



## ARTICLE

**Parasitoids Collected from Animal Feces in Brazil**

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## ABSTRACT

The purpose of the paper is to report the species of dipteran parasitoids in poultry feces on farms, buffalo, and cattle in the field in Brazil. The experiments were carried out from April 2006 to December 2007. The pupae were obtained by the flotation method. They were individually placed in gelatin capsules until the emergency of the adult flies or their parasitoids. The specie more frequent was *Spalangia endius* Walker (Hymenoptera: Pteromalidae) with 7.2%. Were obtained from bovine feces 628 pupae of dipterous in buffalo feces, 3,437 pupae were collected and from chicken feces 2,799 pupae, from which 78, 172 and 504 parasitoids emerged, respectively. The most frequent species in bovine, of buffalo and chicken feces were: *Gnathopleura quadridentata* Wharton (Hymenoptera: Braconidae) with 25.6%, *Spalangia drosophilae* Ashmead (Hymenoptera: Pteromalidae) with 21.5% and *Pachycrepoides vindemmiae* (Rondani, 1875) with 46.8%, respectively.

**1. Introduction**

Dipterans (flies) (Insecta: Diptera) are vectors of pathogens such as viruses, bacteria, protozoan cysts and parasitic worms. Can cause disease in animals and nuisance to humans both in the urban and rural environment<sup>[1]</sup>.

Parasitoids (Hymenoptera) are insects that have adapted to the parasitic way of life using nutritional resources limited by the immature or acquiring nutrients during adult<sup>[6]</sup>.

Therefore, the biological control of dipteran with the use of parasitoid meets the search for alternatives to the problem, as it is a safe method, easy to handle and low cost<sup>[3]</sup>.

The purpose of the paper is to report the species of dipteran parasitoids in poultry feces on farms, buffalo, and cattle in the field in Brazil.

**2. Material and Methods**

The experiment was carried out in a poultry farm

in Morrinhos, Goiás, Midwest, Brazil (18°25'S and 49°13'W). The collected feces originated birds raised in the cage system. Fresh feces, collected immediately after emission, were placed in five 30 cm diameter by 12 cm high bowls, which were left in the dry environment for 15 days: for pupae extraction by the flotation method. The pupae, which were individually placed in gelatin capsules to obtain dipterous and /or the parasitoids.

The experiment was carried out on a farm in the south of Goiás (18°25'S and 49°12'W), Brazil. 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 supbyts of 20 cm in diameter, with a hole to allow rainwater to drain away. This methodology was used for precise determination of

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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 [5]. The experiments were carried out from April 2006 to December 2007.

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.

### 3. Results and Discussion

Were obtained from bovine feces 628 pupae of dipterous in buffalo feces, 3,437 pupae were collected and from chicken feces 2,799 pupae, from which 78, 172 and 504 parasitoids emerged, respectively (Tables 1, 2 and 3).

**Table 1.** Parasitoids and their dipterans collected in the feces chicken in Brazil.

Diptera	Nº. of pupae	Parasitoids	Pupae parasitized	%
Calliphoridae:				
<i>Chrysomya megacephala</i>	500	<i>Nasonia vitripennis</i>	3	0.6
		<i>Pachycrepoideus vindemmiae</i>	3	0.6
		<i>Spalangia endius</i>	3	0.6
Fanniidae:				
<i>Fannia pusio</i>	42	<i>Muscidifurax raptorellus</i>	2	4.8
		<i>Pachycrepoideus vindemmiae</i>	2	4.8
Muscidae:				
<i>Musca domestica</i>	2083	<i>Muscidifurax raptorellus</i>	3	0.6
		<i>Nasonia vitripennis</i>	5	1.0
		<i>Pachycrepoideus vindemmiae</i>	347	16.7
		<i>Spalangia endius</i>	67	3.2
		<i>Spalangia nigra</i>	16	0.8
		<i>Spalangia nigroaenea</i>	2	0.1
		<i>Spalangia</i> sp.	15	0.7
		<i>Tachinaephagus zealandicus</i>	10	0.5
Sepsidae:				
<i>Palaeosepsis</i> sp.	81	<i>Nasonia vitripennis</i>	2	2.5
		<i>Pachycrepoideus vindemmiae</i>	8	10.0
		<i>Spalangia drosophilae</i>	2	2.5
		<i>Spalangia</i> sp.	10	12.3
Syrphidae:				
<i>Ornidia obesa</i>	93	<i>Pachycrepoideus vindemmiae</i>	2	2.2
		<i>Spalangia cameroni</i>	2	2.2
Total	2799	-	504	-

**Table 2.** Percentage of parasitoid collected from cattle feces in Brazil

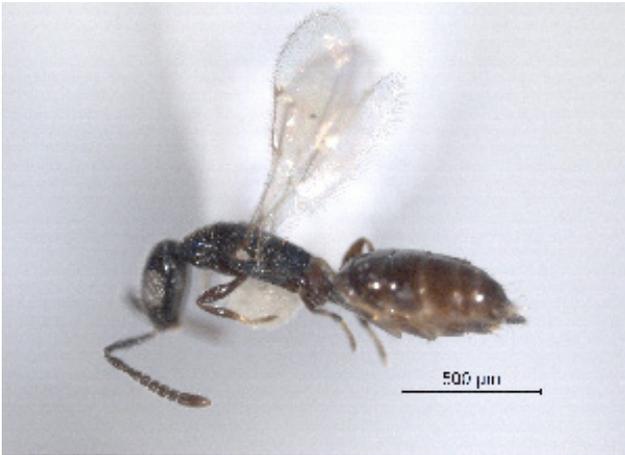
Diptera species (number of pupae collected)	*Parasitoids	Individuals number	%
<i>Archiseptis scabra</i> (40)	<i>Spalangia drosophilae</i>	04	10.0
<i>Brontaea debilis</i> (56)	<i>Spalangia cameroni</i>	01	1.79
	<i>Spalangia nigroaenea</i>	02	3.57
<i>Brontaea quadristigma</i> (49)	<i>Kleidotoma nigra</i>	02	4.08
	<i>Spalangia cameroni</i>	01	2.04
	<i>Spalangia drosophilae</i>	01	2.04
	<i>Spalangia. endius</i>	01	2.04
<i>Cyrtoneurina paraescita</i> (151)	<i>Spalangia nigra</i>	03	1.99
	<i>Spalangia nigroaenea</i>	05	3.31
<i>Chrysomya megacephala</i> (51)	Absent	_____	_____
<i>Musca domestica</i> (10)	<i>Spalangia cameroni</i>	01	10.0
<i>Oxysarcodexia thornax</i> (70)	<i>Gnathopleura quadridentata</i>	20	28.6
<i>Palaeosepsis</i> spp. (107)	<i>Paraganaspis egeria</i>	02	1.87
	<i>Spalangia drosophilae</i>	02	1.87
	<i>Spalangia endius</i>	01	0.93
	<i>Triplasta atrocoxalis</i>	02	1.87
	<i>Triplasta coxalis</i>	08	7.48
<i>Ravinia belforti</i> (63)	<i>Trichopria</i> sp.	01	0.93
	Absent	_____	_____
	<i>Pachycrepoideus vindemmiae</i>	05	7.94
	<i>Spalangia cameroni</i>	01	1.59
<i>Sarcophagula occidua</i> (31)	<i>Spalangia nigra</i>	04	6.35
	<i>Spalangia nigroaenea</i>	06	9.52
Total pupae: 628		78	124

The most frequent species in bovine, of buffalo and chicken feces were: *Gnathopleura quadridentata* Wharton (Hymenoptera: Braconidae) with 25.6%, *Spalangia drosophilae* Ashmead (Hymenoptera: Pteromalidae) (Figure 1) with 21.5% and *Pachycrepoideus vindemmiae* (Ron-

**Table 3.** Percentage of parasitoid microhimenoptera collected in feces of buffaloes in Brazil

Diptera species (number of pupae collected)	*Parasitoids	Individuals number	%
<i>Archiseptis scabra</i> (310)	<i>Paraganaspis egeria</i>	04	1.29
	<i>Spalangia drosophilae</i>	01	0.32
	<i>Trichopria</i> sp.	01	0.32
<i>Brontaea quadristigma</i> (138)	<i>Paraganaspis egeria</i>	01	0.72
	<i>Spalangia drosophilae</i>	02	1.45
<i>Brontaea debilis</i> (127)	<i>Spalangia cameroni</i>	02	1.57
	<i>Spalangia nigroaenea</i>	01	0.79
<i>Cyrtoneurina paraescita</i> (19)	<i>Spalangia nigra</i>	01	5.26
	<i>Spalangia nigroaenea</i>	01	5.26
<i>Palaeosepsis</i> spp. (1948)	<i>Kleidotoma nigra</i>	06	0.31
	<i>Paraganaspis egeria</i>	12	0.62
	<i>Spalangia cameroni</i>	04	0.21
	<i>Spalangia drosophilae</i>	01	0.05
	<i>Spalangia nigra</i>	16	0.82
	<i>Trichopria</i> sp.	09	0.46
	<i>Triplasta atrocoxalis</i>	19	0.98
	<i>Triplasta coxalis</i>	08	0.41
<i>Sarcophagula occidua</i> (931)	<i>Paraganaspis egeria</i>	11	1.18
	<i>Spalangia cameroni</i>	08	0.86
	<i>Spalangia drosophilae</i>	33	3.54
	<i>Spalangia endius</i>	04	0.43
	<i>Spalangia nigroaenea</i>	11	1.18
	<i>Trichopria</i> sp.	16	1.72
Total de pupas: 3473		172	5.0

dani.) (Figure 2) with 46.8%, respectively (Table 1, 2 and 3). Probably, this difference in the number of parasitoids collected in the three substrates is due to its search capabilities and its greatest competitive potential in the larval stage.



**Figure 1.** *Spalangia drosophilae* (Hymenoptera: Pteromalidae)  
Source: [3.boldsystems.org/index.php/Taxbrowser\\_Taxonpage?taxid=484379](http://3.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=484379)



**Figure 2.** *Pachycrepoideus vindemmiae* (Rondani) (Hymenoptera: Pteromalidae)  
Source: [aspweb.org/Chalcidoidea/Pteromalidae/Pteromalinae/Pachycrepoideus/Pachycrepoideus\\_vindemmiae.htm](http://aspweb.org/Chalcidoidea/Pteromalidae/Pteromalinae/Pachycrepoideus/Pachycrepoideus_vindemmiae.htm)

*Gnathopleura quadridentata* it is solitary endoparasitoids of numerous muscoids, preferably of sarcophagids. In some parts of the world they have been used for biological control program<sup>[8]</sup>. *Spalangia drosophilae* Ashmead (Hymenoptera: Pteromalidae) is a pupal parasitoid of small dipterans such as fannids, muscids and others<sup>[5]</sup>. *Pachycrepoideus vindemmiae* it is an endoparasitoid of dipterans, being found in several parts of the world as in the American and African continents<sup>[4]</sup>.

The total percentage of parasitism in bovine, of buffalo and chicken feces were 12.4% (78/628), 45.0% (172/3473) (504/2799) and 18.0%. (504/2799), respectively. The highest percentage of parasitism in bovine feces was presented by the parasitoid *G. quadridentata*, with 28.6% (20/70) in the buffalo feces they were presented by the parasitoids *Spal-*

*angia nigra* Latreille (Hymenoptera: Pteromalidae) (Figure 3) with 5.26% (1/19) and *Spalangia nigroaenea* Curtis also with 5.26% (1/19) and in chicken feces it was *P. vindemmiae* with 46.8% (347/2083) (Tables 1, 2 and 3).



**Figure 3.** *Spalangia nigra* Latreille (Hymenoptera: Pteromalidae)  
Source: flickr.com

Possibly due to the ability to search the parasitoid by food, their seasonality and the greater presence of their hosts in the collection area may explain the higher percentage of parasitism of these species.

*Spalangia nigroaenea* is a pupal parasitoid being collected in some Brazilian states (Figure 4) parasitizing *Musca domestica* L. (Diptera: Muscidae) in bovine feces. *Spalangia nigra* (Latreille) is a species originating from the Holtartic region with wide distribution in North America<sup>[7,2]</sup>.



**Figure 4.** Map of Brazil: and their regions - Midwestern Region green color.

Source: <https://www.preparaenem.com/geografia/mapa-do-brasil.htm>

Regarding the attraction of parasitoids to dipterans,

it was found that *M. raptorellus* was attracted to *Fannia pusio* (Diptera: Fanniidae); *N. vitripennis* by *Chrysomya megacephala* (Fabricius) (Diptera: Calliphoridae); *P. vindemmiae* by *F. pusio*, *M. domestica* and *Ornidia obesa* Fabricius (Diptera: Syrphidae); *S. cameroni* by *O. obesa*; *S. drosophilae* by *Palaeosepsis* sp. (Diptera: Sepsidae); *S. endius* by *C. megacephala* and *M. domestica*; *S. nigra* by *M. domestica*; *S. nigroaenea* by *M. domestica*; *Spalangia* sp. by *M. domestica*; *T. zealandicus* by *M. domestica* ( $X^2=711,80$ ;  $GL=36$ ;  $P<0,05$ ).

Regarding the preference of parasitoids for their hosts in bovine feces, it was found that *G. quadridentata* showed preference for *Oxysarcodexia thornax* (Walker) (Diptera: Sarcophagidae); *Kleidotoma nigra* (Hartig) (Hymenoptera: Figitidae) showed preference for *Brontaea quadristigma* (Thomson) (Diptera: Muscidae); *Pachycrepoides vindemmiae* (Rondani) (Hymenoptera: Pteromalidae) showed preference for *Ravinia belforti* (Prado & Fonseca) (Diptera: Sarcophagidae); *Paraganaspis egeria* Diaz *et al.* (Hymenoptera: Figitidae) showed preference for *Palaeosepsis* spp. (Diptera; Sepsidae); *Spalangia cameroni* Perkins (Hymenoptera: Pteromalidae) showed preference for *Brontaea debilis* (Williston) (Diptera: Muscidae), *B. quadristigma*, *M. domestica* and *R. belforti*; *S. drosophilae* showed preference for *Archiseopsis scabra* (Loew) (Diptera: Sepsidae) and *B. quadristigma* and *Palaeosepsis* spp.; *Spalangia endius* Walker (Hymenoptera: Pteromalidae) showed preference for *B. quadristigma* and *Palaeosepsis* spp.; *S. nigra* showed preference for *Cyrtoneurina paraescita* Couri (Diptera: Muscidae) and *R. belforti*; *S. nigroaenea* showed preference for *B. debilis*, *B. quadristigma*, *C. paraescita* and *R. belforti*; *Trichopria* sp. (Hymenoptera: Diapriidae) showed preference for *Palaeosepsis* spp.; *Triplasta atrocotalis* (Ashmead) (Hymenoptera; Figitidae) showed preference for *Palaeosepsis* spp. and *Triplasta coxalis* (Ashmead) (Hymenoptera; Figitidae) showed preference for *Palaeosepsis* spp. ( $X^2=250,91$ ;  $GL:77$ ;  $P<0,05$ ).

Regarding the preference of parasitoids for their hosts in bovine feces, it was found that *K. nigra* showed preference for *Palaeosepsis* spp.; *P. egeria* showed preference for *A. scabra* and *B. quadristigma*; *S. cameroni* showed preference for *B. debilis* and *Sarcophagula occidua* (Fabricius) (Diptera: Sarcophagidae); *S. drosophilae* showed preference for *B. quadristigma* and *S. occidua*; *S. endius* showed preference for *S. occidua*; *S. nigra* showed prefer-

ence for *C. paraescita* and *S. occidua*; *S. nigroaenea* for *B. debilis*, *C. paraescita* and *S. occidua*; *Trichopria* sp. for *A. scabra* and *S. occidua*; *T. atrocotalis* for *Palaeosepsis* spp. and *T. coxalis* for *Palaeosepsis* spp. ( $X^2=146,12$ ;  $P<0,05$ ;  $GL:45$ ).

#### 4. Conclusions

The most frequent species in bovine, of buffalo and chicken feces were: *G. quadridentata*, *S. drosophilae* and *P. vindemmiae*. The highest percentage of parasitism in bovine feces was presented by the parasitoid *G. quadridentata*, in the buffalo feces they were presented by the parasitoids *S. nigra* and *S. nigroaenea* also and in chicken feces it was *P. vindemmiae*.

#### References

- [1] Berti Filho, E., Thomazini, M.J. 1996. Costa, V.A. Artrópodes benéficos associados ao esterco de galinhas poedeiras no Brasil Revista Agricola 71: 273-286.
- [2] Boucek, Z. 1963 A taxonomic study in *Spalangia* Latr. (Hymenoptera: Chalcidoidea). Acta Entomologica Musei Nationalis Pragae 35: 429-512, 1963.
- [3] Carvalho, A.R., Mello, R.P., D'Almeida, J.M. 2003. Microhimenópteros parasitoides de *Chrysomya megacephala* Revista de Saúde Pública 37(6),810-812, 2003.
- [4] Hanson, P.E., Gauld, I.D. 1995. The Hymenoptera of Costa Rica. Oxford University Press, Oxford, 893 p.
- [5] Marchiori, C.H. 2002. Microhimenópteros parasitoides de moscas em esterco bovino em Cachoeira Dourada, Goiás, Brasil Entomologia y Vectores 9: 365:374.
- [6] Scatolini, D., Pentead-Dias, A.M.P. 1997. A fauna de Braconidae (Hymenoptera) como bioindicadora do grau de preservação de duas localidades do Estado do Paraná. Revista Brasileira de Ecologia 1: 84-8.
- [7] Silveira, G.A.R., Madeira, N.G., Azeredo-Espin, A.M., Pavan, C. 1989. Levantamento de microhimenópteros parasitoides de dípteros de importância médico-veterinária no Brasil. Memórias do Instituto Oswaldo Cruz 84(4), 505-510.
- [8] Wharton, R.A. 1979. Puparia of cyclorrhaphous Diptera from bovine dung in open pasture and rangeland in the transition zone of Western North America. Entomological Society of America 7:80-89.