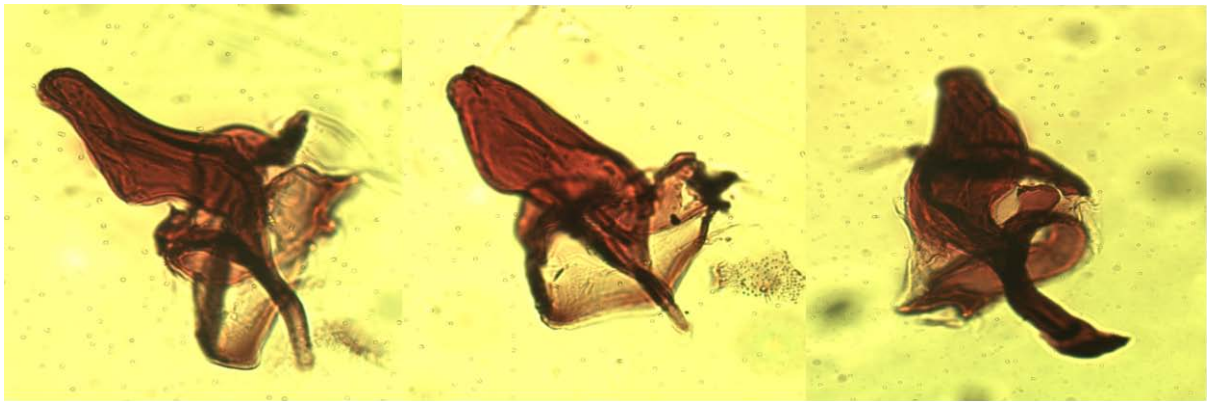

Figure 3. Lateral, dorsum-lateral, and lateral-ventral views from aedeagus of *Drosophila carcinophila.*

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First record of *Drosophila suzukii* in the Brazilian Savanna.

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Introduction

Drosophilid species are not usually considered pests, because they consume microorganisms associated with tissue decay. In the Neotropics, these flies normally infest overripe, fallen, decaying fruits. Some species, however, lay their eggs inside sound fruits before harvest. This is the case of *Zaprionus indianus*, which established itself in South America in the late 20th century and emerged as a pest due to the significant economic damage it caused in fig plantations (Vilela, 1999; Stein *et al*., 2003). In February 2013, another exotic species able to lay eggs inside healthy fruit was documented for the first time in South America: *Drosophila suzukii* Matsumura (Deprá *et al*., 2014). This latter species is considered a pest of soft-skinned fruit crops in a number of countries, because it infests a wide host range using its characteristic serrated ovipositor (Mitsui *et al*., 2006). Estimations of losses due to *D. suzukii*, only for three northwestern states in the USA, reached U$511 million, certainly adding substantial costs to fruit production (Werts and Green, 2014).

Drosophila suzukii, an Oriental species from the *D. melanogaster* group, is also known as Spotted Wing *Drosophila* due to the dark spots on male wings (Acheapong, 2010). In 2008 it invaded Europe, and two years later it arrived in North America (Rota-Stabelli *et al*., 2013). The first occurrences in Brazil, in late 2013, were recorded in southern states, where the climate is subtropical according to Köppen's classification (Deprá *et al*., 2014). In this study, we document *D. suzukii* in the Brazilian Savanna, a tropical biome located in the center of South America.

Materials and Methods

The Brazilian savanna, locally known as the Cerrado biome, covers most of the interior of Brazil and consists of savanna of quite variable structure on well-drained terrain, with forests or other moist vegetation

following the watercourses (Oliveira-Filho and Ratter, 2002). Fieldwork was conducted in the IBGE Ecological Reserve (15º56'S; 47º53'W), a part of an environmental protection area extending over 10,000 ha and located 35 km south of Brasilia, the capital of Brazil. We have been collecting drosophilid communities in this reserve since 1998, and from 2012 we have been monitoring these assemblages bimonthly, using an experimental design of 90 banana-baited traps (Roque *et al*., 2011) that remain in the field for four days. These traps are distributed, as replicates, in forest and savanna vegetation.

The drosophilids captured in this study were transported live to the laboratory and identified by identification keys, descriptions, and in some cases, by the male terminalia (Dobzhansky and Pavan, 1943; Freire-Maia and Pavan, 1949; Pavan and Cunha, 1947; Val, 1982; Vilela and Bachli, 1990; Vilela, 1992; Walsh *et al.*, 2011).

Results

In December 2013, we captured 12,120 specimens in our traps, among them a male of *Drosophila suzukii* recognized by its spotted wings (Figure 1). This was the first record of this species in the Brazilian Savanna. In February 2014, we did not find any specimen of *D. suzukii* among the 16,700 individuals and 41 species identified in this collection, but two months later (April) we captured a female characterized by its distinctive saw-like ovipositor. Both the male and the female were collected in savanna vegetation. In the collections of June, August, and October (2014) we did not catch any specimen of *D. suzukii*. Table 1 shows a summary of these collections.

Exotic species accounted for 47% of the sample collected from October 2013 to August 2014 and were mostly represented by *Zaprionus indianus* (29%), *Drosophila simulans* (10%), and *D. malerkotliana* (7%). The most abundant Neotropical species were those of the *D. willistoni* subgroup (38%) and *D. sturtevanti* (10%). The remaining Neotropical species (41 nominal species and 27 morphospecies) altogether contributed the remaining 5% of the specimens.

Table 1. Abundance of drosophilids from gallery forests (45 traps) and savannas (45 traps) in the IBGE Ecological Reserve, from October 2013 to August 2014.

	Oct	Dec	Feb	Apr	Jun	Aug	Total
Sgr. Drosophila willistoni	4	527	9739	3765	115	4	14154
*Zaprionus indianus**	7	10235	375	112	52	93	10874
*D. simulans**	32	772	719	89	95	2008	3715
D. sturtevanti	1	204	2453	551	318	40	3567
*D. malerkotliana**	0	86	2605	40	2	1	2734
*Scaptodrosophila latifasciaeformis**	0	4	44	12	2	0	62
*D. immigrans**	0	25	8	1	0	1	35
*D. ananassae**	0	1	1	2	0	0	4
*D. kikkawai**	0	2	0	1	1	0	4
*D. busckii**	0	0	0	1	0	1	2
*Drosophila suzukii**	0	1	0	1	0	0	2
Other Neotropical species	79	263	756	364	130	160	1764
TOTAL	123	12120	16700	4939	715	2308	36917

**Exotic species*

Discussion

The Brazilian Savanna is a hotspot of biodiversity, due to its high plant endemism and anthropogenic threats. We have been collecting drosophilids in this region since 1998, especially in the IBGE Ecological Reserve (Tidon *et al.*, 2003; Tidon, 2006; Mata *et al.*, 2008; Roque and Tidon, 2008; Roque *et al.*, 2013), and currently there are 128 species of Drosophilidae recorded in this biome (Roque and Tidon, 2013). It is worrying that during the period of this study (2013-2014) almost half of the drosophilid specimens belonged to exotic species. *Zaprionus indianus*, *Drosophila simulans*, and *D. malerkotliana* have spread not only to the

Brazilian Savanna, but also to several other Neotropical biomes (Gottschalk *et al.*, 2008). Therefore, they have reached the status of invasive species. On the other hand, the other exotic species are locally rare and/or geographically restricted; they have not spread and nor do they dominate Neotropical drosophilid assemblages. The fate of *D. suzukii* is still uncertain. In Brazil and in other areas invaded by this species, the first records were near seaports, suggesting that propagules arrived as immature stages in fruits imported from Asia (Rota-Stabelli, 2013). Nevertheless, our collection sites are at least 1,000 km from the nearest seaport, on the Atlantic coast. Therefore, these propagules could have dispersed from southern Brazil or from North America.

Figure 1. Male of *Drosophila suzukii* collected in the Brazilian Savanna.

It is possible that the presence of *D. suzukii* in our traps was occasional, since we captured only two specimens and *D. suzukii* seems to prefer a moderate climate (Walsh *et al*., 2011; Deprá *et al*., 2014). However, this species can be considered highly thermal tolerant because viable populations resist hot summers in Spain as well as cold mountain regions in Japan (Cini *et al*., 2012). It is possible that, like *Zaprionus indianus* (Mata *et al*., 2010), *D. suzukii* can change its ecological niche and establish viable populations in this savanna area.

The drosophilid populations in the Brazilian savanna, for most species, occur from December to April, when there are more breeding sites available due to the rainy season. As we are monitoring the IBGE Ecological Reserve every two months, we will be able to detect if the presence of *D. suzukii* in these assemblages was occasional or if it is establishing itself in the center of the Neotropical Region.

Acknowledgments: We are grateful to the Universidade de Brasília and Reserva Ecológica do IBGE for logistical support. This work was funded with grants from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

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