Dipterous parasitoids collected from cattle dung in Goiânia, region central Goiás, Brazil

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Abstract

This study had the objective of determining the species of parasitoids in pupae of Diptera present in bovine dung, collected in the municipality of Goiânia, GO, region central of Brazil, from March 2012 to February 2013. The dipterous pupae were obtained by the flotation method. They were individually placed in gelatin capsules until the emergence of the dipterous and/or their parasitoids. The overall percentage of parasitism was 6.5%, and *Nasonia vitripennis* (Walker) (Hymenoptera: Pteromalidae) was the species with the highest percentage of parasitism with 9.8%. The more frequent specie was: *Aleochara notula* Erichson, 1839 (Coleoptera: Staphylinidae) with 26,1%.

Keywords: Diptera, Hymenoptera, biological control, flies

Introduction

Among the means for controlling flies, chemical insecticides are the most widely used. However, these may lose their efficiency as populations become resistant to them (Silveira et al., 1989). The appearance of resistance to insecticides explains the growing need to introduce alternative control programs aimed towards fly control.

Parasitoids are agents responsible for reducing the populations of flies that proliferate on dung (Marchiori et al., 2001), cadavers and animal carcasses. Because parasitoids occupy a higher trophic level, they often act as determinant factors for the

population density of their hosts, consequent to their great diversity of physiological and behavioral adaptations.

These insects are considered to be bioindicators of the biodiversity of ecosystems and are considered to be key species for maintaining the equilibrium of the communities in which they are included. In addition, since they are natural enemies of agricultural pests, they may be used in biological control programs (Scatolini and Dias, 1997).

This study had the objective of determining the species of parasitoids of dipterous insects that were present in bovine feces collected in Goiânia (central regions of the state of Goiás) Brazil.

Material and Methods

In Goiânia, the experiment was conducted at the Veterinary and Zootechnics School of the Federal University of Goiás, in the municipality of Goiânia (16º40'S and 49º16"W). Every fortnight, 10 plates of fecal cake (of approximately 3 kg each) were produced from fresh bovine feces that were collected immediately after defecation in pastures of Brachiaria brizantha (Hochst ex. A. Rich) and in corrals. The material was collected in plastic buckets and was homogenized. It was then placed in 10 round plastic supports of 20 cm in diameter, with a hole to allow rainwater to drain away. This methodology was used for precise determination of the time between the emission of the fecal cake and its collection. The feces remained exposed (five in the pastures and five in the corrals) for 15 days. After this period, the feces were taken to the laboratory for extraction of pupae by means of the flotation method. The pupae were removed with the aid of a sieve; they were counted and individually stored in gelatin capsules (number 00) until the flies and/or parasitoids emerged. The parasitoids and flies that emerged were identified with the aid of a stereoscopic microscope and were conserved in 70% alcohol.

The percentage parasitism of each parasitoid species was calculated by means of the number of pupae parasitized by each parasitoid species divided by the total number of pupae of that host, and multiplied by 100. The parasitoids' preference for their hosts was tested by means of the chi-square test, with 5.0% probability. The voucher material

from the central region was deposited at the laboratory of the Veterinary Parasitology Center of UFG.

Results and Discussion

We collected 359 pupae of Diptera, of which 23 parasitoids emerged. The number of flies and parasitoids Cachoeira Dourada ere low compared to the collected works carried out in the Panama-GO, with 628 and 78 parasitoid flies; Waterfall Golden-GO, with 3145 and 213 parasitoids and dipterous insect Itumbiara-GO, 5884 with 410 flies and parasitoids (Marchiori et al., 2005), all of which belong to the southern municipalities of Goiás.

It could be seen that in the southern region, greater diversity and quantity of parasitoids was obtained than in Goiânia. The lower diversity in the central region was probably related to the low synanthropy of the species of dipterans and parasitoids collected in the region studied. The locality studied is now surrounded by human populations on all sides.

In synanthropy work performed in Monte Alegre-MG, state of Minas Gerais, the parasitoid species *Paraganaspis egeria* Díaz, Gallardo & Walsh (Hymenoptera: Figitidae) and *Spalangia cameroni* Perkins (Hymenoptera: Pteromalidae) showed high levels of synanthropy: -100 and +50, respectively (Marchiori, 2011).

The most frequently observed species in Goiânia was *Aleochara notula* Erichson, 1839 (Coleoptera: Staphylinidae), accounting for 26.1% (Table 1), This was probably due to its capacity to seek hosts or due to variations in the quality and availability of food resources. The larval phase of *A. notula* behaves as a solitary ectoparasitoid of pupae of Cyclorrhapha dipterans of the families Muscidae, Anthomyiidae, Coelopidae, Sarcophagidae and Psilidae (Wright and Müller, 1989). In the adult phase, it behaves as a predator of eggs and larvae of these dipterous insects and can be used for biological control of flies.

The overall percentage of parasitism contacted was 6.4%. The monthly percentage of parasitism was highest in June to 60.0%. These variations in monthly percentages of parasitism may be associated with seasonal changes in environmental conditions.

Nasonia vitripennis (Walker, 1836) (Hymenoptera: Pteromalidae) was the species in the central region that presented the highest percentage parasitism, with 9.8% (Table 3). This was probably due to variations in the quality and availability of food resources or due to the ability of this species to search for food, or possibly because it is a polyphagous parasitoid. *N. vitripennis* behaves as a gregarious parasitoid: it is an ectoparasitoid in pupae of several species of dipterous families, particularly Calliphoridae, Muscidae, Sarcophagidae and Tachinidae (Rivers and Denlinger, 1995). It is a polyphagous insect that parasitizes more than 68 dipterous species (Whiting, 1967).

In relation to the attraction of parasitoids towards dipterous insect in Goiânia, it was found that *A. notula* was attracted to *Sarcophagula occidua* Fabricius (Diptera: Sarcophagidae); *Neralsia splendens* (Borgmeier) (Hymenoptera: Figitidae) to *Cyrtoneurina pararescita* Couri (Muscidae) *N. splendens* to *C. pararescita* and *S. occidua*; *P. egeria* to *S occidua*; *S. cameroni* to *Brontaea debilis* Williston (Diptera: Muscidae); *Spalangia drosophilae* (Ashmead) (Hymenoptera: Pteromalidae) to *B. debilis*, *Brontaea quadristigma* (Thomson) (Diptera: Muscidae) and *Palaeosepsis* spp (Diptera: Sepsidae) and *Spalangia nigra* (Hymenoptera: Pteromalidae) (Curtis) to *B. debilis* ($X2 = 47.28$; $GL = 8$; $P < 0.05$).

This paper reports the first survey of parasitoids associated with cattle dung flies in the region Goiânia, Goiás, Brazil.

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Table 1. Dipterous parasitoids collected from March 2012 to February 2013 in Goiânia, Goiás, Brazil

Taxonomic Group	Months												
	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Fev.	Total
Coleoptera:													
Staphylinidae:													
Aleochara notula	0	0	0	0	5	0	1	0	0	0	0	0	6
Hymenoptera:													
Figitidae:													
Neralsia splendens	0	1	0	0	3	0	0	0	0	0	0	0	4
Paraganaspis egeria	0	1	0	0	0	0	0	0	0	0	0	0	1
Pteromalidae:													
Nasonia vitripennis	0	0	4	0	0	0	0	0	0	0	0	0	4
Spalangia cameroni	0	2	0	0	0	0	0	0	0	0	0	0	2
Spalangia drosophilae	1	0	2	1	0	0	0	0	0	0	0	0	4
Spalangia nigra	0	1	0	0	0	0	0	0	0	0	0	0	1
Spalangia sp.	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	1	6	6	1	8	0	1	0	0	0	0	0	23

Table 2**.** Parasitism rate monthly from March 2012 to February 2013 in Goiânia, Goiás, Brazil

Development phase and Percentage	Monthly												
Pupae:	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Total
Pupae parasitized	1	6	2	6	8	0	1	0	0	0	0	0	23
Not parasitized pupae	50	33	9	10	41	25	69	38	8	24	38	10	359
Percentage of parasitism	2.0	18.2	22.2	60.0	19.5	0.0	14.5	0.0	0.0	0.0	0.0	0.0	6.4

Table 3. Percentage of parasitism parasitoids collected in cattle feces in Goiânia, Goiás Brazil

Diptera species	Number of pupae	Species of parasitoids	Pupae parasitized	Percentage
Brontaea quadristigma	83	*Spalangia drosophilae*	1	1.2
Brontaea debilis	77	*Spalangia drosophilae*	2	2.6
		Spalangia cameroni	2	2.6
		Spalangia nigra	1	1.3
		Spalangia sp.	1	1.3
Cyrtoneurina pararescita	41	*Neralsia splendens*	2	4.9
		Nasonia vitripennis	4	9.8
Palaeosepsis spp.	80	*Spalangia drosophilae*	1	1.3
Sarcophagula occidua	78	*Aleochara notula*	6	7.5
		Neralsia splendens	2	2.6
		Paraganaspis egeria	1	1.3
Total de pupas:	359	-	23	6.4