Aphid parasitoids (Hymenoptera, Braconidae, Aphidiinae) and their associations related to biological control in Brazil

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ABSTRACT. Aphid parasitoids (Hymenoptera, Braconidae, Aphidiinae) and their associations related to biological control in Brazil. This study evaluated the parasitoid-aphid-plant associations in Brazil with the objective of developing a useful research database for further studies of aphid parasitoid ecology and aphid management. The original material was obtained from collections made in Paraná, Rio Grande do Sul, Minas Gerais, and São Paulo states. The published information on the Aphidiinae in Brazil is revised. The general features of the target parasitoid fauna of Central and South America is summarized and promising biological control programs of some aphid species in Brazil is discussed.

KEYWORDS. Aphid; host range; insect-plant interactions.

RESUMO. Parasitóides (Hymenoptera, Braconidae, Aphidiinae) de pulgões e suas interações relacionadas ao controle biológico no Brasil. Este trabalho avaliou as interações parasitóides-pulgão-planta no Brasil, com o objetivo de desenvolver um banco útil de dados para estudos subseqüentes em ecologia de parasitóides de afídeos e manejo de pulgões. O material original foi obtido de coletas nos estados do Paraná, Rio Grande do Sul, Minas Gerais e São Paulo, sendo revisadas as informações sobre Aphidiinae publicadas no Brasil. Foram também sumarizadas as caracteristicas gerais da fauna de parasitóides das Américas Central e do Sul e discutidos os programas potenciais de controle biológico de algumas espécies de pulgões no Brasil.

PALAVRAS-CHAVE. Afídeo; gama hospedeira; interação inseto-planta.

An overall research interest in Aphidiine parasitoids of aphids has increased all over the world. Aphid pest problems and ecological aspects of their control undoubtedly contributed positively to this state. Searches for potentially useful biological control agents in the pest origin center frequently have demonstrated relatively poor knowledge in many areas and the same has been determined in subsequent research efforts targeting parasitoid release and establishment. These studies have also demonstrated a need for broader ecological studies of the local fauna, ecological associations and inter-relationships, and also management problems. Aphidiine parasitoids were also found to be rather useful subjects for several fundamental studies. These studies may be essential for the applied research or stimulated by problems found in it.

Until the end of the 70's only three species of aphid parasitoids (Braconidae: Aphidiinae) *Aphidius colemani* Viereck, 1912, *Diaeretiella rapae* (M'Intosh, 1855), and *Lysiphlebus testaceipes* (Cresson, 1880) were known occur in Brazil (Araújo e Silva *et al.* 1968; Bartoszeck 1975, 1976a b; Pimenta & Smith 1976; Gravena 1979; De Santis 1980; Lázzari 1985). The species on the genus *Ephedrus* Haliday were found parasitizing *Brachycaudus persicae* (Passerini) (Araújo e Silva *et al.* 1968). The parasitoid *Aphidius platensis* Brèthes, 1913 (Starý 1975) and other species mentioned in the South American literature (*Aphidius chilensis* Brèthes, 1912, *Aphidius huebrichi* Brèthes, 1913, *Aphidius porteri* Brèthes, 1915 and *Diaeretus porteri* Brèthes, 1910) were recognized as synonyms of *A. colemani* (Starý 1995). Finally, *Aphidius brasiliensis* Brèthes, 1918 (Araújo e Silva *et al.* 1968, De Santis 1980) and *Aphidius ohioensis* Smith, 1944 (Bartoszeck 1975, 1976a) were, probably, a case of synonym and a misidentification of *A. colemani*, respectively (see below, review of parasitoid-aphid-plant associations, to more details).

New introductions of aphid parasitoid species occurred in the end of the 70´s within a framework of a biological control program of wheat aphids. Some biological control programs have yielded spectacular results in some South American countries and parasitoid contribution is also rather significant for aphid control in Brazil. Biological control of wheat aphids in Brazil is a good example of a successful program. It started in 1979 targeting the aphid species pests *Metopolophium dirhodum* (Walker, 1849), *Schizaphis graminum* (Rondani, 1852), and *Sitobion avenae* (Fabricius, 1775). Twelve aphidiine species were introduced in six States until 1992. The program was considered successful and high aphid populations on wheat crops in the 70's were drastically reduced in the 80's (Starý 1980; Gassen & Tambasco 1983; Salvadori & Salles 2002). Four species of aphid parasitoids were established in Rio Grande do Sul state (*Aphidius ervi* Haliday, 1834, *Aphidius rhopalosiphi* DeStefani-Perez, 1902, *Aphidius uzbekistanicus* Luzhetzki, 1960 and *Praon volucre* (Haliday, 1833)), but their host range was related mainly to grass aphids (Zuñiga-Salinas 1982). A more extensive study was made by Tavares (1991,

1996) in São Paulo state, who recovered only *P. volucre*, from the introduced species, and three new records were added to aphid parasitoid species in Brazil (*Aphidius rosae* Haliday, 1834, *Aphidius salicis* Haliday, 1834, and *Ephedrus persicae* Froggatt, 1904).

After this period, very limited records focusing the post-colonization and the host range of aphid parasitoids on some cultivated plants were found in Brazil (Auad *et al.* 1997; Sousa-Silva *et al.*, 1998; Lara *et al.* 1999; Fernandes *et al.* 2000; Mendes *et al.*, 2000; Pinto *et al*. 2000; Cividanes 2002; Mussury & Fernandes. 2002; Ronquim *et al.* 2004; Zanini *et al.* 2006), and still fewer were found on ornamentals (Peronti 1999; Imenes *et al*. 2002; Carvalho *et al*. 2006). Moreover, this information is scattered in the literature and a compilation of these data is necessary.

Cinara pinivora Wilson, 1919 and *Cinara atlantica* Wilson, 1919 were detected as pests on pine in Brazil in the end of 90's, but no parasitoids were found in the local fauna (Penteado *et al*. 2000). The parasitoid species *Xenostigmus bifasciatus* (Ashmead, 1891) was introduced from USA to the states of Paraná, Santa Catarina and São Paulo, in 2002 and 2003, and it has became established in Brazil, and dispersing 80 Km per year from the release point (Reis-Filho *et al*. 2004; Oliveira 2006).

For these reasons, we have found useful to summarize the information about aphid-plant-parasitoid associations developing a useful research database for further studies. So, this study is focused in the associations of aphid parasitoids and their aphid and plant hosts in Brazil. For this, field collections of parasitized aphids were made in two southern states of Brazil (Paraná and Rio Grande do Sul) in 1980, during the wheat biological control program, and also in two southeastern states of the country (Minas Gerais and São Paulo) from 1999 to 2006, in an area where no releases of parasitoids were made during the biological programs of wheat and pine aphids. These field collections were made in cropping areas, greenhouses, avenues, parks and households, to obtain supplemental information of aphid-plant relationship for each parasitoid species. In order to complete the information on parasitoid-aphid-plant association in Brazil, literature data were revised, summarized, and doubtful records were explained based on the literature data, or derived from the experience of the authors. The general features of the parasitoid fauna of Central and South America were summarized and promising biological control programs of some aphid species in Brazil are discussed.

MATERIALS AND METHODS

Parasitoids were reared on identified host aphid-plant associations from field collections. Plant parts with aphid colonies were gently cut with scissors, placed in plastic containers covered with nylon mesh, and transferred to the laboratory. The emerging parasitoids were collected and preserved in ethanol 70%. The sample data were arranged with the objective of developing a tri-trophic database. In each numbered sample, the information about location, date, aphid, plant and habitat was recorded.

Most of the material was obtained from the collections made within the framework of FAO biocontrol programs in Brazil (wheat aphids, Paraná, Rio Grande do Sul), and the others originated from studies by the authors, especially in Minas Gerais and São Paulo states.

Review of parasitoid-aphid-plant associations. The material is arranged according to host aphid names, subdivided by the States of Brazil. For our data from field collections the individual localities are listed alphabetically, presenting the location name, collection date, aphid host plant, habitat, collection number and the collector's name in brackets. Collector's names were abbreviated as follows: (MS) – M.V. Sampaio, (PS) – P. Starý, (VB) – V.H.P. Bueno. Other names are presented in full. Only the reference, in chronological order, and the host plant species were listed for data from the literature. At last, the whole published information on the target parasitoids was revised as much as possible based on up-dated knowledge. Incomplete information in literature resulting in doubtful parasitoid-aphid relationships are followed by a question mark (?). The opinions of the authors and comments about probable misidentifications are indicated by asterisk (*) after the species name. Aphid nomenclature followed Remaudiere & Remaudiere (1997), in general.

Abbreviations of the Brazilian States are as follows: **BA** – Bahia; **MG** - Minas Gerais; **MS** – Mato Grosso do Sul †; **PE –** Pernambuco; **PR** – Paraná †°; **RJ** – Rio de Janeiro; **RS** - Rio Grande do Sul †; **SC** – Santa Catarina †°; **SP** - São Paulo †°; **Brazil** – no State determined.

Only the States from where collections were made are listed. Parasitoids were released as part of wheat and pine aphids biocontrol programs in the States marked with dagger (†) and a sun (°) sign, respectively. In the paragraph "Laboratory" results of laboratory observations on aphid-parasitoid relationships, which were not associated with faunal field data, are included.

RESULTS

Review of parasitoid-aphid-plant associations

Aphidius brasiliensis Brèthes, 1918*

*Probable synonym of *Aphidius colemani* Viereck – Even though we do not have access to the type material of this species and with only original description of Brèthes it is impossible to recognize this species, in our opinion, *A. brasiliensis* is a synonym of *A. colemani*. Our opinion is reinforced due to a general prevalence of *A. colemani* as a parasitoid species on *A. fabae* and *B. schwartzi* in the area.

Aphis fabae Scopoli, 1763
Brazil: Araújo e Silva *et al.* (1968), De Santis (1980).

Brachycaudus schwartzi (Börner, 1931)
PR: Bartoszeck (1976a), *Prunus domestica*, *Prunus persica*.

Macrosiphum euphorbiae (Thomas, 1878)
Brazil Araújo e Silva *et al.* (1968), De Santis (1980).

Aphidius colemani Viereck, 1912

Aphis coreopsidis (Thomas, 1878)
SP: Tavares (1991), *Bidens pilosa, Emilia sonchifolia*.

Aphis craccivora Koch, 1854
MG: Lavras, 10-X-2001, *Medicago sativa*, field, TS/30 (MS). – Mendes *et al.* (2000), *Medicago sativa*.

Aphis fabae solanella Theobald, 1914
SP: Tavares (1991), *Sessea brasiliensis, Solanum americanum*. – Tavares (1996), *Solanum americanum, Sessea brasiliensis*.

Aphis gossypii Glover, 1877
MG: Lavras, 28-X-2001, *Theobroma cacao*, greenhouse, TS/32 (MS). – Lavras, 7-VII-2002, *Duranta repens aurea*, city, TS/33 (MS). – Lavras, 17-VII-2002, *Gossypium hirsutum*, field, TS/39 (MS). – Lavras, 17-VII-2002, *Hibiscus rosa-sinensis*, city, TS/46 (MS).
RS: Passo Fundo, 22-IX-1980, *Hibiscus* sp., avenue, 80/53 (PS). – Passo Fundo, 28-IX-1980, *Hibiscus* sp., avenue, 80/91 (PS).
SP: Santo Antônio de Posse, 18-VI-2001, *Dendranthema grandiflora*, greenhouse, TS/17 (A. Silva). – Tavares (1991), *Ageratum conyzoides, Cyphomandra arabica, Schefflera* sp., *Tecomma* sp. – Tavares (1996), *Hibiscus rosa-sinensis, Schefflera* sp. – Peronti (1999), *Dieffenbachia amoena, Hibiscus rosa-sinensis*. – Imenes *et al.* (2002), *Ixora macrothyrsa*. – Carvalho *et al.* (2006), *Dendranthema grandiflora* ?
Brazil: De Santis (1980).

Aphis hederae Kaltenbach, 1843
RS: Passo Fundo, 22-IX-1980, *Hedera helix*, garden – city, 80/48 (PS).

Aphis nerii Boyer de Fonscolombe, 1841
RS: Passo Fundo, 22-IX-1980, undetermined shrub, city, 80/47 (PS). – Passo Fundo, 22-IX-1980, *Nerium oleander*, city park, 80/52 (PS). – Passo Fundo, 22-IX-1980, *Nerium oleander*, avenue, 80/54 (PS). – Passo Fundo, 22-IX-1980, *Nerium oleander*, garden, 80/55 (PS). – Santo Angelo, 18-IX-1980, N*erium oleander*, park, 80/39 (PS).
SP: Tavares (1991), *Asclepias curassavica, Nerium oleander*. – Tavares (1996) *Asclepias curassavica*.
Brazil: De Santis (1980).

Aphis spiraecola Patch, 1914
MG: Juramento, 12-VIII-2002, *Citrus sinensis*, field, TS/49 (Rocha). – Lavras, 21-VIII-2002, *Citrus sinensis*, orchard, TS/52 (MS).
SP: Tavares (1991), *Baccharis dracunculifolia, Emilia sonchifolia, Erigeron bonariensis, Citrus sp., Rosa sp., Spirea sp., Tecomma sp*.

Aphis sp.
MG: Lavras, 13-IX-2002, *Callendula officinalis*, garden, TS/57 (MS).
RS: Tapera, 23-IX-1980, *Solanum* sp., roadside, 80/72 (PS). – Passo Fundo, 1-X-1980, *Spirea* sp., park, 80/98 (PS). – Passo Fundo, 2-X-1980, *Pittosporum* sp., park, 80/101 (PS). – Passo Fundo, 3-X-1980, *Buxus* sp., park, 80/105 (PS). – Passo Fundo, 5-X-1980, *Psidium* sp., park, 80/108 (PS).

Brachycaudus helichrysi (Kaltenbach, 1843)
SP: Tavares (1991), *Ageratum conyzoides, Baccharis dracunculifolia, Erechtites valerianaefolia, Erigeron bonariensis*.

Brachycaudus schwartzi (Börner, 1931)
MG: Auad *et al.* (1997), *Prunus persica*.
PR: Bartoszeck (1976a), *Prunus domestica, Prunus persica*.

Brevicoryne brassicae (Linné, 1758)
SP: Tavares (1991), *Lepidium virginicum*.
Brazil: De Santis (1980).

Cavariella aegopodii (Scopoli, 1763)
SP: Tavares (1991), *Foeniculum vulgare*. – Tavares (1996), *Foeniculum vulgare?*

Diuraphis noxia (Mordvilko, 1913)*
Brazil: USDA material.
* Doubtful record – The occurrence of target aphid was not confirmed in Brazil.

Dysaphis apiifolia (Theobald, 1922)
SP: Tavares (1991), *Petroselinum sativum*.

Dysaphis tulipae (Boyer De Fonscolombe, 1841)
MG: Uberlândia, 26-VIII-2006, *Belamcanda chinensis*, city, TS/118 (Almeida).

Dysaphis sp.
SP: Carvalho *et al.* (2006), *Dendranthema grandiflora* ?

Eucarazzia elegans (Ferrari, 1872)
MG: Lavras, 26-IX-2002, *Salvia splendens*, city, TS/65 (DeConti).
SP: Peronti (1999), *Salvia splendens*.

Hysteroneura setariae (Thomas, 1878)
MG: Uberlândia, 22-VII-2005, *Oryza sativa*, greenhouse, TS/113 (MS).
SP: Tavares (1991), *Eleusine indica, Oryza sativa, Rhynchaelitrum roseum*.

Macrosiphum euphorbiae (Thomas, 1878)
MG: Pinto *et al.* (2000), *Solanum tuberosum?*

Metopolophium dirhodum (Walker, 1849)
PR: Pimenta & Smith (1976), *Triticum* sp. – Lázzari (1985) *Hordeum* sp.?

Myzus ornatus Laing, 1932
SP: Tavares (1991), *Erechtites valerianaefolia, Erigeron bonariensis, Solanum americanum, Sonchus oleraceus*. – Peronti (1999), *Duranta repens aurea*.

Myzus persicae (Sulzer, 1776)
MG: Ijací, 2-X-2002, *Capsicum annuum*, greenhouse, TS/71 (Barbosa). – Lavras, 11-IX- 2000, *Capsicum annuum*, greenhouse, TS/7 (MS). – Lavras, 18-V-2001, *Capsicum annuum*, greenhouse, TS/12 (MS). – Lavras, 24-IX-2001, *Lactuca sativa*, greenhouse, TS/23 (MS). – Lavras, 20-VIII-2003, *Duranta repens aurea*, garden, TS/92 (DeConti). – São Gotardo, 22-VIII-2002, *Solanum tuberosum*, field, TS/51 (Leme). – Uberlândia, 13-VII-2006, *Portulaca oleracea*, city, TS/115 (MS) – Pinto *et al.* (2000), *Solanum tuberosum* ?
SP: Santo Antônio de Posse, 23-VI-2001, *Dendranthema grandiflora*, greenhouse, TS/18 (A. Silva). – Tavares (1991), *Ageratum conyzoides, Bidens pilosa, Brassica oleracea, Capsicum sp., Emilia sonchifolia, Erechtites valerianaefolia, Erigeron bonariensis, Lepidium virginicum, Solanum americanum*. – Carvalho *et al.* (2006), *Dendranthema grandiflora* ?

Nasonovia ribisnigri (Mosley, 1841)
MG: Três Pontas, 12-IX-2002, *Lactuca sativa*, field, TS/60 (Figueira).

Picturaphis vignaphila Blanchard, 1922
SP: Tavares (1991), *Desmodium* sp.

Rhopalosiphum maidis (Fitch, 1856)
PR: Lázzari (1985), *Hordeum* sp.
SP: Tavares (1991), *Eleusine indica, Oryza sativa*. – Ronquim *et al.* (2004), *Avena sativa* ?
Brazil: De Santis (1980).

Rhopalosiphum padi (Linné, 1758)
MG: Lavras, 13-VII-2003, *Avena sativa*, field, TS/88 (MS). – Lavras, 31-VII-2003, *Avena sativa*, field, TS/89 (MS).
PR: Lázzari (1985), *Hordeum* sp.
RS: Ernestina, 23-IX-1980, *Triticum aestivum*, field, 80/59 (PS). – Marau, 29-IX-1980, *Triticum aestivum*, field, 80/94 (PS). – Passo Fundo, 23-IX-1980, *Avena sativa*, field, 80/77 (PS). – Passo Fundo, IX-1980, *Triticum aestivum*, EMBRAPA insectary glasshouse (PS). – Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS). – São Borja, 17-IX-1980, *Triticum aestivum*, field, 80/28 (PS).
SP: Ronquim *et al.* (2004), *Avena sativa* ?

Schizaphis graminum (Rondani, 1852)
MG: Lavras, 24-VIII-1993, *Sorghum* sp. (VB). – Lavras, 2-X-2002, *Triticum aestivum* field, TS/68 (MS). – Lavras, 31-VII-2003, *Avena sativa*, field, TS/90 (MS).
PR: Lázzari (1985), *Hordeum* sp.
RS: Passo Fundo, 12-IX-1980, *Triticum aestivum*, EMBRAPA insectary glasshouse, 80/19 (PS). – São Borja, 16-IX-1980, *Triticum aestivum*, field, 80/21 (PS).
SP: Gravena (1979), *Sorghum bicolor*. – Ronquim *et al.* (2004), *Avena sativa* ?
Brazil: De Santis (1980).

Sitobion avenae (Fabricius, 1775)
MG: Lavras, 2-X-2002, *Triticum aestivum*, field, TS/67 (MS).
PR: Pimenta & Smith (1976), *Triticum* sp. – Lázzari (1985), *Hordeum* sp.?

Toxoptera aurantii (Boyer de Fonscolombe, 1841)
MG: Santo Antônio do Amparo, 14-X-2001, *Coffea arabica*, field, TS/31 (Ecole).
SP: Tavares (1991), *Myricaria sp.*, *Citrus sp.* – Peronti (1999), *Camellia japonica*, *Schefflera arboricola*.

Toxoptera citricidus (Kirkaldy, 1907)
MG: Lavras, *Citrus* sp. (F. Leclant).
SP: Tavares (1991), *Citrus sp.*, *Zanthoxylum rhoefolium*. – Tavares (1996), *Citrus* sp.
Brazil: De Santis (1980).

Toxoptera sp.
RS: Marau, 22-IX-1980, *Citrus* sp., orchard, 80/45 (PS). – Passo Fundo, 22-IX-1980, *Citrus* sp., garden 80/56 (PS). – Santa Maria, 22-IX-1980, *Citrus* sp., garden, 80/58 (PS). – Santo Angelo, 18-IX-1980, *Citrus* sp., orchard, 80/38 (PS). – Santo Goncalves, 27-IX-1980, *Citrus* sp., garden, 80/87 (PS). – Sao Borja, 16-IX-1980, *Citrus* sp., forest edge, 80/278 (PS).

Uroleucon cordobense (Blanchard, 1932)
SP: Tavares (1991), *Erigeron bonariensis*.

Uroleucon erigeronense (Thomas, 1878)
SP: Tavares (1991), *Erigeron bonariensis*.

Cereal aphids
RS: Passo Fundo, IX-1980, EMBRAPA insectary (PS).

Without host records
SC: Seara, Nova Teutônia, 27º11´S, 52º23´W, 300-350m alt. a.s.l. VII-1971 (Plaumann).

Laboratory
Gamarra *et al.* (1997), *Myzus persicae*. – Gonçalves-Gervásio *et al.* (2001), *Schizaphis graminum*. – Sampaio *et al.* (2001ab), *Aphis gossypii*, *Myzus persicae*. – Sampaio *et al.* (2003b), *Aphis gossypii*. – Sampaio *et al.* (2004), *Myzus persicae*. – Sampaio *et al.* (2005b), *Aphis gossypii*. – Bueno *et al.* (2006), *Aphis gossypii*, *Myzus persicae*, *Rhopalosiphum maidis*, *Schizaphis graminum*. – Pierre *et al.* (2006), *Aphis gossypii*. – Sampaio *et al.* (2006), *Aphis gossypii*, *Schizaphis graminum*.

Aphidius ervi Haliday, 1834

Acyrthosiphon kondoi Shinji, 1938
MG: Lavras, 10-X-2001, *Medicago sativa*, field, TS/27 (MS). – Mendes *et al.* (2000), *Medicago sativa*.

Acyrthosiphon pisum (Harris, 1776)
MG: Lavras, 10-X-2001, *Medicago sativa*, field, TS/27 (MS). – Sousa-Silva *et al.* (1998), *Medicago sativa*. – Mendes *et al.* (2000), *Medicago sativa*.

Acyrthosiphon sp.
MG: Lavras, 1993, *Medicago sativa* (VB).

Aphis gossypii Glover, 1877
SP: Lara *et al.* (1999), *Solanum tuberosum* ?

Macrosiphum euphorbiae (Thomas, 1878)
MG: Lavras, 11-IX-2000, *Capsicum annuum*, field, TS/8 (MS).
SP: Lara *et al.* (1999), *Solanum tuberosum* ?

Metopolophium dirhodum (Walker, 1849)
RS: Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS).

Myzus persicae (Sulzer, 1776)
MG: Lavras, 11-IX-2000, *Capsicum annuum*, field, TS/7 (MS).
SP: Lara *et al.* (1999), *Solanum tuberosum* ?

Rhodobium porosum (Sanderson, 1901)
MG: Lavras, 16-VII-2002, *Rosa* sp., garden, TS/37 (MS).

Sitobion avenae (Fabricius, 1775)
MG: Lavras, 17-VIII-2003, *Triticum aestivum*, field, TS/91 (MS). – Lavras, 28-VIII-2003, *Triticum aestivum*, field, TS/97 (MS).
RS: Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS).

Cereal aphids
Laboratory stock, introduced as “EPL-79-50”.

Aphidius matricariae Haliday, 1834*

*Doubtful identification – The record of this target species is doubtful due to a general prevalence of *A. colemani* as a parasitoid species on *A. gossypii* in the area, and to uncertain identification at that time.

Aphis gossypii Glover, 1877
Brazil: Mendes (1959)

Aphidius ohioensis Smith, 1944*

*Doubtful identification – The target species was previously found only in the Neartic region, with different host records, which does not include *Brachycaudus schwartzi*. Probably a misidentification of *A. colemani* due the prevalence of this species in *B. schwartzi*.

Brachycaudus schwartzi (Börner, 1931)
PR: Bartoszeck (1976a), *Prunus domestica*, *Prunus persica*.
Brazil: De Santis (1980).

Aphidius rhopalosiphi DeStefani-Perez, 1902

Metopolophium dirhodum (Walker, 1849)
RS: Bento Goncalves, 27-IX-1980, *Triticum aestivum*, field, 80/94

(PS). – Ernestina, 23-IX-1980, *Triticum aestivum*, field, 80/59 (PS). – Ibiruba, 25-IX-1980, *Triticum aestivum*, field, 80/80 (PS). – Marau, 22-IX-1980, *Triticum aestivum*, field, 80/44 (PS). – Marau, 29-IX-19890, *Triticum aestivum*, field, 80/94 (PS). – Passo Fundo, 22-IX-1980, *Lolium* sp., waste place – roadside, in a park, 80/50 (PS). – Passo Fundo, 23-IX-1980, *Triticum aestivum*, field, 80/71 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/76 (PS). – Passo Fundo, 24-IX-1980, *Avena sativa*, field, 80/77 (PS). – Passo Fundo, 2-X-1980, *Triticum aestivum*, field, 80/102 (PS). - Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/70 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/71 (PS). – Zuñiga (1982).

Sitobion avenae (Fabricius, 1775)
RS: Bento Gonçalves, 27-IX-1980, *Triticum aestivum*, garden undergrowth, 80/88 (PS). – Ernestina, 23-IX-1980, *Triticum aestivum*, field, 80/54 (PS). – Espumoso, 25-IX-1980, *Triticum aestivum*, Field, 80/79 (PS). – Ibiruba, 25-IX- 1980, *Triticum aestivum*, field, 80/80 (PS). – Marau, 22-IX-1980, *Triticum aestivum*, field, 80/44 (PS). – Marau, 29-IX-1980, *Triticum aestivum*, field, 80/?? (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/74 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/76 (PS). – Passo Fundo, 24-IX-1980, *Avena sativa*, field, 80/77 (PS). – Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/70 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/71 (PS). – Zuñiga (1982).

Cereal aphids
RS: Passo Fundo, IX-1980, EMBRAPA insectary, *Triticum aestivum* (PS). – Passo Fundo, 1978, *Triticum aestivum* (E. Zuñiga).

Laboratory stock introduced from England. – Introduced as *Aphidius* sp. 1213.

Aphidius rosae Haliday, 1834

Macrosiphum rosae (Linné, 1758)
SP: Tavares (1991), *Rosa* sp.

Aphidius salicis Haliday, 1834

Cavariella aegopodii (Scopoli, 1763)
SP: Tavares (1991), *Foeniculum vulgare*. – Tavares (1996).

Cavariella sp.
RS: Bento Gonçalves, 27-IX-1980, *Petroselinum carvifolia*, garden, 80/89 (PS).

Aphidius smithi Subba Rao and Sharma, 1959

Acyrthosiphon pisum (Harris, 1776)
RS: Feliz, 27-IX-12980, *Medicago sativa*, field, 80/86 (PS). – Ijuí, 29-VIII-1980, Leguminosae, garden, 80/92 (PS). – Ijuí, 18-IX-1980, *Medicago sativa*, field, 80/43 (PS). – Passo Fundo, IX-1980, EMBRAPA insectary, *Vicia* sp. (PS).

Aphidius uzbekistanicus Luzhetzki, 1960

Metopolophium dirhodum (Walker, 1849)
RS: Colorado, 25-IX-1980, *Triticum aestivum*, field, 80/85 (PS). – Ernestina, 23-IX-1980, *Triticum aestivum*, field, 80/59, (PS). – Ibiruba, 25-IX-1980, *Triticum aestivum*, field, 80/80 (PS). – Ijuí, 18-IX-1980, *Triticum aestivum*, field, 80/40 (PS). – Marau, 22-IX-1980, *Triticum aestivum*, field, 80/44 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/74 (PS). – Passo Fundo, 25-IX- 1980, *Triticum aestivum*, Field, 80/78 (PS). – Passo Fundo, 19-IX-1980, *Triticum aestivum*, field (Werner). – Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/69 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/70 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/71 (PS). – Zuñiga (1982).

Schizaphis graminum (Rondani, 1852)
MS: Gomez & Rumiatto (1989a)

Sitobion avenae (Fabricius, 1775)
MG: Lavras, 2-X-2002, *Triticum aestivum*, field, TS/69 (MS). – Lavras, 17-VIII-2003, *Triticum aestivum*, field, TS/94 (MS). – Lavras, 28-VIII-2003, *Triticum aestivum*, field, TS/95 (MS).
RS: Colorado, 25-IX-1980, *Triticum aestivum*, field, 80/85 (PS). – Ernestina, 23-IX-1980, *Triticum aestivum*, field, 80/59 (PS). – Espumoso, 25-IX-1980, *Triticum aestivum*, field, 80/79 (PS). – Ibiruba, 25-IX-1980, *Triticum aestivum*, field, 80/85 (PS). – Ijuí, 18-IX-19890, *Triticum aestivum*, field, 80/40 (PS). – Marau, 22-IX-1980, *Triticum aestivum*, field, 80/44 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/74 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/76 (PS). – Passo Fundo, 19-IX-1980, *Triticum aestivum*, field (Werner). – Tio Hugo, 25-IX-1980, *Triticum aestivum*, field, 80/78 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/69 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/70 (PS). – Tapera, 23-IX-1980, *Triticum aestivum*, field, 80/71 (PS). – Zuñiga (1982).

Cereal aphids
Laboratory stock introduced as EPL 79-66.

Laboratory
Gomez & Rumiatto (1989b), *Schizaphis graminum*.

***Aphidius* sp.**

SP: Moreti *et al.* (1984), *Triticum aestivum*.

Binodoxys brevicornis (Haliday, 1883)

Cavariella aegopodii (Scopoli, 1763)
MG: Lavras, 13-IX-2002, *Foeniculum vulgare*, garden, TS/54 (MS). – Lavras, 18-IX-2002, *Foeniculum vulgare*, garden, TS/59 (DeConti). – Uberlândia, 04-IX-2005, *Foeniculum vulgare*, field, TS/112 (MS). Sampaio *et al.* (2003a), *Foeniculum vulgare*.
SP: Mococa, 20-XII-2004, *Foeniculum vulgare*, city, TS/110 (MS).

Hyadaphis foeniculi (Passerini, 1860)
MG: Lavras, 27-IX-2002, *Apium leptophyllum*, city, TS/64 (MS).
SP: Mococa, 14-XI-2005, *Petroselinum crispum*, city, TS/111 (MS).

Binodoxys tucumanus (Starý, 1987)*

* Identification needs confirmation – The target species was previously found only on *Myzus persicae* in Argentina. It is very close to another Neotropical species of *Binodoxys* which parasitizes *Uroleucon* aphids.

Uroleucon cordobense (Blanchard, 1932)
SP: Tavares (1991), *Erigeron bonariensis*.

Uroleucon erigeronense (Thomas, 1878)
SP: Tavares (1991), *Erigeron bonariensis*.

***Binodoxys* sp.**

Uroleucon sp.
RS: Passo Fundo, 24-IX-1980, *Taraxacum* sp., waste place, 80/75 (PS).

Diaeretiella rapae (M'Intosh, 1855)

Acyrthosiphon kondoi Shinji, 1938
RS: Ijuí, 18-IX-19080, *Medicago sativa*, field, 80/43 (PS).

Acyrthosiphon pisum (Harris, 1776)
RS: Ijuí, 18-IX-1980, *Medicago sativa*, field, 80/43 (PS).

Aphis gossypii Glover, 1877
SP: Lara *et al.* (1999), *Solanum tuberosum* ?

Brevicoryne brassicae (Linné, 1758)
MG: Cana Verde, 14-IX-2002, *Raphanus raphanistrum*, field, TS/93 (Auad). – Juramento, 12-IX-2002, *Brassica oleracea acephala*, field, TS/66 (Rocha). – Lavras, 17-VI-2001, *Raphanus raphanistrum*, field, TS/14 (Mendes). – Lavras, 15-VII-2002, *Brassica oleracea acephala*, field, TS/36 (MS). – Lavras, 1-X-2003, *Nasturtium officinale*, hidroponic greenhouse, TS/99 (MS). – Souza & Bueno (1992), *Brassica oleracea acephala*. – Bueno & Souza (1993), *Brassica oleracea acephala*. – Cividanes (2002), *Brassica oleracea acephala*.
MS: Mussury & Fernandes (2002), *Brassica napus*.
RJ: Valença, 19-II-2000, *Brassica oleracea acephala*, city, TS/9 (MS).
SP: Santo Antônio de Posse, 30-IV- 2001, *Brassica oleracea acephala*, field, TS/11 (Carvalho). – Tavares (1991), *Brassica oleracea*, *Lepidium virginicum*.
Brazil: De Santis (1980).

Lipaphis erysimi (Kaltenbach, 1834)
MG: Cana Verde, 14-IX-2002, *Raphanus raphanistrum*, field, TS/93 (Auad). Lavras, 15-VII-2002, *Brassica oleracea acephala*, field, TS/41 (MS). – Lavras, 17-VI-2001, *Raphanus raphanistrum*, field, TS/14 (Mendes). – Lavras, 1-X-2003, *Nasturtium officinale*, hidroponic greenhouse, TS/100 (MS).
MS: Mussury & Fernandes (2002), *Brassica napus*.
RJ: Seropédica, 26-VII-2002, *Brassica oleracea acephala*, field, TS/47 (MS).
RS: Passo Fundo, 3-X-1980, *Brassica* sp., field, 80/107 (PS).

Macrosiphum euphorbiae (Thomas, 1878)
MG: Pinto *et al.* (2000), *Solanum tuberosum* ?
SP: Lara *et al.* (1999), *Solanum tuberosum* ?
Brazil: De Santis (1980).

Metopolophium dirhodum (Walker, 1849)
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum* ?.

Myzus persicae (Sulzer, 1776)
MG: Cana Verde, 14-IX-2002, *Raphanus raphanistrum*, field, TS/93 (Auad). – Ijací, 2-X-2002, *Capsicum annuum*, greenhouse, TS/70 (Barbosa). – Lavras, 17-VII-2001, *Raphanus raphanistrum*, field, TS/14 (Mendes). – Lavras, 15-VII-2002, *Brassica oleracea acephala*, field, TS/35 (MS).– São Gotardo, 22-VIII-2002, *Solanum tuberosum*, field, TS/50 (Leme). – Lara *et al.* (1999), *Solanum tuberosum* ?
RJ: Valença, 19-II-2000, *Brassica oleracea acephala*, city, TS/9 (MS).
SP: Santo Antônio de Posse, 21-V-2001, *Dendranthema grandiflora*, greenhouse, TS/16 (A. Silva). – Tavares (1991), *Brassica oleracea*, *Lepidium virginicum*, *Solanum americanum*, *Sonchus oleraceus*.

Rhopalosiphum maidis (Fitch, 1856)
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum* ?
SP: Ronquim *et al.* (2004), *Avena sativa* ?

Rhopalosiphum padi (Linné, 1758)
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum* ?
RS: São Borja, 16-IX-1980, *Triticum aestivum*, field, 80/25 (PS).
SP: Ronquim *et al.* (2004), *Avena sativa* ?

Sitobion avenae (Fabricius, 1775)
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum* ?

Schizaphis graminum (Rondani, 1852)
MS: Gomez & Rumiatto (1989a).
SP: Gravena (1979), *Sorghum bicolor*. – Ronquim *et al.* (2004), *Avena sativa* ?

Cereal aphids
Introduced laboratory stock EPL 79-65.

Laboratory
Bueno & Souza (1992), B*revicoryne brassicae*. – Pereira & Lomônaco (2003), B*revicoryne brassicae*.

Ephedrus persicae Froggatt, 1904

Aphis fabae solanella Theobald, 1914
SP: Tavares (1991), *Solanum americanum*.

Brachycaudus helichrysi (Kaltenbach, 1843)
SP: Tavares (1991), *Erechtites valerianaefolia* ?

Myzus ornatus Laing, 1932
SP: Tavares (1991), *Erechtites valerianaefolia* ?

Myzus persicae (Sulzer, 1776)
SP: Tavares (1991), *Erechtites valerianaefolia* ?

Without host records
SP: Tavares (1996).

Ephedrus plagiator (Nees, 1811)

Acyrthosiphon pisum (Harris, 1776)
RS: Passo Fundo, IX-1980, EMBRAPA insectary, *Vicia* sp. (PS).

Metopolophium dirhodum (Walker, 1849)
RS: Passo Fundo, 19-IX-1980, *Triticum aestivum*, field (Werner). – Passo Fundo, 30-IX-1980, *Hordeum vulgare*, field (de Salles).

Sitobion avenae (Fabricius, 1775)
RS: Passo Fundo, 19-IX-1980, *Triticum aestivum*, field (PS). – Passo Fundo, 30-IX-1980, *Hordeum vulgare*, field (de Salles). – Passo Fundo, 19-IX-1980, *T. aestivum* (Werner). São Borja, 16-IX-1980, *Triticum aestivum*, field (PS).

Cereal aphids
RS: Passo Fundo, IX-1980, *Triticum aestivum*, EMBRAPA insectary (PS). – Passo Fundo, 1978, *Triticum aestivum* (E. Zuñiga).
Laboratory stock- introduced as *Ephedrus* "novo".

Laboratory
Gomez & Rumiatto (1989b), *Schizaphis graminum*.

Lysiphlebus testaceipes (Cresson, 1880)

Aphis coreopsidis (Thomas, 1878)
MG: Lavras, 26-XII-2002, *Bidens pilosa*, field, TS/74 (MS). – Lavras, 9-I-2003, *Bidens pilosa*, city, TS/80 (MS). – Lavras, 19-IV-2003, *Bidens pilosa*, city, TS/86 (MS).
SP: Tavares (1991), *Bidens pilosa*.

Aphis craccivora Koch, 1854
MG: Lavras, 10-X-2002, *Medicago sativa*, field, TS/29 (MS).

Aphis fabae Scopoli, 1763
SP: Peronti (1999), *Anthurium froebelii*.

Aphis fabae solanella Theobald, 1914
MG: Uberlândia, 22-VIII-2006, *Solanum americanum*, city, TS/119 (MS).
SP: Tavares (1991), *Sessea brasiliensis*.

Aphis gossypii Glover, 1877
BA: Soares *et al.* (1999).
MG: Belo Oriente, 30-IV-2001, *Eucalyptus* sp., greenhouse, TS/19 (Zanetti). – Lavras, 7-VII-2002, *Duranta repens aurea*, city, TS/34 (MS). – Lavras, 15-VII-2002, *Dendranthema grandiflora*, greenhouse, TS/43 (MS). – Lavras, 15-VII-2002, *Gossypium hirsutum*, greenhouse, TS/42 (MS). – Lavras, 17-VII-2002, *Gossypium hirsutum*, field, TS/40 (MS). – Lavras, 17-VII-2002, *Hibiscus rosa-sinensis*, city, TS/45 (MS). – Lavras, 8-VIII-2002, *Cucumis sativus*, field, TS/48 (MS). – Lavras, 23-VIII-2002, *Solanum tuberosum*, field, TS/53 (MS). – Lavras, 18-IX-2002, *Ageratum conyzoides*, city, TS/61 (Figueira). – Lavras, 23-XII-2002, *Tibouchina granulosa*, city, TS/76 (MS). – Lavras, 26-XII-2002, *Bidens pilosa*, field, TS/75 (MS). – Lavras, 9-I-2003, *Bidens pilosa*, city, TS/79 (MS). – Lavras, 21-I-2003, *Tibouchina granulosa*, city, TS/82 (MS). – Nova Porteirinha, 13-V-2000, *Gossypium hirsutum*, field, TS/5 (Gonçalves). – Pitangui, 15-IX-2003, *Malpighia glabra*, field, TS/98 (Moreno). – São Gonçalo do Sapucaí, 22-XI-2002, *Abelmoschus esculentus*, field, TS/77 (Figueira).
PE: Fernandes *et al.* (2000), *Gossypium hirsutum*.
RJ: Valença, 2-I-2003, *Hibiscus rosa-sinensis*, city, TS/78 (MS). – Valença, 5-I-2003, *Kalanchoë blossfeldiana*, city, TS/84 (MS).
SP: Santo Antônio de Posse, 26-IV-2001, *Dendranthema grandiflora*, greenhouse, TS/20 (A. Silva). – Santo Antônio de Posse, 30-IV-2001, *Dendranthema grandiflora*, greenhouse, TS/10 (A. Silva). – Santo Antônio de Posse, 7-V-2001, *Dendranthema grandiflora*, greenhouse, TS/21 (A. Silva). – Santo Antônio de Posse, 21-V-2001, *Dendranthema grandiflora*, greenhouse, TS/15 (A. Silva). – São José do Rio Pardo, 23-XII-1999, *Abelmoschus esculentus*, field, TS/2 (MS). – São José do Rio Pardo, 03-X-2006, *Malpighia glabra*, city, TS/117 (MS).
– Tavares (1991), *Cassia leptocarpa*, *Schefflera sp.*, *Tecomma sp.*, *Sessea brasiliensis*. – Peronti (1999), *Calliandra inaequilatera*. – Imenes *et al.* (2002), *Ixora macrothyrsa*. – Carvalho *et al.* (2006), *Dendranthema grandiflora* ?
Brazil: De Santis (1980).

Aphis hederae (Kaltenbach, 1843)
SP: Peronti (1999), *Schefflera arboricola*.

Aphis nerii Boyer de Fonscolombe, 1841
MG: Lavras, 20-II-2003, *Asclepias curassavica*, waste place, TS/85 (DeConti).
SP: São José do Rio Pardo, 22-XII-1999, *Nerium oleander*, city, TS/1 (MS). – Tavares (1991), *Nerium oleander*. – Peronti (1999), *Nerium oleander*.
Brazil: De Santis (1980).

Aphis spiraecola Patch, 1914
MG: Barbacena, 21-IX-2002, *Schefflera* sp., city, TS/63 (Auad).
PR: Bartoszeck (1975), *Pyrus malus*.
SP: Tavares (1991), *Tecomma* sp. – Peronti (1999), *Polyscia guilfoylei*.

Aphis sp.
MG: Lavras, 19-IX-2002, *Foeniculum vulgare*, garden, TS/62 (MS).

Brevicoryne brassicae (Linné, 1758)
Brazil: De Santis (1980).

Dysaphis apiifolia (Theobald, 1922)
MG: Bambuí, 15-VI-2004, *Petroselinum crispum*, city, TS/120 (Figueira).

Dysaphis sp.
SP: Carvalho *et al.* (2006), *Dendranthema grandiflora* ?

Hysteroneura setariae (Thomas, 1878)
MG: Uberlândia, 22-VII-2005, *Oryza sativa*, greenhouse, TS/114 (MS).

Longiunguis sacchari (Zehntner, 1897)
Brazil: De Santis (1980).

Metopolophium dirhodum (Walker, 1849)
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum*.

Myzus persicae (Sulzer, 1776)
MG: Lavras, 31-VIII-1995 (D.Gamarra). – Lavras, 21-V-2001, *Capsicum annuum*, greenhouse, TS/13 (MS) – Lavras, 15-VII-2002, *Capsicum annuum*, greenhouse, TS/44 (MS).
SP: Tavares (1991), *Bidens pilosa*, *Emilia sonchifolia*. – Carvalho *et al.* (2006), *Dendranthema grandiflora* ?

Rhopalosiphum maidis (Fitch, 1856)
MG: Lavras, 4-X-2002, *Sorghum bicolor*, greenhouse, TS/73 (MS). – Pitangui, 5-X-2003, *Zea mays*, field, TS/101 (Moreno).
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum*.
SP: Ronquim *et al.* (2004), *Avena sativa* ?
Brazil: De Santis (1980).

Rhopalosiphum padi (Linné, 1758)
MG: Lavras, 31-VII-2003, *Avena sativa*, field, TS/89 (MS).
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum*.
SP: Ronquim *et al.* (2004), *Avena sativa* ?

Schizaphis graminum (Rondani, 1852)
MG: Lavras, 24-VIII-1993, *Sorghum* sp. (VB). – Lavras, 4-X-2002, *Sorghum bicolor*, greenhouse, TS/72 (MS). – Lavras, 31-VII-2003, *Avena sativa*, field, TS/90 (MS).
SP: Ronquim *et al.* (2004), *Avena sativa* ?
Brazil: De Santis (1980).

Sitobion avenae (Fabricius, 1775)
PR: Alves *et al.* (2005), *Triticum aestivum* ?. – Zanini *et al.* (2006), *Triticum aestivum*.

Toxoptera aurantii (Boyer de Fonscolombe, 1841)
SP: Tavares (1991), *Chrysophyllum* sp.

Toxoptera citricidus (Kirkaldy, 1907)
MG: Lavras, *Citrus* sp. (F. Leclant). –Lavras, 22-IX-2002, *Citrus* sp., city, TS/83 (Auad).
PR: Bartoszeck (1976b), *Citrus* sp.
SP: Mococa, 10-XII-2002, *Citrus sinensis*, city, TS/81 (MS).
Brazil: De Santis (1980).

Without host records
SP: Tavares (1996).

Laboratory
Araújo & Moraes (1998), *Aphis gossypii*. – Rodrigues & Bueno (2001), *Aphis gossypii*, *Schizaphis graminum*. – Rodrigues *et al.* (2001), *Aphis gossypii*, *Schizaphis graminum*. – Bueno *et al.* (2003a), *Aphis gossypii*, *Myzus persicae*. – Bueno *et al.* (2003b), *Aphis gossypii*. – Carnevale *et al.* (2003), *Aphis gossypii*, *Myzus persicae*. – Rodrigues *et al.* (2003ab), *Schizaphis graminum*. – Rodrigues *et al.* (2005), *Aphis gossypii*, *Schizaphis graminum*. – Bueno *et al.*

(2006), *Myzus persicae*, *Rhopalosiphum maidis*, *Schizaphis graminum*. – Sampaio *et al.* (2006), *Aphis gossypii*, *Schizaphis graminum*.

Praon gallicum Starý, 1971

Acyrthosiphon pisum (Harris, 1776)
RS: Passo Fundo, IX-1980, *Vicia* sp., EMBRAPA insectary (PS).

Schizaphis graminum (Rondani, 1852)
MS: Gomez & Rumiatto (1989a).

Cereal aphids
RS: Passo Fundo, IX-1980, *Triticum aestivum*, EMBRAPA insectary (PS). – Passo Fundo, 1978, *Triticum aestivum* (E. Zuñiga).
Laboratory stock introduced as "*Praon* 68".
Introduced as EPL 79-76.

Laboratory
Gomez & Rumiatto (1989b), *Schizaphis graminum*.

Praon volucre (Haliday, 1833)

Acyrthosiphon kondoi Shinji, 1938
MG: Lavras, 10-X-2001, *Medicago sativa*, field, TS/28 (MS).
RS: Ijuí, 18-IX-1980, *Medicago sativa*, field, 80/41 (PS). – Ijuí, 18-IX-1980, *Medicago sativa*, field, 80/43 (PS).

Acyrthosiphon pisum (Harris, 1776)
MG: Lavras, 10-X-2001, *Medicago sativa*, field, TS/28 (MS).
RS: Ijuí, 18-IX-1980, *Medicago sativa*, field, 80/43 (PS).

Acyrthosiphon sp.
RS: Feliz, 27-IX-1980, *Medicago sativa*, field, 80/86 (PS). – Passo Fundo, 3-X-1980, *Lupinus* sp., field, 80/106 (PS).

Aulacorthum solani (Kaltenbach, 1843)
MG: Lavras, 24-IX-2001, *Lactuca sativa*, greenhouse, TS/25 (MS).

Brachycaudus helichrysi (Kaltenbach, 1843)
SP: Tavares (1991), *Erechtites valerianaefolia* ?

Brevicoryne brassicae (Linné, 1758)
RS: Passo Fundo, 30-IX-1980, *Brassica* sp., field, 80/95 (PS).

Hyperomyzus lactucae (Linné, 1758)
SP: Tavares (1991), *Sonchus oleraceus*.

Hyperomyzus sp.
RS: Passo Fundo, 2-X-1980, *Sonchus* sp., park, 80/99 (PS).

Macrosiphum euphorbiae (Thomas, 1878)
MG: Andradas, 17-XI-2000, *Rosa* sp., greenhouse, TS/4 (VB). – Lavras, 11-IX-2000, *Capsicum annuum*, field, TS/6 (MS). – Lavras, 24-IX-2001, *Lactuca sativa*, greenhouse, TS/25 (MS). – Lavras, 1-X-2003, *Lactuca sativa*, hidroponic greenhouse, TS/102 (MS).
SP: Holambra, 10-VIII-2001, *Rosa* sp., greenhouse, TS/22 (VB).

Macrosiphum rosae (Linné, 1758)
MG: Lavras, 13-IX-2002, *Rosa* sp., garden, TS/55 (MS).
RS: Ibiruba, 25-IX-1980, *Rosa* sp., garden, 80/81 (PS).

Metopolophium dirhodum (Walker, 1849)
RS: Bento Gonçalves, 27-IX-19890, *Triticum aestivum*, field, 80/88 (PS). – Colorado, 25-IX-1980, *Triticum aestivum*, field, 80/85 (PS). – Ibiruba, 25-IX-1980, *Triticum aestivum*, field, 80/80 (PS). – Marau, 22-IX-1980, *Triticum aestivum*, field, 80/44 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/74 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/76 (PS). – Passo Fundo, 24-IX-1980, *Avena sativa*, field, 80/77 (PS). – Zuñiga (1982).

Cryptomyzus ribis (Linné, 1758)
MG: Lavras, 18-IX-2002, *Leonurus sibiricus*, garden, TS/58 (MS).

Myzus ornatus Laing, 1932
SP: Tavares (1991), *Erechtites valerianaefolia*.

Myzus persicae (Sulzer, 1776)
MG: Lavras, 31-VIII-19945 (D.Gamarra). – Lavras, 11-IX-2000, *Capsicum annuum*, field, TS/6 (MS). – Lavras, 24-IX-2002, *Lactuca sativa*, greenhouse, TS/25 (MS). – Lavras, 13-IX-2002, *Callendula officinalis*, garden, TS/56 (MS).
SP: Tavares (1991), *Erechtites valerianaefolia* ?

Rhodobium porosum (Sanderson, 1901)
MG: Andradas, 20-V-2003, *Rosa* sp., TS/87 (VB). – Lavras, 16-VII-2002, *Rosa sp.*, garden, TS/38 (MS). – Lavras, 28-V-2003, *Rosa* sp., garden, TS/108 (Cavalcanti). – Lavras, 19-VI-2003, *Rosa* sp., garden, TS/109 (DeConti).

Sitobion avenae (Fabricius, 1775)
MG: Lavras, 28-VIII-2003, *Triticum* aestivum, field, TS/97 (MS).
RS: Bento Gonçalves, 27-IX-1980, *Triticum* aestivum, field, 80/88 (PS). Colorado, 25-IX-1980, *Triticum aestivum*, field, 80/85 (PS). – Ibiruba, 25-IX-1980, *Triticum aestivum*, field, 80/80 (PS). – Marau, 22-IX-1980, *Triticum aestivum*, field, 80/44 (PS). – Passo Fundo, 24-IX-1980, *Avena sativa*, field, 80/77 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/76 (PS). – Passo Fundo, 24-IX-1980, *Triticum aestivum*, field, 80/74 (PS). – Zuñiga (1982).

Uroleucon cordobense (Blanchard, 1932)
SP: Tavares (1991), *Erigeron bonariensis*.

Uroleucon sonchi (Linné, 1767)
SP: Tavares (1991), *Sonchus oleraceus*.

Uroleucon sp.
MG: Lavras, 24-IX-2001, *Lactuca sativa*, greenhouse, TS/24 (MS).
RS: Passo Fundo, 12-IX-1980, *Sonchus* sp., waste place, 80/18 (PS). – Passo Fundo, 2-X-1980, *Sonchus* sp., park, 80/99 (PS).

Cereal aphids
RS: Passo Fundo, IX-1980, *Triticum aestivum*, EMBRAPA insectary (PS).

Laboratory
Gomez & Rumiatto (1989b), *Schizaphis graminum*.

Xenostigmus bifasciatus (Ashmead, 1891)

Cinara atlantica Wilson, 1919
PR: Reis-Filho *et al.* (2004), *Pinus* spp.
SC: Reis-Filho *et al.* (2004), *Pinus* spp.
SP: Reis-Filho *et al.* (2004), *Pinus* spp.

Cinara sp.
MG: Lavras, 16-VIII-2005, *Pinus* sp., avenue, TS/121 (Santos). – Uberlândia, 17-IX-2006, *Pinus* sp., park, TS/116 (MS).

Laboratory
Reis-Filho *et al.* (2004), *Cinara atlantica*. – Oliveira (2006), *Cinara atlantica*.

DISCUSSION

Fauna and their relationships. To understand the position of Brazil, a few general features on the aphidiine parasitoid fauna of Central and South America are presented. The following paragraph is generalized and derived from a set of published papers (Mackauer & Starý 1967; Starý 1972; Aguilar 1980; De Huiza & Ortu 1980; Starý 1981; Botto & Hernández 1982; Starý & Vogel 1985; Monguí *et al.* 1986; Starý 1987; Starý & Delfino 1987; Valdiviesco Jara 1987; Starý & Cermeli 1989; Gärdenfors 1990; Botto *et al.* 1991; Starý 1993; Starý *et al.* 1993; Starý 1994; Vergara Ruiz & Galeano 1994; Yokomi *et al.* 1994; Guevara & Zuluaga 1995; Starý 1995; Ravelo & Triana 1997; Berta *et al.* 1998) as well as from original information by the authors. However, all the classification is rather preliminary due to the limited information from extensive areas of the Continent.

Apparently, Central America manifests relatively rich and mixed fauna partially penetrating from the southern parts of North America, apart from native elements and penetrations from South America. Similar features can also be observed in the Antilles, although species composition is less numerous (Cuba).

In South America, the Andean mountain range apparently has many specific fauna. Indications of such peculiar parasitoid fauna in the northern parts of South America are obvious. One of the peculiar complexes represents the *Nothofagus* – associated fauna, which is also distributed in the lowlands in the north-south direction in the continent. The other distinct complex (under observation) is the parasitoid guild on *Uroleucon* aphids. Another peculiar fauna was indicated to occur in the subantarctics.

However, most of the aphidiine fauna of the continent is characterized by a typical complex consisting of several species (*A. colemani*, *D. rapae* and *L. testaceipes*) which is distributed widely both in the Atlantic and the Pacific coastal areas, penetrating far into the interior to even high altitudes. These parasitoid species are associated with common aphid species on many different crops, weeds, vegetables and ornamental plants both in the field and urban agglomerations.

The latter complex has been enriched by several species which were introduced as biocontrol agents and became well-established and dispersed beyond the target areas into the lowlands and into high altitude (*A. ervi*, *Aphidius smithi* Sharma & Subba Rao, 1959, *A. rhopalosiphi*, *A. uzbekistanicus*, *Ephedrus plagiator* (Nees, 1811) and *P. volucre*).

Also, research has determined further exotic species that were accidentally introduced and became naturalized faunal elements (*Aphidius matricariae* Haliday, 1834, *A. salicis* and *Binodoxys brevicornis* (Haliday, 1883)).

The classification of the known Brazilian Aphidiine fauna demonstrated features corresponding to the Atlantic coastal areas and inland-distribution, enriched by the exotic species introduced accidentally and/or purposely. The faunal composition of the individual parasitoid-aphid associations is affected naturally and deeply by the climate zoning with the increasing numbers of species from the southern of the tropical belt.

Research outlines. The Aphidiine parasitoids were collected in as many environments as their host species could be found, in field crops, in greenhouses, and in non-crop plants. *A. smithi* was recorded for the first time in Brazil. Prior to the wheat aphid biocontrol program, the known parasitoid species in Brazil (*A. colemani*, *D. rapae*, and *L. testaceipes*) were reported as associated with many aphid pests such as *Aphis gossypii* Glover, 1877, *Brachycaudus schwartzi* (Börner, 1931), *Brevicoryne brassicae* (Linné, 1758), *Myzus persicae* (Sulzer, 1776), *Rhopalosiphum maidis* (Fitch, 1856), *R. padi* (Linné, 1758), and *S. graminum* (Brèthes 1913, 1918; Moreira 1919; Costa Lima 1936; Mendes 1959; Araújo e Silva *et al.* 1968; Bartoszeck 1975, 1976a, 1976b; Pimenta & Smith 1976; Gallo *et al.* 1978; Gravena 1979; De Santis 1980). However, a literature review demonstrates how inequal information has been obtained from the different states of Brazil.

Non-target aphid species as alternative hosts of introduced parasitoid biocontrol agents were considered to be only secondary within the program network centered the individual target pests of wheat and pine. Even today, the actual distribution of introduced parasitoid species has remained unknown in many areas of Brazil. At least three biocontrol agents used in wheat biocontrol program (*A. ervi*, *A. uzbekistanicus*, and *P. volucre*) and one in pine aphid biological control program (*X. bifasciatus*) were found in Minas Gerais state, at least 300 Km and 1000 Km away from the release sites, respectively. Other parasitoid species (*A. rhopalosiphi*, *Ephedrus plagiator* (Nees, 1811) and *Praon gallicum* Starý, 1971) introduced for the biological program of wheat aphids, were found in original release sites and their establishment needs to be confirmed in Brazil.

The prevailing ability of many parasitoid species to develop on several host species was observed to contribute to their establishment, and it also represents an important resource for biological control programs in the future. Several promising targets are presented:

Preliminary studies on biological control of *A. gossypii* and *M. persicae* were done in Brazil (Sampaio *et al.* 2001a, 2001b; Rodrigues & Bueno 2001; Rodrigues *et al.* 2001; Bueno *et al.* 2003a; Carnevale *et al.* 2003; Sampaio *et al.* 2003b, 2004, 2005). Good results have been obtained on controlling *A. gossypii* on commercial chrysanthemums under greenhouse conditions (Bueno *et al.* 2003b; Rodrigues *et al.* 2005).

Introduced parasitoid species specialized in Macrosiphini aphids (i.e. *A. ervi* and *P. volucre*) might be used on biological control of some aphid species, such as *Acyrthosiphon kondoi* Shinji, 1938, *Acyrthosiphon pisum* (Harris, 1776), *Aulacorthum solani* (Kaltenbach, 1843), and *Macrosiphum euphorbiae* (Thomas, 1878).

Research on *Therioaphis trifolii* (Monell, 1882), an exotic alfalfa pest showed a lack of parasitoids in Brazil (Sousa-Silva *et al.* 1998; Mendes *et al.* 2000). However, successful biocontrol has been achieved in some other parts of the world. These programs might also be applied in Brazil.

Also, *Uroleucon ambrosiae* (Thomas, 1878) has become a serious lettuce pest (Auad *et al.* 2002). According to our observations, the pest status of this aphid has increased with the increase of hydroponics system in lettuce crops grown in greenhouses in Brazil. The authors have collected large colonies of this pest aphid on hydroponics lettuce without parasitoids. There are some indications of the presence of some native parasitoid species in Brazil, which should be preferred over the possibility of exotic introductions.

In general, pest aphids are usually the key position due to economical reasons. However, broader environmental studies on, inter alia, ecological aspects of pest control programs need to be done, focusing the necessary and useful interaction between the so-called fundamental and applied research.

Acknowledgments. The authors (M. V. Sampaio and V. H. P. Bueno) are in debit for scholarships and financial support by CNPQ (Brasil) and with Dr Carlos R. Sousa-Silva of UFSCar, São Carlos (SP) and Dr Rebeca Peña-Martines of Escuela Nacional de Ciencias Biologicas del Mexico (México) for the identification of part of the aphid species. A part of the results was achieved within the framework of research activities in FAO programmers TCP /BRA/ 8908 for Brazil and TCP/ CHI/0153 for Chile (consultancies by P. Starý). The research (P. Starý) was also partially supported by Grant S5007102 (Grant Agency of the Academy of Sciences of the Czech Republic) and from the Entomology Institute Project Z5007907 (Acad. Sci. of the Czech Rep.).

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Received 13/06/2006; accepted 13/02/2007