

First record of *Zaprionus indianus* (Diptera, Drosophilidae) in the State of Santa Catarina, Brazil

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Resumo

Neste trabalho, é relatado o primeiro registro do gênero *Zaprionus* (Diptera, Drosophilidae) para o Estado de Santa Catarina, na região litorânea que inclui as Ilhas de: Santa Catarina, Arvoredo, Ratones Grande, Ratones Pequeno e Campeche. Esse registro pode auxiliar no monitoramento do impacto da colonização destes ambientes por essa mosca sobre as comunidades endêmicas de moscas, especialmente as da Família Drosophilidae, muito abundantes nessas ilhas que são parcial ou totalmente cobertas por vegetação de Mata Atlântica. Embora tenha sido detectado um pequeno aumento na frequência de *Z. indianus* entre amostras obtidas entre janeiro e abril de 2000, o número de entidades (espécies e sub-grupos de espécies) de Drosophilidae parece ter sido preservado.

Unitermos: *Zaprionus indianus*, Drosophilidae, Estado de Santa Catarina, ilhas.

Summary

This article reports, for the first time, the occurrence of a member of the genus *Zaprionus* (Diptera, Drosophilidae), *Zaprionus indianus*, in the State of Santa Catarina, on the Atlantic islands of Santa Catarina, Arvoredo, Ratones Grande, Ratones Pequeno and Campeche, in Southern Brazil. This finding could help in monitoring the impact of the introduction and colonization of this fly on the local community of flies, especially those of the family Drosophilidae, highly abundant on these islands which are partially or totally covered by the typical vegetation of the Atlantic Forest. Although we detected a slight increase in the frequency of *Z. indianus* in the samples obtained from January to April 2000, the absolute number of species and species groups of Drosophilidae appeared to be preserved.

Key words: *Zaprionus indianus*, Drosophilidae, Santa Catarina State, islands.

Introduction

The genus *Zaprionus* Coquillett, 1901 (Diptera, Drosophilidae), is composed of two subgenera and a total of 56 species, from which *Zaprionus indianus* seems to be unique since it colonizes several tropical areas of the world, probably due to the intensification of global fruit commerce (Karan et al., 1999; Vilela et al., 1999).

The first report of *Z. indianus* Gupta, 1970 (Diptera, Drosophilidae), on the American continent, was made by Vilela (1999) in a sample of flies attracted by *Dyospiros kaky* in Santa Isabel county, in the State of São Paulo, Brazil. This fly, of African origin, has recently been introduced into Brazil, South America. Probably due to the favorable environmental conditions, it has acquired the status of a pest in the main area of fig plantation in the Brazilian State of São Paulo (Vilela et al., 1999).

The present report has the aim of contributing to the knowledge of the process of colonization of *Z. indianus* in South America, thus helping to monitor its consequences on the native neotropical fauna of Drosophilidae.

Material and Methods

Zaprionus indianus is a fly of roughly 2.5-3.0 mm in length with a brown-colored body, red eyes, and a pair of conspicuous longitudinal white-silver stripes with black margins along the dorsal region of the head and thorax (Gupta 1970; Vilela et al., 1999). This description corresponds to the aspect of the specimens collected in our samples shown in figure 1.



FIGURE 1: Aspect of *Zaprionus indianus* collected on the Atlantic islands of the State of Santa Catarina, Southern Brazil.

Adult Drosophilids were caught when flying around rotting fruits and banana baits, while preadult specimens emerged in the laboratory from the fruits of both exotic and native trees. All these samples were collected during the period from December 1999 through April 2000 in the State of Santa Catarina, Southern Brazil. In this Brazilian State, the four seasons of the year are

well defined, thus justifying the performance of seasonal sampling in order to monitor the dynamics of the fly communities.

Collection trips were made to the following Atlantic islands of Santa Catarina State in Southern Brazil: Santa Catarina Island (27° 42'S; 48° 30'W); Ratonas Grande Island (27° 29' 30" S; 48° 36'42"W); Ratonas Pequeno Island (27° 29'31" S; 48° 34'04"W); Campeche Island (27° 41'S; 48° 28'W), close to Santa Catarina Island, and Arvoredo Island (27° 17'S; 48° 21'W).

Samples of the specimens analyzed were deposited in the Drosophilidae entomological collection (*Drosophila* Laboratory) at the Universidade Federal de Santa Catarina.

Results and Discussion

The first 10 specimens of *Z. indianus* were collected in a sample of flies flying over fruits of the exotic plant *Aleurites mollucana* in Morro da Lagoa da Conceição (Santa Catarina Island), a suburban locality partially covered by vestiges of the Atlantic Forest, in December 1999. After this finding, *Z. indianus* were collected in samples from the islands of Arvoredo and Campeche in January 2000, and on the Ratonas Grande and Ratonas Pequeno islands, in April 2000 (Table 1).

Zaprionus indianus also emerged from fruits of the native *Syagrus romanzoffiana*, showing the generalist feature of this fly, capable of successfully exploring substrates preferentially used by native species of the genus *Drosophila* (Table 1), such as those of the subgroup *willistoni*, or of the *D. cardini* or *D. tripunctata* groups.

TABLE 1 – Number of adult specimens of *Drosophila* spp. collected on/or emerging from different natural resources in the localities surveyed in Santa Catarina State. The resources were used as breeding and/or feeding sites. The individuals of *D. willistoni* and *D. paulistorum* (Subgroup *willistoni*) were not identified at the species level.

Locality	Resource	Date (month. year)	Species	Collected		Emergед	
				N	%	N	%
Canto da Lagoa	<i>Alleurites mollucana</i>	Dec./1999	<i>D. cardinoides</i>	39	33	-	-
			<i>D. griseolineata</i>	3	2	-	-
			<i>D. mediotriata</i>	3	2	-	-
			<i>D. mercatorum</i>	3	2	-	-
			<i>D. simulans</i>	32	26	-	-
			<i>D. zotti</i>	1	.08	-	-
			<i>S. g. willistoni</i>	10	8	-	-
			<i>Zaprionus indianus</i>	32	26	-	-
Arvoredo Island	Banana Baits	Dec./1999	<i>D. atrata</i>	3	1	-	-
			<i>D. fumipennis</i>	5	1	-	-
			<i>D. griseolineata</i>	20	4	-	-
			<i>D. paraguayensis</i>	21	5	-	-
			<i>D. mercatorum</i>	12	3	-	-
			<i>D. latifascieformis</i>	1	0	-	-
			<i>D. neocardini</i>	11	2	-	-

Continue

Continuation

			<i>D. onca</i>	3	1	-	-
			<i>D. polymorpha</i>	32	7	-	-
			<i>D. prosaltans</i>	1	0	-	-
			<i>D. serido</i>	2	0	-	-
			<i>D. simulans</i>	9	20	-	-
			<i>D. sturtevantii</i>	18	4	-	-
			<i>S. g. willistoni</i>	221	48	-	-
			sp. 1	2	0	-	-
			sp. 2	1	0	-	-
			<i>Zaprionus indianus</i>	17	4	-	-
Arvoredo Island	Banana Baits	Apr./2000	<i>D. atrata</i>	1	0	-	-
			<i>D. fradilis(df.)</i>	1	0	-	-
			<i>D. griseolineata</i>	180	14	-	-
			<i>D. paraguayensis</i>	47	4	-	-
			<i>D. mercatorum</i>	5	0	-	-
			<i>D. latifascieformis</i>	1	0	-	-
			<i>D. neocardini</i>	5	0	-	-
			<i>D. onca</i>	2	0	-	-
			<i>D. pallidipenis</i>	1	0	-	-
			<i>D. platitersus</i>	1	0	-	-
			<i>D. simulans</i>	690	56	-	-
			<i>D. sturtevantii</i>	11	1	-	-
			<i>S. g. willistoni</i>	155	12	-	-
			<i>Dithoneura</i>	2	0	-	-
			<i>D. polymorpha</i>	23	2	-	-
			<i>Zaprionus indianus</i>	75	6	-	-
			<i>Zygotricha</i>	1	0	-	-

Continue

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Continuation

Arvoredo Island	<i>Psidium</i> <i>guayava</i>	Apr./2000	<i>D. kikkawai</i>	-	-	1	2
			<i>D. simulans</i>	-	-	8	17
			<i>S.g. willistoni</i>	-	-	38	79
			<i>Zaprionus indianus</i>	-	-	1	2
Campeche Island	Banana Baits	Dec./1999	<i>D. atrata</i>	1	0	-	-
			<i>D. bromelioides</i>	8	2	-	-
			<i>D. capricorni</i>	1	0	-	-
			<i>D. griseolineata</i>	12	3	-	-
			<i>D. immigrans</i>	7	2	-	-
			<i>D. paraguayensis</i>	1	0	-	-
			<i>D. mediotriata</i>	37	9	-	-
			<i>D. mercatorum</i>	19	4	-	-
			<i>D. neocardini</i>	49	11	-	-
			<i>D. onca</i>	3	1	-	-
			<i>D. polymorpha</i>	23	5	-	-
			<i>D. prosaltans</i>	1	0	-	-
			<i>D. sellata</i>	1	0	-	-
			<i>D. simulans</i>	57	13	-	-
			<i>D. sturtevanti</i>	4	1	-	-
			<i>D. zotti</i>	1	0	-	-
			<i>S. g. willistoni</i>	196	45	-	-
			<i>Zaprionus indianus</i>	4	1	-	-
Campeche Island	Banana Baits	Apr./2000	<i>D. atrata</i>	1	0	-	-
			<i>D. griseolineata</i>	2	0	-	-
			<i>D. kikkawai</i>	2	0	-	-
			<i>D. malerkotliana</i>	1	0	-	-

Continue

Continuation

			<i>D. mediopunctata</i>	1	0	-	-
			<i>D. paraguayensis</i>	1	0	-	-
			<i>D. mediotriata</i>	11	2	-	-
			<i>D. mercatorum</i>	3	1	-	-
			<i>D. neocardini</i>	18	2	-	-
			<i>D. polymorpha</i>	22	5	-	-
			<i>D. quadrum</i>	1	0	-	-
			<i>D. hydei</i>	1	0	-	-
			<i>D. simulans</i>	129	27	-	-
			<i>D. sturtevantii</i>	4	1	-	-
			<i>D. zotti</i>	1	0	-	-
			<i>S. g. willistoni</i>	271	56	-	-
			<i>Zaprionus indianus</i>	15	3	-	-
Campeche Island	<i>Syagrus romanffiana</i>	Apr. /2000	<i>D. busckii</i>	-	-	1	0
			<i>D. fumipennis</i>	-	-	3	0
			<i>D. griseolineata</i>	-	-	12	1
			<i>D. kikawai</i>	-	-	2	0
			<i>D. malkotiana</i>	-	-	2	0
			<i>D. mediopunctata</i>	-	-	2	0
			<i>D. paraguayensis</i>	-	-	44	3
			<i>D. mediotriata</i>	-	-	77	5
			<i>D. nebulosa</i>	-	-	1	0
			<i>D. neocardini</i>	-	-	9	1
			<i>D. polymorpha</i>	-	-	18	1
			<i>D. onca</i>	-	-	12	1
			<i>D. simulans</i>	-	-	405	24
			<i>D. sturtevantii</i>	-	-	4	0
			<i>S. g. willistoni</i>	-	-	938	55
			<i>Zaprionus indianus</i>	-	-	177	10

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Continuation

Campeche Island	Citrus sp	Apr./2000	<i>D. onca</i>	-	-	2	
			<i>D. pallidipennis</i>	-	-	2	15
			<i>D. simulans</i>	-	-	6	46
			<i>Zaprionus indianus</i>	-	-	15	23
Campeche Island	<i>Averrhoa carambola</i>	Apr./2000	<i>D. malerkotliana</i>	-	-	7	3
			<i>D. paraguayensis</i>	-	-	1	0
			<i>D. mediotriata</i>	-	-	4	2
			<i>D. onca</i>	-	-	2	1
			<i>D. simulans</i>	-	-	128	62
			<i>S. g. willistoni</i>	-	-	51	25
			<i>Zaprionus indianus</i>	-	-	11	5
Campeche Island	" <i>Solanum reitzii</i> "	Apr. /2000	<i>D. cardinoides</i>	-	-	25	30
			<i>D. paraguayensis</i>	-	-	1	1
			<i>D. simulans</i>	-	-	53	65
			<i>Zaprionus indianus</i>	-	-	3	4
Ratones Pequeno Island	Banana Baits	Apr. / 2000	<i>D. atrata</i>	1	0	-	-
			<i>D. bandeirantorum</i>	3	0	-	-
			<i>D. capricorni</i>	2	0	-	-
			<i>D. griseolineata</i>	112	14	-	-
			<i>D. malerkotliana</i>	9	1	-	-
			<i>D. mediopunctata</i>	35	4	-	-
			<i>D. paraguayensis</i>	14	2	-	-
			<i>D. mediotriata</i>	4	0	-	-
			<i>D. mercatorum</i>	7	1	-	-

Continue

Continuation

			<i>D. neocardini</i>	2	0	-	-
			<i>D. onca</i>	2	0	-	-
			<i>D. polymorpha</i>	109	13	-	-
			<i>D. sellata</i>	13	2	-	-
			<i>D. serido</i>	2	0	-	-
			<i>D. simulans</i>	5	1	-	-
			<i>D. sturtevantii</i>	10	1	-	-
			<i>D. tarsata</i> (cf.)	1	0	-	-
			<i>S. g. willistoni</i>	488	59	-	-
			<i>Zaprionus indianus</i>	4	0	-	-
						-	
Ralones	Banana Baits	Apr. / 2000	<i>D. bandeirantonum</i>	1	0	-	-
Grande							
Island							
			<i>D. capricorni</i>	4	1	-	-
			<i>D. fumipennis</i>	1	0	-	-
			<i>D. griseolineata</i>	2	0	-	-
			<i>D. hydei</i>	1	0	-	-
			<i>D. malerkotliana</i>	1	0	-	-
			<i>D. paraguayensis</i>	1	0	-	-
			<i>D. mediotriata</i>	2	0	-	-
			<i>D. mercatorum</i>	5	1	-	-
			<i>D. neocardini</i>	9	2	-	-
			<i>D. polymorpha</i>	64	12	-	-
			<i>D. prosaltans</i>	4	1	-	-
			<i>D. sellata</i>	1	0	-	-
			<i>D. simulans</i>	45	8	-	-
			<i>S. g. willistoni</i>	400	72	-	-
			<i>Gitona</i>	1	0	-	-
			<i>Zaprionus indianus</i>	9	2	-	-

Continue

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Continuation

Ratones Grande Island	Syagrus romanzoffiana	Apr. / 2000	<i>D. griseolineata</i>	-	-	2	0
			<i>D. malerkotliana</i>	-	-	162	6
			<i>D. polymorpha</i>	-	-	6	0
			<i>D. simulans</i>	-	-	2224	83
			<i>S. g. willistoni</i>	-	-	264	10
			<i>Gitona</i>	-	-	1	0
			<i>Zaprionus indianus</i>	-	-	14	1
			<i>Zygotricha</i>	-	-	1	0
				-	-		
Ratones Grande Island	Psidium guayava	Apr. / 2000	<i>D. malerkotliana</i>	-	-	14	48
			<i>D. simulans</i>	-	-	15	52
			<i>Zaprionus indianus</i>	-	-	13	45

S. g. = sub group; sp.1 e sp. 2 = unidentified species

In general, in all places and substrates surveyed, the percentages of *Z. indianus* sampled increased slightly from January to April 2000. The absolute number of entities (species or species groups), however, does not appear to be highly affected by the introduction of *Z. indianus* so far. However, only continuous sampling throughout the seasons would be capable to revealing the impact of this invader species on the composition of the native *Drosophilid* communities.

Up to the present, *Z. indianus* has been found in several locations of São Paulo State (Vilela 1999; Vilela et al., 1999), but this is the first record of the genus *Zaprionus* in Santa Catarina State. It is opportune to indicate that we have been regularly collecting and studying the *Drosophila* communities in seasonal samples since July

1997, both on the islands and the mainland of the State of Santa Catarina (De Toni, 1998). During this time, we have collected more than 43,000 flies both in banana baits and in 27 plant substrates. These flies were classified up to the species level, but no specimens of *Zaprionus* were ever sampled in this area.

Colonization events are important not only because they represent an opportunity to study evolution, but also because they may represent a potential danger to the stability of the native communities of animals and plants. In the last decades, several examples of colonizing flies on Neotropical fauna have been reported. For instance, the Asiatic *Drosophila malerkotliana* was successfully introduced into Brazilian areas covered by open vegetation (Sene and Val, 1977; Sene et al., 1980; Val and Sene, 1982). In the 1980s, Martins (1989) detected this species in the Amazonian forest. Since then, *D. malerkotliana* has been increasingly found in *Drosophila* communities sampled firstly on the forest borders, and subsequently in fragments of Amazonian forest, altering the frequencies of the native and dominant species such as those of the subgroup *willistoni* (Martins, 1996).

A similar situation occurred with the palearctic *D. subobscura* which successfully colonized South America, in Chile since 1978 (Brncic and Budnik, 1980; Brncic et al., 1981), Argentina (Lopez, 1985) and Uruguay (Goñi and Martinez, 1995), and additionally in North America since 1982 (as reviewed by Ayala et al., 1989). In Chile, *D. subobscura* quickly expanded its territory, occupying vacant niches, not exploited by the endemic and established species. It seems that this species is currently expanding its distribution southeastwards and northwards in Southern South America, as indicated by records that have successively been available during the two last decades (Beckenbach and Prevosti, 1986, apud Goñi et al., 1998). The appearance of new variants of several genetic markers (enzymatic loci, chromosomal inversions, morphometric traits) suggests genomic adjustment to the new environment followed by selective effects.

Pinto et al. (1997) and Khadem et al. (1998) studied the genetic and molecular characteristics of the *D. subobscura* populations that colonized the Canaries and Madeira Islands. They observed that the colonization of these islands by *D. subobscura* is consistent with a stepping-stone model of directional east-west migration.

Fontdevila et al. (1981, 1982) studied, from several approaches, other invading species, such as *D. buzzatii* endemic from the Neotropical region which was introduced into the Palearctic region. The success of this colonization event was accomplished by the maintenance of high levels of genetic variability, expressed by different frequencies of variants (inversions, in this particular case found in the original South American populations).

These studies could be used to support future research on the evolution of this fly in Neotropical environments.

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