

A brief review of the occurrence of Eulophinae (Hymenoptera: Eulophidae) for the Rio Grande do Sul state, with a key to the genera
Breve revisão da ocorrência de Eulophinae (Eymenoptera: Eulophidae) para o estado do Rio Grande do Sul, com chave para gêneros

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Abstract

The occurrence of genera and species of Eulophinae in Rio Grande do Sul is briefly analyzed, and a commented list of genera, as well as a dichotomous key, are provided. There is a new registry of species for the Brazilian and South American Eulophine fauna, and for the state there is one new genus occurrence, as well as three species.

Palavras-chave

Chalcidoidea. *Euplectrus*.
 Neotropical region. New
 occurrences. Taxonomy.

Resumo

A ocorrência de gêneros e espécies de Eulophinae no estado do Rio Grande do Sul é brevemente analisada, e uma lista comentada de gêneros, assim como uma chave dicotômica, são fornecidas. Há um novo registro de espécies para as faunas brasileira e sul-americana de eulofíneos, assim como a ocorrência de um novo gênero para o estado, bem como o registro de três espécies.

Keywords

Chalcidoidea. *Euplectrus*.
 Região Neotropical. Novas
 ocorrências. Taxonomia.

1. Introduction

Eulophidae is considered one of the most diverse families in Chalcidoidea. Their small species can be found in all habitats, and their greatest concentration is seen in tropical and tempered regions (Grissel & Schauff, 1990). About 4300 species distributed in 294 genera are known in the world so far. Of these genera, 114 are registered to the Neotropical region, distributed among four subfamilies (Entedoninae, Entiinae, Eulophinae, and Tetrastichinae) (Hansson, 2009).

Excepting about the entedonines, there is less knowledge about the Neotropic eulophid fauna. The work of Hanson & Gauld (2006) is emphatic about the importance of this family, regarding the ecologic and economic aspects: many species could be used in biological control of several immature instars of Diptera, Coleoptera, Lepidoptera and Hymenoptera, potential pests of the most diversified crops. These pest groups could damage leaves, form galls and invade vegetal tissues.

Being one of the smallest and less studied subfamilies of this group, Eulophinae is represented by 16 genera and 38 species in Brazil, according to Costa & Pikart (2018). For the Rio Grande do Sul state, the numbers are scarciest: Only two genera and five species are recorded (Noyes, 2018). This subfamily is recognizable within Eulophidae as having an antenna with 10-12 segments, two pairs or more of setae in the mesoscutellum, a well developed postmarginal vein, usually longer than the stigmal vein, as well as three or more setae found in the dorsal surface of postmarginal vein (Ubaidillah, 2006).

There are few reliable taxonomic references of Eulophinae to the Neotropics, with even more needy studies about its occurrence and distribution for Brazil and the state of Rio Grande do Sul. A catalog from Hansson (2009) for Eulophidae species in the Neotropical region is available, including occurrences for Brazil. Another important catalog is provided by De Santis (1980), more generalized to the Parasitica series. An integrated taxonomic revision for *Euplectrus* Geoffroy, 1762 species occurring in the New World is given by Hansson et al. (2015) with focus in conservation areas in northwestern of Costa Rica. *Diglyphus* Walker, 1844 and *Diaulinopsis* Crawford, 1912 were taxonomically analyzed by Gordh and Hendrickson (1979), presenting a key to the New World taxa. Regarding the other genera, there is more fragmented information, concentrated on Europe, North America, Asia and Australasia (Schauff et al., 1997).

The aim of this study is to analyze the occurrence of genera and species of Eulophinae in the Rio Grande do Sul state, giving a commented species list, and presenting a dichotomous key that could help in future taxonomic studies.

2. Methodology

A taxonomic analysis was firstly made with the material stored in the Coleção Entomológica de Santa Cruz do Sul (CESC), at Universidade de Santa Cruz do Sul (UNISC), municipality of Santa Cruz do Sul, Rio Grande do Sul, Brazil. It should be noted that CESC comprises the largest collection of parasitoid wasps in the state of Rio Grande do Sul. For the identification of specimens the following keys were followed: Burks (2003), Delvare et al. (2002) and Schauff, LaSalle & Coote (1997). The identification to the species level was realized by a systematic analysis of the original descriptions of every taxa, as contained in Ashmead (1904), Walker (1839, 1839b) and Thomson (1878). Also, the catalogs of Hansson (2009) and Costa and Pikart (2018) were utilized for a conference of the occurring species, as well as the database found in Noyes (2018). The metadata available in these resources were also used to build distribution maps, with the specific occurrences of eulophines in the Brazil and Rio Grande do Sul territory. The GIS data transformation, as well as the map building, was performed in Google Earth v. 7.3.2 and gvSIG Desktop v. 2.4.0.2850 final.

A dichotomous key of Eulophinae genera was built, based on Burks (2003) and Schauff et al. (1997), using the software DKey v. 1.2.0 (Tofilski, 2018). The same software was used to develop a dichotomous key regarding the *Euplectrus* species occurring in the Rio Grande do Sul state, from an adaptation of the key provided by Hansson (2015).

3. Results

For the present study, were identified three genera and four species (Table 1). In comparison to Costa and Pikart (2018), Noyes (2018) catalogs, there is a new register of genus, *Eulophus* Geoffroy, 1762, as well as three species record for the Rio Grande do Sul state. Regarding the Brazilian and South American fauna, there is one new register, *Euplectrus alvarowillei* Hansson, 2015 (Table 1).

Table 1: List of Eulophinae species occurring in Rio Grande do Sul. Bold species were considered to this study, and the bold occurrences are taken as new. Abbreviations: MT: Mato Grosso; RJ: Rio de Janeiro; RS: Rio Grande do Sul; SP: São Paulo.

Taxon	Brazil (occurrent) ¹	World (occurrent) ²
<i>Elasmus phyllocnistoides</i> Diez, Torrén & Fidalgo, 2006	RS	South America
<i>Elasmus polistis</i> Burks, 1971	RS	South America, North America, Europe, Asia
<i>Eulophus cemiostomatis</i> Mann, 1872	RJ, RS	South America
<i>Euplectrus alvarowillei</i> Hansson, 2015	RS	South America , Central America
<i>Euplectrus chapadae</i> (Ashmead, 1904)	MT, RS	South America, Central America, Asia
<i>Euplectrus furnius</i> Walker, 1843	RS	South America, Central America, North America
<i>Euplectrus insularis</i> (Howard, 1897)	RS	South America, Central America, North America
<i>Euplectrus platyhypenae</i> (Howard, 1885)	RS , SP	South America, Central America, North America
<i>Euplectrus ronnai</i> (Brèthes, 1918)	RS	South America

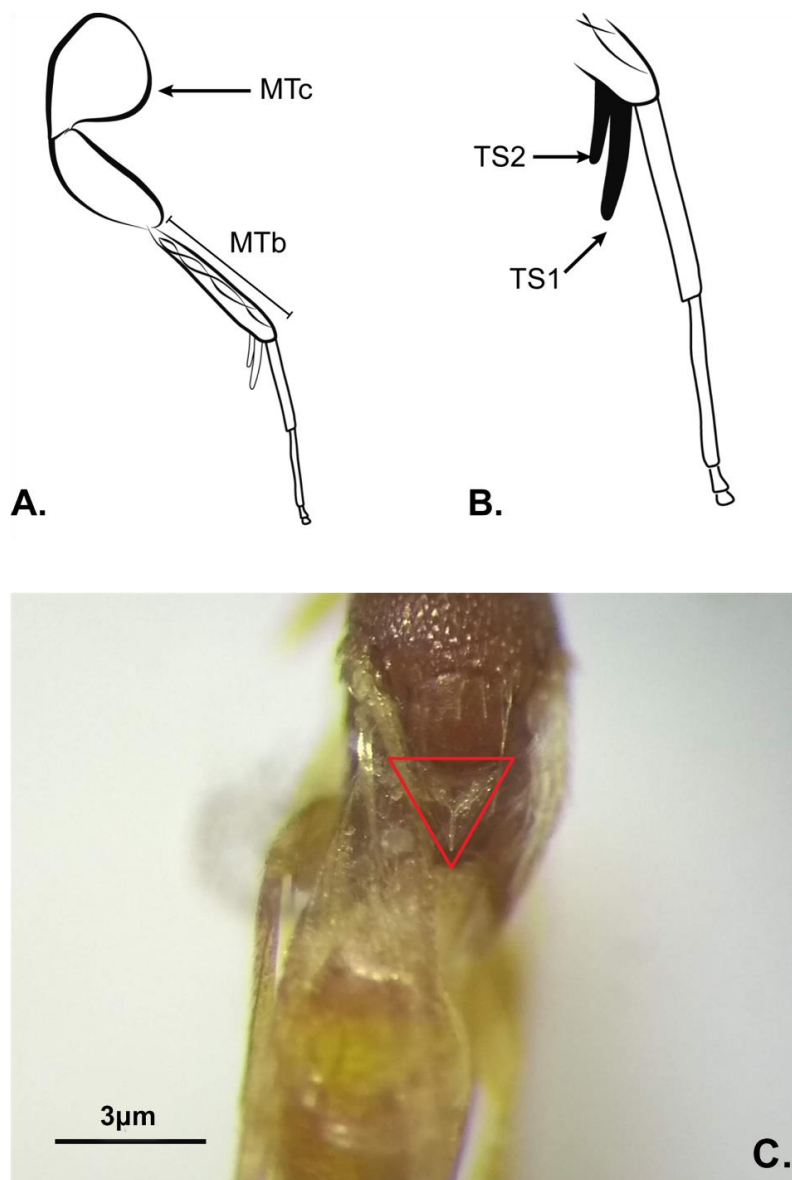
¹ Costa e Pikart (2018), Noyes (2018)

² Noyes (2018)

Dichotomous key to genera of Eulophinae occurrent in the state of Rio Grande do Sul (adapted from Burks, 2003, and details from Boucek, 1959, 1988; Askew, 1964, Schauff, 1991 and Schauff et al. 1997)

- 1 Metacoxa broad (Fig. 3A); scutellum with laminar projection in triangular shape; metatibia with setae arrangement, forming diamond or parallel lines patterns (Fig. 3A). ***Elasmus*** Westwood
- Metacoxa not broad; scutellum without apparent laminar projection; metatibia usually with setae, but not forming patterns like mentioned above. 2
- 2 Large metatibial spur (Fig. 3B), bigger than the basal segment of metatarsus. ***Euplectrus*** Westwood
- Metatibial spur not so large, smaller than the basal segment of metatarsus. ***Eulophus*** Geoffroy

Figure 1: A. *Elasmus*, hind leg (MTc: metacoxa; MTb: metatibia); B. *Euplectrus*, hind leg (TS: tibial spur); C. *Elasmus*, thorax, with scutellum projection in red triangle. Adaptations from Burks (2003) and Hansson et al. (2015).



Elasmus Westwood, 1833

Diagnose: Head with triangle shape in frontal view. Highly punctured face, with short setae disposed in a spaced way around the eyes. Antennae inserted in the inferior line of the eye, funiculars with subcylindrical shape and subequal size, with setae and sensillae dispersed. Punctured mesosoma, with dispersed setae. Apparent notauli on mesoscutum, extending to the terminal region. Scutellum with laminar projection in a triangular shape, could having two pairs of setae laterally disposed. Broad and stried coxae, with apparent setae in tibia in a diamond or parallel lines shapes. Metasoma with funiculars of subequal size, with short setae lines.

Comments: This is one of the most uniform genera among Chalcidoidea, according to Ferrière (1929), once its species are easily grouped because of sharing visible common characters. However, it is not possible yet to make a proper keying of the Neotropical species. As LaSalle (2018, pers. comm.) relates, most part of the available information about this genus, more than old, are scattered, with the lacking of important details. One apparent exception is the recent description of *E. phyllocnistoides* made by Diez et al. (2006). There is a key for the Nearctic

species on Burks (1965), though not comprehends the whole Neotropical known fauna.

Bibliography. Ferrière (1929), Crawford (1910), De Santis (1964), Ashmead (1904), Riley et al. (1894), Howard (1897), Burks (1965, 1971).

Material examined: BRAZIL. Rio Grande do Sul: Santa Cruz do Sul, 21.XII.2009 (CESC 31735/18), 25.XII.2009 (CESC 32072/16), 24.I.2012 (CESC 47833/12), 28.II.2012 (CESC 51117/10)

***Euplectrus* Westwood, 1832**

Diagnose: Antennae with six flagellomeres in both sexes, with males having a usually inflated scape. Posterior tibial spurs elongated, being the longest of them at least the half of the width of posterior tarsus; scutellum without lateral sulcus or foveae lines; propodeum with a "cup" erected - triangular to semicircular, and with a complete median carina behind this cup.

Comments. Along with *Dighlyphus e Diaulinopsis*, this is one of the best taxonomically explored genera of Eulophinae, due to the comprehensible analysis made by Hansson (2009). There are detailed descriptions of the seven species of Rio Grande do Sul in this work, covering mostly both sexes, which could be distinguished by the shape of the scape.

Bibliography. Hansson (2009), for the new World *Euplectrus*.

Material examined: BRAZIL. Rio Grande do Sul: Passa Sete, 06.III.2010 (CESC 31496/11), Passa Sete, 29.I.2010 (CESC 31152/11); Santa Cruz do Sul, 11.XII.2010 (CESC 37402/10), 19.XI.2010 (CESC 37818/9).

Dichotomous key to the species of *Euplectrus* occurrent in Brazil (adapted from Hansson, 2015)

- | | | |
|---|---------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 1 | Frons with lower face dark (black to very dark reddish-brown) and not delimited for surrounding parts of frons..... | 2 |
| - | Frons with at least parts of lower face distinctly paler than surrounding parts of frons..... | 5 |
| 2 | Hind coxa black to brown | <i>Euplectrus alvarowillei</i> |
| - | Hind coxa yellow to dark yellow | 3 |
| 3 | Gaster yellowish-brown with dark brown lateral margins | <i>Euplectrus platyhyphenae</i> |
| - | Gaster completely dark brown in at least posterior 1/2 | 4 |
| 4 | Gaster with anterior 1/2 yellowish brown with dark-brown lateral margins | <i>Euplectrus furnius</i> |
| - | Gaster dark brown with a pale median spot or striae anteromedially | <i>Euplectrus chapadae</i> |
| 5 | Scape dark brown to black | <i>Euplectrus insularis</i> |
| - | Scape yellow to pale brown..... | <i>Euplectrus ronnai</i> |

Eulophus Geoffroy, 1762

Diagnose: Triangular head in frontal view. Surface strongly punctuated, with some apparent setae in the vertex region. Eye not prominent, with a glabrous surface. Antennae inserted in the median line of the eyes, funiculars with subequal size and presence of setae and sensillae in the whole extension. Scape with no more than 3.0x the size of the first flagellomere. Glabrous mesosoma with apparent punctuations and notauli weakly apparent in the mesoscutum. Absence of median or lateral carina in metanotum. Small tegulae, with semicircular shape. Metasoma dorsally compressed. Terga with subequal size, smooth surface.

Comments. This genus is one of the most pristine chalcidoid taxa, and one of the less studied in the Neotropics. The only described species for Brazil, *E. cemiostomatis*, has a comprehensive description of its morphological characters, though the antiqueness.

Bibliography. Burks (2003), Mann (1872)

Material examined: BRAZIL. Rio Grande do Sul: Santa Cruz do Sul, 03.XI.2010 (CESC 36224/06), 26.XI.2010 (CESC 38274/08)

4. Discussion

The difficulty to make a specific keying of genera and species of Eulophidae to the Neotropics is due to the great diversity and the antique descriptions (e.g.: Ashmead, 1904; Walker, 1839, 1839b; Thomson, 1878), that lacking more broad details. Also, the lack of resources and specialized taxonomists, not only in Brazil, but in the Neotropical region, hampers a more comprehensive taxonomic analysis not only of this group, but of the Chalcidoidea as a whole. Apparent exceptions in this family are the genera *Euplectrus*, properly discussed by Hansson (2009), as well as *Diglyphus* and *Diaulinopsis*, explored by Gordh e Hendrickson (1979).

Although there are keys to Eulophidae from other regions that could be used reasonably to identify the Neotropic specimens, as Burks (2003) and Schauff et al. (1997), these works still hampers in the great morphological differences between the individuals from distinct regions. The Neotropical region is needy of a proper key that could embrace all genera occurrent of this family,

The discovery and the establishment of four new species and two new genera for the Rio Grande do Sul state, considering the catalogues of Costa and Pikart (2018) and Noyes (2018), as well as a determination of a new registry of *Euplectrus* to Brazil and South America is an aggravating fact showing the lack of knowledge of the subfamily Eulophinae to the region.

Another problem that can be seen by the results appointed in Table 1 is the dispersal of species occurrence in the Brazilian territory. Apart from the species that only occurs in Rio Grande do Sul, there are some registries for states like Rio de Janeiro and São Paulo, in the southeastern region, as well as Mato Grosso, in the center-western part, as seen in Figures 2 and 3. This lack of contiguity is could be reflex of a bias that can be seen not only in the eulophine group, but also in several groups of parasitoid wasps. This phenomena is discussed by Shaw and Hochberg (2001), taking the British parasitic Hymenoptera fauna as an example. The authors stress in this work the threat to the chalcidoid wasps conservation caused by the ignorance of their taxonomy and biology. Araújo (2018) makes similar analysis for the Brazilian galling insects, and bring evidences of a concentration of occurrences in some regions of Brazil. One of the reasons appointed by the author agrees with the stated before: a lack of specialists in more Brazilian states.

Figure 2: Distribution map of registries of Eulophine species from genus *Euplectrus* in Brazilian territory.

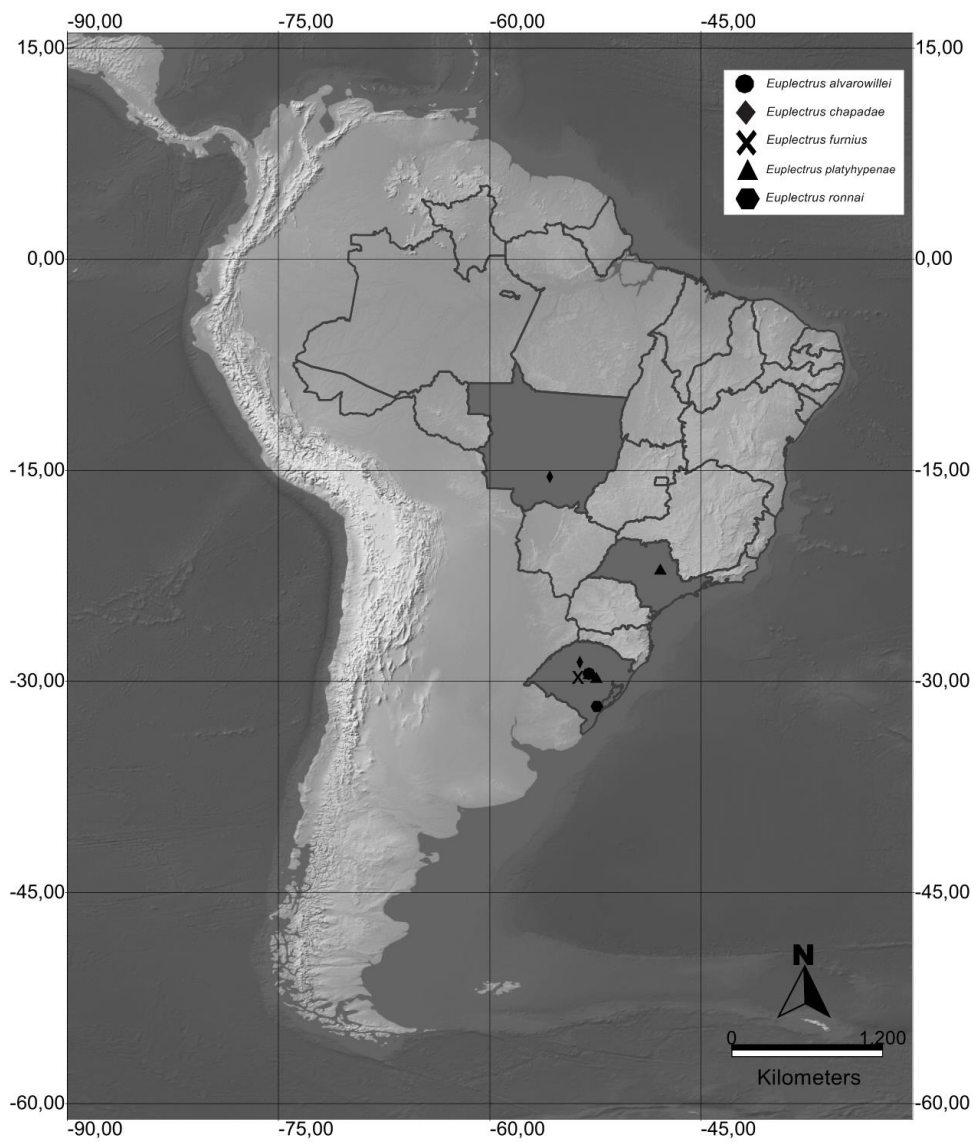
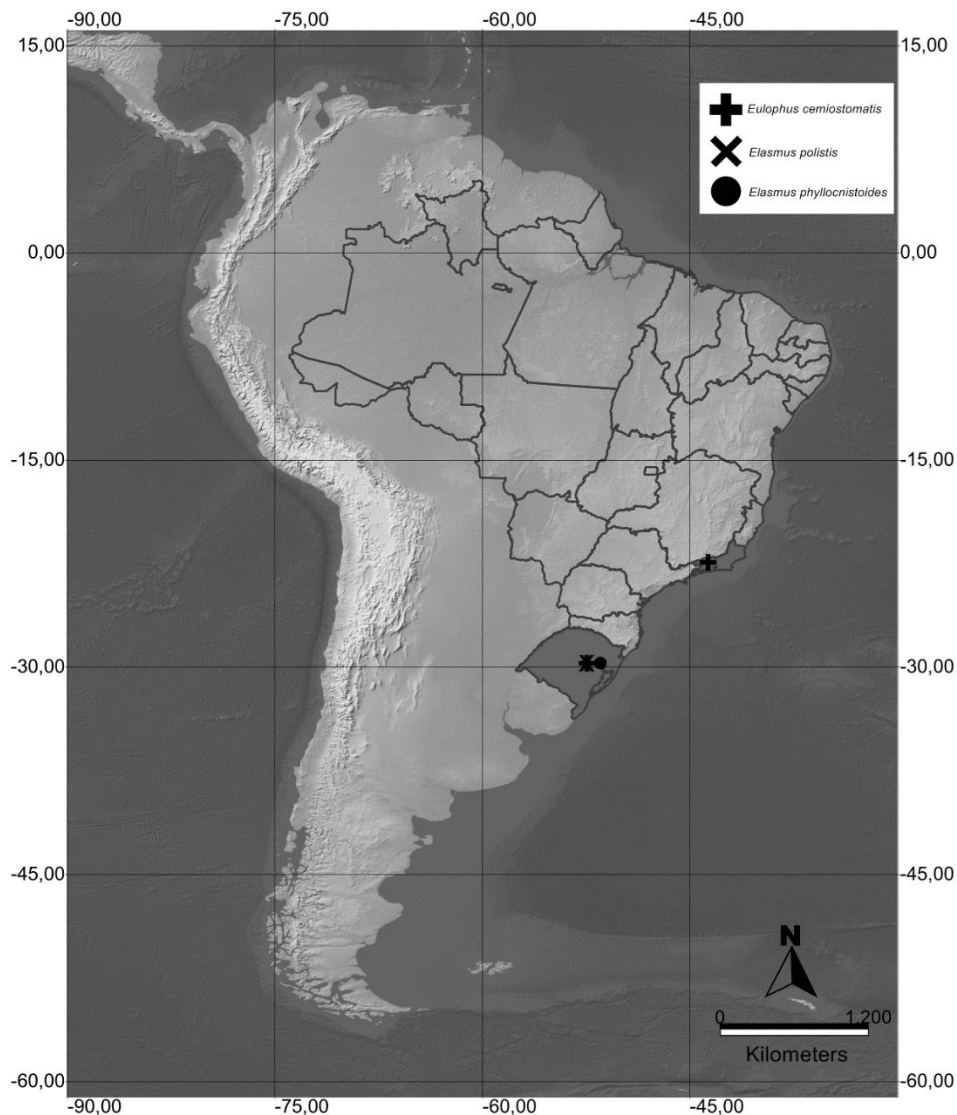


Figura 3: Distribution map of registries of Eulophine species from *Elasmus* and *Eulophus* genera in the Brazilian territory.



Conclusions

With the results exposed, this study could serve as an ignition to the realization of more profound and comprehensible incursions about the Eulophinae fauna in Rio Grande do Sul, Brazil, and the Neotropical region, considering the new registries for the state, national and continental levels. Also, there is still a necessity of more intense studies of the parasitoid wasps, due their ecological and economic importance. A sustainable development passes necessarily to the basic knowledge about the taxonomy, phylogeny and biology of this great group of chalcidoids.

Acknowledgments

The authors thank Christer Hansson, Ryan Perry and Roger Burks for the orientation and help in specific topics of Eulophinae. The authors also acknowledge the great help of Valmir Antônio da Costa. A special thanks to John LaSalle (*in memoriam*) for the precious orientation and suggestions about - in his words - that "truly remarkable group". The revision and the important appointments on the manuscript made by Karine Schoeninger are also acknowledged.

This research was funded by Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul (FAPERGS).

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