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Aphid parasitoids that occur on wheat crops of Northeast of the Parana State with recovery of *Aphidius rhopalosiphi* in Brazil

Parasitoides de pulgões-do-trigo que ocorrem no Norte do estado do Paraná e recaptura de *Aphidius rhopalosiphi* no Brasil

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Abstract

Aphids (Hemiptera: Aphididae) are the main pest of wheat (Hemiptera: Aphididae) in several countries. In Brazil, the Biological Control of Wheat Aphids released millions of aphid parasitoids (Hymenoptera: Braconidae and Aphelinidae) on wheat fields and in the present moment the chemical control is rarely necessary. However, since the 80's few studies was carried out to evaluate the species established in Brazil. For this reason, the aim of this study was to record the species of aphid parasitoids that occur in wheat in the northern region of Parana state, Brazil. Four commercial wheat fields were investigated in the agricultural years of 2008 and 2009. The aphid parasitoids were captured with traps (Moericke and Malaise) and aphid mummified were collected. In total, six species of parasitoids were found, *Aphidius colemani*, *A. uzbekistanicus*, *A. ervi*, *Aphidius rhopalosiphi*, *Diaeretiella rapae* e *Lysiphlebus testaceipes*. These results contribute with the register of three exotic species in Parana, and confirm the establishment of *A. rhopalosiphi* in the country. We emphasize the need for further studies in other regions of the country, as other species introduced also need to have their establishment confirmed.

Key words: Aphids, natural parasitism, Aphidiinae, biological control agents

Resumo

Os pulgões (Hemiptera: Aphididae) são pragas de extrema importância em cereais de inverno no mundo todo. No Brasil, o programa Controle Biológico de Pulgões do Trigo liberou milhões de parasitoides (Hymenoptera: Braconidae e Aphelinidae) nas áreas tritícolas, reduzindo expressivamente a população da praga, e atualmente raramente o controle químico se faz necessário. Entretanto, desde a década de 80 poucos trabalhos de campo tem sido realizados para verificar as espécies efetivamente estabelecidas no País. Por esta razão, este estudo objetivou registrar as espécies de parasitoides de pulgões ocorrentes em lavouras de trigo na região Norte no Paraná. O trabalho foi realizado em quatro áreas comerciais de trigo, durante as safras 2008 e 2009. A captura dos parasitoides ocorreu com uso de armadilhas (Moericke e Malaise) e coleta de pulgões mumificados. No total foram encontradas seis espécies de parasitoides, *Aphidius colemani*, *A. uzbekistanicus*, *A. ervi*, *Aphidius rhopalosiphi*, *Diaeretiella rapae* e *Lysiphlebus testaceipes*. Esses resultados contribuem com a comprovação do estabelecimento de três espécies exóticas de parasitoides de pulgões no Paraná, e confirma o estabelecimento de *A. rhopalosiphi* no País. Ressalta-se a necessidade de estudos complementares em outras regiões do País, pois outras espécies introduzidas necessitam ter o estabelecimento comprovado.

Palavras-chave: Afídeos, parasitismo natural, Aphidiinae, agentes de controle biológico

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Aphids (Hemiptera: Aphididae) are the main pest of wheat (Hemiptera: Aphididae) in several countries. In Brazil, these insects caused damage to winter cereals until the late 1970s, when Embrapa Wheat successfully implemented the Biological Control of Wheat Aphids (BCWA) program (SALVADORI; SALLES, 2002).

However, after the introduction of the parasitoids, few studies were conducted on agroecosystem to identify the species established in Brazil. For example, *Aphidius rhopalosiphi* De Stefani-Perez, 1902, *Ephedrus plagiator* (Nees, 1811) and *Praon gallicum* Starý, 1971 were captured only in the early 1980s. Consequently, it is not known whether these species are established in Brazil or whether their capture resulted from their frequent field releases as part of the BCWA (STARÝ; SAMPAIO; BUENO, 2007). Recently, Alves et al. (2005) and Zanini et al. (2006a, b) reported the occurrence of *Lysiphlebus testaceipes* (Cresson, 1880) and *Aphidius colemani* Viereck, 1912 in west Parana, on *Rhopalosiphum padi* (Linnaeus, 1758) and *Sitobion avenae* (Fabricius, 1794) hosts aphids. Both aphid parasitoids are native, what can explain the capture, but the researches didn't find exotic species introduced by BCWA.

Thus, this study aimed to record the occurrence of parasitoids (Hymenoptera: Braconidae: Aphidiinae) on wheat crops in the north of Parana state in an attempt to contribute to the knowledge of the species of parasitoids effectively established in Brazil.

The investigation was conducted in four commercial wheat fields from May to August of 2008 and from June to September of 2009 in the north of Parana state, Brazil. In 2008, the insects were collected in Ibiporã – Sítio Santo Antônio (SSA) (23°14'34"S, 51°27'07"O, 480m) and Londrina (23°20'23"S, 51°12'32"W, 532m), and in 2009, parasitoids were also collected in Ibiporã – Bonsucesso Farm (FBS) (23°12'26"S, 51°03'51"O, 480 m) and Rolândia (23°23'59"S, 51°19'01"O, 650 m). The survey comprised direct sampling of parasitized aphids on plants and the capture of adult parasitoids with traps. Adult parasitoids were

captured with Moericke (yellow color) and Malaise traps in 2008 and 2009, respectively. The Moericke traps (40 units) contained water, detergent and salt. This trap was placed at ground level, between crop rows, and in each field in an area of 6,000 m² and left in place for two days per week. Eleven and nine samples were collected in Ibiporã-SSA and Londrina, respectively. In 2009, two Malaise traps were set 500 m apart in each area. A flask with 70% alcohol was placed on top of each trap for insect collection and changed weekly. All specimens captured were identified in laboratory, in specie level. Also, parasitized hosts were collected by inspecting whole plants, from early growth to the ripening stage of wheat plants. A total of 800 and 400 wheat tillers were evaluated every week in 2008 and 2009, respectively. Each collected parasitized host was individualized in a gelatin capsule until the emergence of the parasitoid. All mummies were identified in laboratory, at specie level, using a stereoscopic microscope.

A total of 1,270 parasitized hosts and six species of parasitoids were captured in the two-year period, and all species belonging to Braconidae family. In 2008, five species were observed in the direct evaluation and the same species were captured with the Moericke trap (Tables 1 and 2). In Ibiporã-SSA, 392 parasitoids were trapped, with greater abundance of *L. testaceipes* (57%), followed by *A. ervi* (22%), *A. colemani* (15%), *Diaeretiella rapae* (M'Intosh, 1855) (4%), and *Aphidius uzbekistanicus* Luzhetski, 1960 (2%). In Londrina, 95 parasitoids were captured, with a greater abundance of *A. colemani* (51%), followed by *L. testaceipes* (31%), and *D. rapae* (18%).

The parasitoids *A. ervi* and *A. uzbekistanicus* were not captured with the Moericke trap, probably because collection was stopped when the crop bloomed, before the greatest infestation of *Sitobion avenae* (Fabricius), the preferential host of these parasitoids in wheat (Table 1). Among the parasitized hosts collected in 2009, we observed the emergence of six species of parasitoids in Ibiporã-SSA, and five in Londrina (Table 1).

Table 1. Parasitoids emerged from host aphids from commercial wheat fields in Ibiporã-SSA (Sítio Santo Antônio) and Londrina, Parana (n = 629 and n = 317, hosts collected in the 2008 and 2009 agricultural years, respectively). Paraná, from May to August of 2008 and from June to September of 2009.

Location	2008			
	<i>Rhopalosiphum padi</i>	<i>Schizaphis graminum</i>	<i>R. maidis</i>	<i>Sitobion avenae</i>
Ibiporã SSA				
<i>Lysiphlebus testaceipes</i>	139	8	27	-
<i>Diaeretiella rapae</i>	21	-	-	-
<i>Aphidius colemani</i>	6	2	-	-
<i>A. ervi</i>	-	-	-	83
<i>A. uzbekistanicus</i>	3	-	-	3
Londrina				
<i>Aphidius ervi</i>	-	-	-	10
<i>A. uzbekistanicus</i>	-	-	-	1
2009				
Ibiporã SSA				
<i>Lysiphlebus testaceipes</i>	68	-	-	-
<i>Diaeretiella rapae</i>	1	-	-	-
<i>Aphidius colemani</i>	2	-	-	-
<i>A. ervi</i>	-	-	-	2
<i>A. uzbekistanicus</i>	-	-	-	11
<i>A. rhopalosiphi</i>	-	-	-	1
Londrina				
<i>Aphidius ervi</i>	3	-	-	10
<i>A. uzbekistanicus</i>	-	-	-	16
<i>A. colemani</i>	6	-	-	1

(-) = zero.

Source: Elaboration of the authors.

In Ibiporã-FBS and in Rolândia, we collected only 11 and 10 mummified hosts, respectively, and it was not possible to identify the parasitoids because the adults had not emerged. The Malaise trap captured a total of 23,300 parasitoids from six

species in all the sampled areas. *Aphidius colemani* was the most abundant (62.32%), followed by *L. testaceipes* (26.38%), *D. rapae* (~7%), *A. ervi* (~0.93%), *A. uzbekistanicus* (~3.22%), and *A. rhopalosiphi* (~0.15%) (Table 2).

Table 2. Parasitoids captured with Moericke traps (agricultural year 2008) and Malaise trap (agricultural year 2009) in commercial wheat fields in Ibiporã-FSB (Bonsucesso Farm), Ibiporã-SSA (Sítio Santo Antônio), Londrina, and Rolândia. Paraná, from May to August of 2008 and from June to September of 2009.

Location	Trap (Year)	
	Moericke (2008)	Malaise (2009)
Ibiporã FBS		
<i>Lysiphlebus testaceipes</i>	-	656
<i>Diaeretiella rapae</i>	-	150
<i>Aphidius colemani</i>	-	2,277
<i>A. ervi</i>	-	71
<i>A. uzbekistanicus</i>	-	89
<i>A. rhopalosiphi</i>	-	14
Ibiporã SSA		
<i>Lysiphlebus testaceipes</i>	217	1,961
<i>Diaeretiella rapae</i>	16	803
<i>Aphidius colemani</i>	60	321
<i>A. ervi</i>	88	21
<i>A. uzbekistanicus</i>	11	163
<i>A. rhopalosiphi</i>	0	4
Londrina		
<i>Lysiphlebus testaceipes</i>	31	1,348
<i>Diaeretiella rapae</i>	11	136
<i>Aphidius colemani</i>	53	6,218
<i>A. ervi</i>	0	50
<i>A. uzbekistanicus</i>	0	240
<i>A. rhopalosiphi</i>	0	5
Rolândia		
<i>Lysiphlebus testaceipes</i>	-	262
<i>Diaeretiella rapae</i>	-	22
<i>Aphidius colemani</i>	-	1,173
<i>A. ervi</i>	-	5
<i>A. uzbekistanicus</i>	-	41
<i>A. rhopalosiphi</i>	-	1

(-) Areas evaluated only in the 2009 agricultural year, without using the Moericke trap.

Source: Elaboration of the authors.

In the present study, *A. colemani* and *L. testaceipes* were the most abundant species in the field. These species were considered predominant in studies done in wheat fields in the west of Paraná State (ALVES et al., 2005; ZANINI et al., 2006a, b), and according to Starý, Sampaio and Bueno (2007), *A. colemani*, *L. testaceipes*, and *D. rapae* were also predominant in South America. The great host range of these species (SAMPAIO; BUENO; LENTEREN, 2001; SAMPAIO; BUENO; DE CONTI, 2008; SILVA, BUENO, SAMPAIO;

2008) may favor their adaptation to different agroecosystems.

Parasitoids *A. uzbekistanicus* and *A. ervi* were released in the west of Parana in the 1980s; however, recent studies carried out in the state have not reported their occurrence in wheat fields (ALVES et al., 2005; ZANINI et al., 2006a, b). The establishment of *A. rhopalosiphi* was confirmed in Brazil with 24 specimens captured with the Malaise trap, but only one individual emerged from parasitized *S. avenae* host (Table 2). Until the

1980s, when BCWA was started, this species was found in great numbers in wheat fields in the south of Brazil (STARÝ; SAMPAIO; BUENO, 2007). However, after that, this species was not found in the field anymore, and its establishment in Brazil was questioned (STARÝ; SAMPAIO; BUENO, 2007). Although *A. rhopalosiphi* was present in the wheat crop, its population was much smaller than those of the other species, and it was found in small numbers on its host when compared with *A. uzbekistanicus* and *A. ervi*. Our data suggest that *A. rhopalosiphi* has a low impact on the control of aphids in wheat in Paraná.

In summary, this study recorded the occurrence of six species of aphid parasitoids in the north of the state of Paraná and, with the register of three exotic parasitoids released by BCWE, and in addition, this work confirmed the establishment of *A. rhopalosiphi* in Brazil. Finally, we suggest that further field investigation are necessary, because is still unknown the establishment of many species of these natural enemies on Brazilian agroecosystem.

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