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## The genus *Zygothrica* Wiedemann 1830 (Diptera, Drosophilidae) in Santa Catarina state, southern Brazil: distribution and ecological notes

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### Abstract

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The present paper brings together survey data from nine collection sites in Santa Catarina state, southern Brazil. Samples were obtained during about four years in forested, coastal and urban areas. Flies were attracted by fermented banana baits and captured in traps. Among the species of the genus *Zygothrica* Wiedemann 1830 collected, *Zygothrica apopoeyi* Burla 1956, *Z. bilineata* (Williston 1896), *Z. dispar* (Wiedemann 1830), *Z. lanceolata* Burla 1956, *Z. nigropleura* Grimaldi 1987, and *Z. poeyi* (Sturtevant 1921) were recorded for the first time in Santa Catarina state and, except for *Z. bilineata*, also in southern Brazil. Apart from these species, we also collected *Zygothrica hypandriata* Burla 1956, *Z. orbitalis* (Sturtevant 1916) (as *Z. parilis*), *Z. prodispar* Duda 1925 and *Z. vittimaculosa* Burla 1956. Except for *Z. bilineata* and *Z. hypandriata*, these are the new southernmost records for the geographical distribution of these species. All the collected species were represented by few individuals, probably as a consequence of the collection method, and most of them was captured in winters and springs. Five species were restricted to the more preserved studied site, and most individuals were collected in forest sites. Nevertheless, four species were also captured in urban or xeric environments, indicating a higher tolerance and a wider ecological versatility in this genus as compared to what was previously thought, at least for some species.

**Keywords:** *Neotropics, new records, species distribution.*

### Resumo

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O presente estudo reúne dados de pesquisa de nove locais de coleta no estado de Santa Catarina, sul do Brasil. Foram obtidas amostras durante aproximadamente quatro anos em áreas florestais, litorâneas e urbanas. As moscas foram atraídas através de isca de banana fermentada e capturadas em armadilhas. Dentre as espécies do gênero *Zygothrica* Wiedemann 1830 coletadas, *Zygothrica apopoeyi* Burla 1956, *Z. bilineata* (Williston 1896), *Z. dispar* (Wiedemann 1830), *Z. lanceolata* Burla 1956, *Z. nigropleura* Grimaldi 1987, e *Z. poeyi* (Sturtevant 1921) foram registradas pela primeira vez no estado de Santa Catarina e, com exceção de *Z. bilineata*, também no sul do Brasil. Além destas espécies, também foram coletadas *Zygothrica hypandriata* Burla 1956, *Z. orbitalis* (Sturtevant 1916) (como *Z. parilis*), *Z. prodispar* Duda 1925 e *Z. vittimaculosa* Burla 1956. Com exceção de *Z. bilineata* e *Z. hypandriata*, estes registros representam os novos limites de distribuição geográfica sul para estas espécies. Todas as espécies coletadas foram representadas por poucos

indivíduos, provavelmente como consequência do método de coleta, e a maioria delas foi capturada em invernos e primaveras. Cinco espécies foram restritas ao local estudado mais preservado e a maioria dos indivíduos foi coletada em áreas de floresta. Entretanto, quatro espécies também foram capturadas em ambientes urbanos ou xéricos, indicando uma tolerância mais alta e uma versatilidade ecológica mais ampla do que previamente era pensado para este gênero, pelo menos para algumas de suas espécies.

**Palavras-chave:** Neotrópico, novos registros, distribuição de espécies.

## Introduction

The type species of the genus *Zygothrica*, *Z. dispar*, was initially described as a subgenus in *Achias* (Platystomatidae) in 1830 by Wiedemann. The use of *Zygothrica* as a generic name began with Loew (1873). Sturtevant (1920) described several species and was one of the first authors to emphasize the study of this genus. Later, Duda (1925), working with specimens collected in Costa Rica, and Burla (1956), with specimens collected in Brazil, described a large number of species. These authors greatly promoted the study of this genus, as well as the revision and species descriptions done by Grimaldi (1987, 1990). Up to now, the genus includes 123 described species (Bächli 2006), most of them restricted to the Neotropics, where the genus originated, while few species were registered in other areas of the Earth (Grimaldi 1990).

The genus *Zygothrica* assembles species predominantly mycophagous (Malogolowkin 1952, Grimaldi 1987, 1990) and some flower-feeding species (Grimaldi 1987). However, most studies focusing on drosophilids use banana baits to attract the flies, since this strategy is very efficiently draws a considerable number of species, mainly *Drosophila*. Probably, this is the reason why *Zygothrica* species were not sampled or their abundances were so low that, in general, these flies were not identified to a specific level or were even neglected in most studies. This fact makes the ecology and biogeography of the genus *Zygothrica* poorly known.

The present paper extends the knowledge on the distribution of ten species of the genus *Zygothrica* and registers the southernmost occurrences so far observed for eight of them. Besides, ecological aspects are also briefly discussed.

## Material and Methods

Forested, coastal and urban areas in the State of Santa Catarina (Table 1), southern Brazil, were sampled during about four years (Table 2).

Collections were conducted using traps made according to the Tidon & Sene (1988) designs but with some modifications. Fly

identification was based on external morphology and mainly on the shape of male terminalia (males dissected according to Wheeler & Kambysellis 1966). Voucher specimens of the species collected are preserved in microvials (in ethanol 70°) or pinned. These specimens were deposited in reference collections at the Universidade Federal de Santa Catarina and Universidade Federal do Rio Grande do Sul.

## Results

More than 315.000 drosophilids were collected among the nine sampled sites during this four-year study, but only 137 specimens were assigned to *Zygothrica*. Among the 73 specimens of this genus identified (at the species level), 33 belonged to only one species, *Z. orbitalis* (Sturtevant 1916) (as *Z. parilis*), and the remaining individuals were assigned to nine other species. Six of these species were registered for the first time in the State of Santa Catarina (Table 3) and among these, only *Z. bilineata* (Williston 1896) had previously been registered anywhere else in southern Brazil (Grimaldi 1990). *Zygothrica hypandriata* Burla 1956, *Z. orbitalis* (as *Z. parilis*) and *Z. vittamaculosa* Burla 1956 have occurrences registered in Santa Catarina referred by Val & Kaneshiro (1988) while the record of *Zygothrica prodispar* Duda 1925 in this state was referred by Grimaldi (1987).

## Discussion

*Zygothrica apopoeyi* Burla 1956 and *Z. lanceolata* Burla 1956 were previously recorded just in Brazil (Burla 1956, Val & Kaneshiro 1988). *Zygothrica nigropleura* Grimaldi 1987 is only known from its type locality, in Brazil (Grimaldi 1987). These species were recorded in the southeastern area and, therefore, our data set represents the first record in southern Brazil for them.

In the same way, *Z. hypandriata* and *Z. vittamaculosa* were previously recorded only in Brazil, but these records occurred both in the southern and southeastern areas (Burla 1956, Val & Kaneshiro 1988).

**Table 1.** Collection sites, co-ordinates, and their respective environment types and preservation levels.

**Tabela 1.** Locais de coleta, coordenadas geográficas e seus respectivos tipos de ambiente e graus de preservação.

Sampled site	Co-ordinates	Environment	Preservation Level
A - Pirafá*	26° 17' 15" S and 49° 00' 56" W	Rain Forest	a
B - Unidade de Conservação Ambiental Desterro	27° 31' 26" S and 48° 30' 32" W	Rain Forest	b
C - Morro da Lagoa da Conceição	27° 35' 27" S and 48° 28' 33" W	Rain Forest	c
D - Morro da Cruz	27° 35' 04" S and 48° 31' 04" W	Rain Forest	d
E - Manguezal do Itacorubi	27° 34' 14" S and 48° 30' 33" W	Mangrove Forest	e
F - Manguezal do Rio Tavares	27° 39' 13" S and 48° 32' 12" W	Mangrove Forest	f
G - Restinga do Rio Tavares	27° 38' 21" S and 48° 27' 49" W	Strand Forest	g
H - Campus Universitário UFSC	27° 36' 13" S and 48° 31' 22" W	Urban	h
I - Brigada Motorizada do Exército	27° 35' 27" S and 48° 33' 02" W	Urban	h

\*This is the only continental site, the others are insular ones. a) Well-preserved area, in advanced condition of regeneration, with very low human influence; b) Well-preserved area, in advanced condition of regeneration, with low human influence; c) Moderately preserved area, in advanced condition of regeneration, with moderate human influence; d) Area at an intermediary level of regeneration, with high human influence; e) Mangrove vegetation with high human influence; f) mangrove vegetation with low human influence; g) Strand (or "restinga") vegetation area with high human influence; and h) Cultivated vegetation area with high human influence.

**Table 2.** Sampling periods for each collection site.**Tabela 2.** Períodos de amostragem em cada local de coleta.

Season/Year	Period	Sampled sites*
Spring/2001	09 Oct.	A
Summer/2002	22 Jan.	A
Autumn/2002	19 May - 26 May	A, G
Winter/2002	21 Jul. - 07 Sep.	A, B, C, D, E, G, H, I
Spring/2002	07 Oct. - 22 Nov.	A, B, C, D, E, G, H, I
Summer/2003	17 Jan. - 11 Mar.	A, B, C, D, E, G, H, I
Autumn/2003	23 Apr. - 30 May	A, B, C, D, E, G, H, I
Winter/2003	21 Jul. - 29 Aug.	A, B, C, D, E, G, H, I
Spring/2003	21 Oct. - 02 Dec.	A, E, F, G
Summer/2004	20 Jan. - 24 Feb.	A, E, F, G
Autumn/2004	14 Apr. - 22 May	A, E, F, G
Winter/2004	23 Jul. - 09 Aug.	A, E, F
Spring/2004	26 Oct. - 04 Nov.	A, E, F
Summer/2005	24 Jan. - 28 Feb.	A, E, F
Autumn/2005	18 Apr. - 22 Apr.	E, F
Winter/2005	26 Jul. - 30 Jul.	E, F

\* Sampled sites according to Table 1.

**Table 3.** Temporal and spatial occurrence of species of the genus *Zygothrica* recorded in the state of Santa Catarina.**Tabela 3.** Ocorrência temporal e espacial das espécies do gênero *Zygothrica* registradas no estado de Santa Catarina.

Species	Season/Year, Site, and Absolute Abundance
<i>Z. apopoeyi</i> <sup>1</sup> Burla, 1956	wi03 - A(1); sp04 - A(1)
<i>Z. bilineata</i> <sup>2</sup> (Williston, 1896)	wi02 - B(1); au03 - D(1); su05 - A(3)
<i>Z. dispar</i> <sup>1</sup> (Wiedemann, 1830)	au03 - A (1), D(6); wi05 - F(3)
<i>Z. hypandriata</i> Burla, 1956	sp04 - A(2)
<i>Z. lanceolata</i> <sup>1</sup> Burla, 1956	au03 - A(2)
<i>Z. nigropleura</i> <sup>1</sup> Grimaldi, 1987	au03 - A(1)
<i>Z. orbitalis</i> (Sturtevant, 1916)	wi02 - E(1), G(8), H(1); sp02 - D(1), I(1); au03 - C(3), D(1), G(1), H(6); wi03 - B(2); sp03 - E(1); wi04 - A(5), F(1); wi05 - E(1)
<i>Z. poeyi</i> <sup>1</sup> (Sturtevant, 1921)	wi02 - A(2); sp03 - A(1); sp04 - A(1)
<i>Z. prodispar</i> Duda, 1925	au03 - D(2); au05 - F(1)
<i>Z. vittimaculosa</i> Burla, 1956	sp01 - A (1); wi02 - E(3), H(1); sp02 - D(1); su03 - I(2); au03 - A(1), D(1); sp03 - A(1)

The lower-case letters represent the seasons (wi - Winter, sp - Spring, su - Summer, au - Autumn); the numbers following represent the year (p.ex., 01 - 2001, 02 - 2002); the upper-case letters represent the sites (according to Table 1) and the numbers between brackets stand for the absolute abundance at each collection site. First records in: <sup>1</sup>southern Brazil and <sup>2</sup>state of Santa Catarina.

On the other hand, *Z. orbitalis* were collected in northern Brazil, as *Z. ochracea* (Frota-Pessoa 1951, Bächli 1988), southeastern, as *Z. parilis* (Burla 1956, Val & Kaneshiro 1988) and *Z. nitidifrons* (Burla 1954), and southern regions of the country, as *Z. parilis* (Val & Kaneshiro 1988). This species were also collected in Panama (Grimaldi 1987) and Peru (as *Z. nitidifrons* Duda 1927).

*Zygothrica bilineta* specimens have been collected from southern South America (southernmost state of Brazil, Rio Grande do Sul) to northern Central America. According to Grimaldi (1990), this species spreads over Bolivia, Brazil, Colombia, Peru, and several countries of Central America. This species and *Z. hypandriata* were the only ones collected by us to present previous records more to the south than the record made in our study.

*Zygothrica dispar*, *Z. poeyi* and *Z. prodispar* present a wide geographical distribution. The first of these, whose geographical distribution ranges from Mexico to Brazil (Burla 1956, Grimaldi 1987, Val & Kaneshiro 1988, and others), had not been collected in southern Brazil before. *Zygothrica poeyi*, predominantly recorded in Central America (Duda 1925, Patterson & Mainland 1944, Heed 1957) but also in Peru (Duda 1927) and Brazil (Burla 1956), had never been registered in southern Brazil either. *Zygothrica prodispar*, which spreads from southern North America to southern Brazil (Grimaldi 1987), had already been recorded in the State of Santa Catarina (Grimaldi 1987) but more to the north (27° 11' S) than in the present study.

According to Val & Kaneshiro (1988), *Zygothrica parapoeyi* Burla 1956, *Z. parvipoeyi* Burla 1956, *Z. ptialialis* Burla 1956, *Z. subcandens* Burla 1956, and *Z. vittisecta* Burla 1956 were also recorded in the state of Santa Catarina. So, up to now, there are 15 species registered for this area in Brazil.

All the collected species of *Zygothrica* were recorded at such a little number of individuals that their records might be considered casual. This small number of specimens, however, may not reflect the true size of the population, but may be a consequence of the collection method, since species of *Zygothrica* are predominantly mycophagous (Malogolowkin 1952, Grimaldi 1987, 1990).

Fifty-seven individuals (78%) were captured in winters and springs, suggesting that there might be a biotic or abiotic factor influencing the number of flies factually captured, such as shortage of food or the existence of stressful environment. Tidon (2006) suggested that this last factor might favor migrations of drosophilids, which may increase the capture of flies. Wheeler (1952), in a study that investigated the mycophagous genus *Leucopenga* (Diptera, Drosophilidae), stated that "in times of severe drought, when it may be assumed that the usual feeding sources are absent or nearly so, these flies will come to banana-baited traps fairly readily". If this statement is valid to *Zygothrica*, it could explain the temporal distribution observed in our data set.

The species of *Zygothrica* are forest-dwelling species, and are usually considered sensitive to wide fluctuations in abiotic factors (Parsons 1991). Indeed, five species were restricted to site A, the most well-preserved studied site, and most individuals have been collected in forests. Nevertheless, it is important to highlight that four species were also captured within urban or xeric environments, which may indicate a higher tolerance and a wider ecological versatility, as opposed to what has previously been thought, at least for some species. Among these, *Z. dispar* and *Z. prodispar* were collected in mangrove forests; *Z. vittimaculosa* was captured in the strand forest, in a mangrove forest and in the urban environment; and *Z. orbitalis* was observed in all collection sites. Therefore, these results reinforce the idea that the knowledge on the species of this genus needs to be further increased.

Although a suitable collection method for the study of *Zygothrica* has not been used, our data set improves the knowledge on the geographical distribution of ten species of this genus and provides new insights on the ecology of this genus. This observation provides important support for the knowledge on the diversity in the Atlantic Rain Forest, one of the more speciose hotspots in the world (Myers et al. 2000).

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