in Brazil in 1970 and its gradual dispersion nationwide, *C. macellaria* began to compete with exotic species for similar ecological niches (FURLANETTO et al., 1984) in the States of São Paulo (LINHARES, 1981) and Goiás (FERREIRA, 1983).

There are relatively few studies on *C. macellaria* abundance and population dynamics in Brazil and information about its ecology in different biomes is scarce. This study described population fluctuation of *C. macellaria* in Southern Pantanal region, Central-Western Brazil.

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Material and Methods

A 3-year survey was conducted from December 2004 to November 2007 at Nhumirim cattle farm (18° 59' S and 56° 39' W, 98 m a.s.l.), an experimental station of the Brazilian Agricultural Research Corporation (Embrapa) Pantanal located in the subregion of Nhecolândia, Corumbá county, State of Mato Grosso do Sul, Central-Western Brazil. It is a tropical region characterized by seasonal flooding, with a well defined rainfall season from November to March, accounting for 72% of the total annual rainfall of about 1,200 mm, and a dry season from April to October. Average annual temperature is 25.5 °C and relative humidity is about 82% (SORIANO et al., 1997).

Fly catches were carried out with four-wind oriented traps, as described by Broce, Goodenough and Coppedge (1977) and modified by Oliveira, Moya-Borja and Mello (1982). The traps were suspended approximately 1.2 m above the ground and placed more than 1,200 m apart in four sites: Site 1 – trap placed about 50 m from corral in a pasture area with sparse trees; Site 2 – trap placed in an open area with native grasses about 30 m from a forested savanna edge; Site 3 – trap placed 15 m inside an area of forested savanna; and Site 4 – trap placed in an area of transition between an open area and forested savanna edge.

About 500 g of bovine liver placed in a plastic container protected by nylon net were used as bait inside each trap. Liver was previously left at room temperature for 24 hours before use and half of the rotting liver bait was replaced on a weekly basis.

The traps were kept active throughout the study period and were weekly replaced for collection of captured specimens and routine maintenance. Flies were removed from traps after killed with insecticide (pyrethroid) spray. The insects collected were placed into labeled plastic ziplock bags and brought to the Embrapa Pantanal Entomology Laboratory for sorting, counting and preliminary identification (MELLO, 2003). The samples were subsequently sent to the Embrapa Beef Cattle Entomology Laboratory for confirmation of species. The entomological material was deposited in both Embrapa Pantanal and Embrapa Beef Cattle reference collections.

Daily records of temperature, relative humidity, and rainfall were obtained from a weather station at the study site. Monthly average temperatures and relative humidity, as well as total monthly rainfall, were usaed in the analysis.

A descriptive statistical analysis was performed using data from monthly fly catches. The influence of climatic parameters on population dynamics was assessed by correlation analysis.

Results and Discussion

A total of 677,313 dipterans were caught during the study period. Calliphorids totalized 159,397 specimens from the following species: *Cochliomyia macellaria* (Fabricius, 1775), *Cochliomyia hominivorax* (Coquerel, 1858); *Chloroprocta idioidea* Robineau – Desvoidy, 1830; *Chrysomya albiceps* (Wiedemann, 1819); *Chrysomya megacephala* (Fabricius, 1794); *Chrysomya putoria* (Wiedmann, 1830), *Lucilia cuprina* (Wiedmann, 1830) and *Lucilia eximia* (Wiedmann, 1819). Specimens from other families were also sampled and included Fanniidae, Muscidae, Sarcophagidae, Syrphidae, and Ropalomeridae.

Cochliomyia macellaria (n = 91,386) was the most abundant species, accounting for 13.49% of all dipteran catches and 57.33% of the Calliphoridae. Yearly relative abundances of *C. macellaria* compared to other calliphorids were always above 50% (64.03, 50.46, and 52.25%, respectively for the three years of study). A high abundance of *C. macellaria* (76.09%) among Calliphoridae was also described by Ferreira (1983) in a rural area of Goiânia. However, much lower relative abundances have been found in most studies conducted in different regions (OLIVEIRA; MOYA-BORJA; MELLO, 1982; MADEIRA; DIAS; MASCARENHAS, 1982; D'ALMEIDA; LOPES, 1983; WIEGAND et al., 1991). Several factors such as trap sites and bait attractiveness may influence the frequency of C. *macellaria* in catches (FERREIRA, 1983). However, competition with *Chrysomya* species has been considered a major factor for reduced abundance of *C. macellaria* (GUIMARÃES; PRADO; BURALLI, 1979; D'ALMEIDA; LOPES, 1983).

This interespecific competition with *Chrysomya* species did not seem to play a major role in this study since relative abundance of *C. macellaria* was consistently high during the three years studied, although its population peaks coincided with those found in *Chrysomya* species (CORRÊA; KOLLER; BARROS, 2010). Furthermore, no negative correlation was found between abundance of *C. macellaria* and *Chrysomya* flies, as it would be expected in the event of major competition, but rather a low positive correlation ($r \leq 0.18$) was found between *C. macellaria* and the three species of *Chrysomya* (*C. albiceps, C. megacephala,* and *C. putoria*).

C. macellaria was caught in all sites but its abundance markedly varied among them. The highest number of individuals was caught in the open area (35.57%) whereas the lowest abundance was seen in the forested savanna (8.07%). The denser vegetation of the forested site may have reduced dispersion of the bait odor, thus reducing catches in that environment.

Remarkable differences have been described regarding abundance of *C. macellaria* in rural and urban areas. In this study, which was carried out in a rural area about 150 km away from the city of Corumbá, this species accounted for 57.33% of all calliphorids while a much lower abundance (7.26%) was reported in an urban area of Corumbá (CAMPOS; BARROS, 1995). D'Almeida and Lopes (1983) studied preference of *C. macellaria* for ecological environments in Rio de Janeiro and reported that this species was practically restricted to rural areas (97.96%) when compared to urban (1.37%) and forested (0.69%) areas.

C. macellaria females (76.07%) were more frequently seen than males in the traps, which can be explained by the attractiveness of decaying liver as a potential substrate for oviposition. Similar results were reported by Oliveira, Moya-Borja and Mello (1982) and Gomes, Koller and Barros (2000) using liver baits.

In general, the weather was typical for the study region. Moderate temperatures occurred from May to August and the highest temperatures were recorded from October to March. The rainy season began in September-October and the heaviest rainfall period was December-February. The average relative humidity was lower in August-September during the dry season (Figure 1).

C. macellaria was caught throughout the year in Pantanal. Similar results were reported by Gomes, Koller and Barros (2000) from ecological studies carried out in the same state in a highland region about 400 km apart.

Two yearly population peaks of *C. macellaria* were recorded in Pantanal (Figure 2). The first peak occurred between May and July (late autumn/early winter) coinciding with the beginning of the dry season in the region; the second peak occurred between October and December (spring), early rainy season. Oliveira, Moya-Borja and Mello (1982) also reported greater abundance of this species during the winter and spring in Rio de Janeiro. However, Wiegand et al. (1991) and Ribeiro et al. (1993) described a single population growth in early summer in studies in Rio Grande do Sul. Variations in the seasonality of *C. macellaria* result from climatic conditions found in different Brazilian regions – the central-western ans southern are quite different regions.

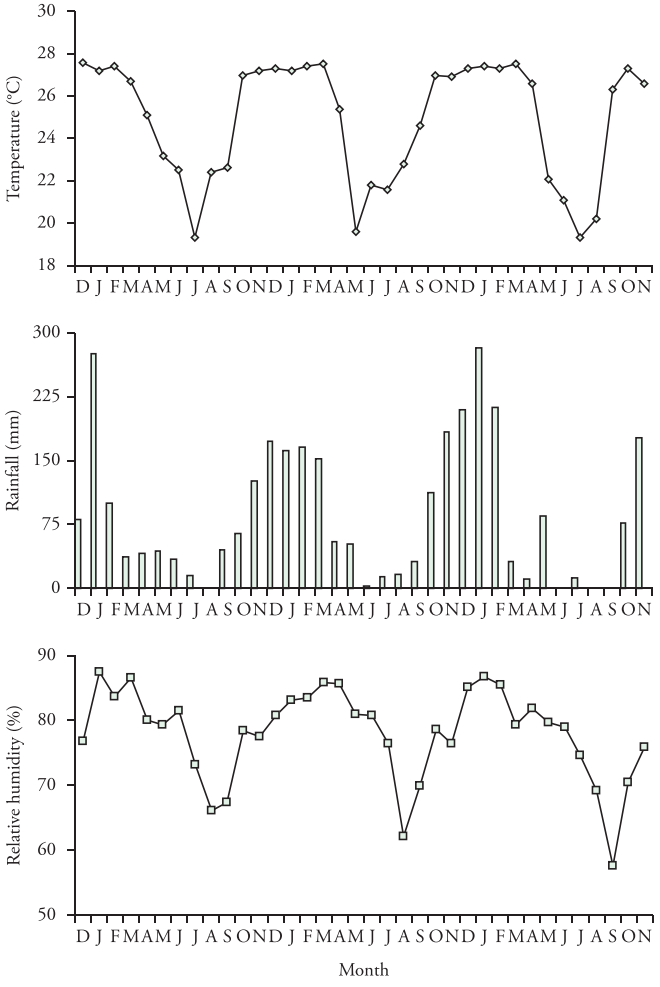

Figure 1. Climatic data at the Nhumirim cattle farm, Nhecolândia subregion, Pantanal, State of Mato Grosso do Sul, Brazil, December 2004 to November 2007.

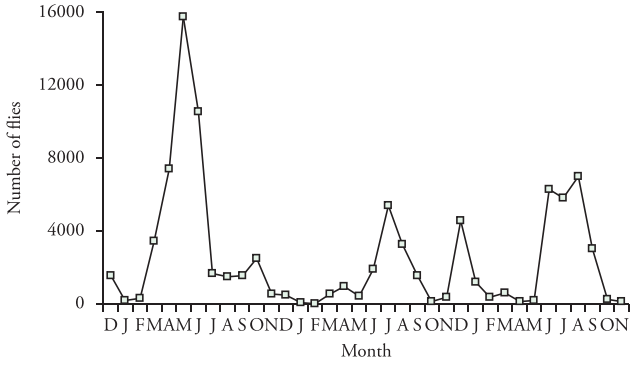

Figure 2. Seasonal fluctuation of *Cochliomyia macellaria* in the subregion of Nhecolândia, Pantanal, State of Mato Grosso do Sul, Brazil, December 2004 to November 2007.

Low correlation ($r < 0.19$) between population data and climatic records (temperature, relative humidity, and rainfall) indicated that seasonality of *C. macellaria* was not determined by a single climatic parameter but probably by an association of abiotic variables.

In conclusion, *C. macellaria* is the most abundant Calliphoridae in Southern Pantanal (subregion of Nhecolândia); it occurs throughout the year and shows a bimodal behavior with population peaks in late autumn/early winter and spring.

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