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PARASITOIDS OF *MUSCA DOMESTICA* L. 1758 (DIPTERA: MUSCIDAE) COLLECTED IN TWO AREAS OF THE CENTRAL REGION OF GOIÁS, BRAZIL

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ABSTRACT

This study aimed to ascertain the species of parasitoids of Musca domestica L. (Diptera: Muscidae) that were collected in two areas of the central region of Goiás. This experiment was conducted in two places: on the farm of the School of Veterinary and Animal Science of the Federal University of Goiás, Brazil (rural area - 1), and on the campus of the Federal University of Goiás in Goiânia, Goiás, Brazil (urban area - 2). Parasitoids were collected by exposing larvae of M. domestica and its breeding substrate (beef liver) outdoors, in containers filled with sand that were placed next to garbage containers. From March to December 2015, 67 species of parasitoids were collected; 39.3% of the individuals were obtained in rural area and 60.7% in urban area. In both locations, Pachycrepoideus vindemmiae (Rondani) (Hymenoptera: Pteromalidae) was the most frequent species, with 79.2% and 62.0% in the rural and urban areas, respectively. The percentage of parasitism in urban area was 6.9%, and in rural area 9.1%.

KEY WORDS: *Biocontrol, dipterous, fly, hymenopterous, natural enemy*

INTRODUCTION

Musca domestica L. 1758 (Diptera: Muscidae) is a species of great sanitary interest because of its synanthropic characteristics, abundance in urban areas, capacity to develop in several sorts of substrates and high reproductive capacity (Marchiori, 2013; Marchiori, 2014; Marchiori & Borges, 2015).

Parasitoids are important regulators of insect populations and stand out as the main group of natural enemies in agricultural systems. They are present in various orders of insects and their adaptation to a parasitic behavior is seen most diversely and abundantly in the order Hymenoptera (Panizzi & Parra, 2009).

This study aimed to ascertain the species of parasitoids of *M. domestica* that were collected in two areas of the central region of Goiás.

MATERIALS AND METHODS

This experiment was conducted in two places: 1) on the farm of the School of Veterinary and 2) Animal Science of the Federal University of Goiás, Brazil (rural area), and on the campus of the Federal University of Goiás in Goiânia, Goiás, Brazil (urban area). Parasitoids were collected by exposing larvae of *M. domestica* and its breeding substrate (bovine beef liver) outdoors, in containers filled with sand that were placed next to garbage containers. The larvae of *M. domestica* used were from the stock maintained and reared at the Institute of Tropical Pathology and Public Health. They were kept in the laboratory so as to begin abandonment of the diet. The larvae remained in the field for fifteen days, and became pupae. The insects collected were taken to the laboratory, sacrificed using ethyl ether and kept in 70% alcohol for further identification. To obtain the parasitoids, the contents of the traps were placed in plastic containers with a layer of sand for use as a substrate for transformation of the larvae into pupae. This sand was sifted after being in the field for 15 days and the pupae were extracted from it and were individually placed in gelatin capsules (number 00) in order to obtain the flies and/or parasitoids.

The total of percentage parasitism was calculated by means of the number of pupae parasitized, divided by the total number of pupae collected, and multiplied by 100. The percentage parasitism of each parasitoid species was calculated by means of the number of pupae parasitized per species of parasitoid, divided by the total number of pupae from that host, and multiplied by 100.

RESULTS AND DISCUSSIONS

From March to December 2015, 66 species of parasitoids were collected: 39.3% of the individuals were obtained from rural areas, whereas 60.7% were obtained from urban areas (Table 1). The greater number of specimens collected in urban areas was possibly due to greater food supply, to variations in the quality and availability of food resources, the composition and relative abundance of parasitoids undergoes variation according to the localities, seasonal period and habitat type. Possibly, these parasites have become adapted to urban conditions, and may be used in biological control programs.

Nevertheless, it is believed that rural areas are important source locations for parasitoids that are natural enemies of other insects. These insects are considered bioindicators for the biodiversity of ecosystems, and are considered as key species for maintaining the equilibrium of the communities in which they are included. In addition, since they are natural enemies of insects, they may be used in biological control programs of agricultural pests (Scatolini & Penteado-Dias, 1997).

In both locations, *Pachycrepoideus vindemmiae* (Hymenoptera: Pteromalidae) was the most frequent species, with 79.2% and 62.0% in the rural and urban areas, respectively. Since several species of parasitoids were collected in the same host, it is very likely that interspecific competition determined which species of parasitoid would emerge in greater quantity, as well as the remainder would have been eliminated by competition.

TABLE 1: Percentage of parasitism of *Musca domestica* L. 1758 (Diptera: Muscidae) collected in two areas of the central region of Goiás, Brazil.

Taxonomic Group	Rural		Urbana	
	Number of pupae parasitized	% parasitism	Number of pupae parasitized	% parasitism
Encyrtidae:				
Hemencyrtus herbertii	*5*	*1.5*	*1*	*0.2*
Eulophidae:				
Tachinobia sp.	-	-	*1*	0.2
Pteromalidae:				
Nasonia vitripennis	-	-	*7*	*1.5*
Pachycrepoideus vindemmiae	*19*	*5.4*	*26*	*5.5*
Spalangia sp.	-	-	*7*	*1.5*
Total of pupae parasitized:	*24*	-	42	
Total of pupae:	*350*		*472*	

Pachycrepoideus vindemmiae is a solitary parasitoid of many Diptera of the families Anthomyiidae, Calliphoridae, Muscidae, Sarcophagidae, Tachinidae, Tephritidae and others. It presents wide geographical distribution, including in North America and Africa (Hanson & Gauld, 1995).

The percentage of parasitism in urban was 9.0% and in rural areas 6.9%. These proportions are related to the search capacity and the seasonal variation in parasitoid levels. *Pachycrepoideus vindemmiae* found in the two collection areas also had the highest percentage of parasitism. Perhaps its greater competitive potential in the larval stage can explain this fact.

Several species of the Encyrtidae family have been successfully used in biological control programs. *Hemencyrtus herbertii* Ashmead (Hymenoptera: Encyrtidae) behave as parasitoid, developing internally in the host body and emerging from the puparium (Noyes, 1980; Gauld & Bolton, 1988).

Nasonia vitripennis (Walker) (Hymenoptera: Pteromalidae), that behaves as gregarious parasitoid, is ectoparasitoid in pupae of several species of Diptera families, particularly Calliphoridae, Muscidae, Sarcophagidae and Tachinidae (Rivers & Denlinger, 1995; Schurmanm *et al.*, 2014). It is a polyphagous insect parasite over 68 species of Diptera.

When determined reliably through rearing, species of *Spalangia* Latreille, 1805 (Hymenoptera: Pteromalidae) have been shown to be either primary parasitoids of Diptera puparia or, much more rarely, hyperparasitoids of Diptera puparia through Hymenoptera primary parasitoids or hyperparasitoids of non-dipterous hosts through Tachinidae (Diptera) primary parasitoids. Because of their dipterous hosts, many species of *Spalangia* are economically important and there is a huge literature reporting their parasitism against Muscidae, Calliphoridae, Sarcophagidae, Drosophilidae, Chloropidae, Sepsidae and others (Gibson, 2009).

As *Tachinobia* (Boucek, 1977) (Hymenoptera: Eulophidae) species behave as gregarious parasitoids of Lepidoptera and Diptera (Boucek, 1977; La Salle, 1994).

The use of chemical substances to control this fly may result in high production costs. Moreover, this may render fruit unfit for exportation, cause damage to the environment and

harm human health as well. Thus, searching for effective natural enemies may provide a viable alternative method for containing this pest through a long-term control programs.

CONCLUSIONS

1-39.3% of the individuals were obtained in rural area and 60.7% in urban area. 2- In both locations, *P. vindemmiae* was the most frequent species, with 79.2% and 62.0% in the rural and urban areas, respectively. 3-The percentage of parasitism in urban area was 6.9%, and in rural area 9.1%.

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