highly urbanized areas, nine (43%) of the 21 species of Drosophilidae and 450 (62%) of the 721 sampled specimens are represented by invasive species. The nine invasive species, in decreasing order of abundance, are as follows: *Drosophila simulans*, *D. nasuta*, *D. immigrans*, *D. malerkotliana*, *Zaprionus indianus*, *D. hydei*, *Scaptodrosophila latifasciaeformis*, *D. kikkawai*, and *D. melanogaster*. The capture of 76 (32 males: 44 females) specimens belonging to *Drosophila nasuta*, an invasive species registered for the first time in the Americas five months earlier, in March 2015 (Vilela and Goñi 2015), is suggestive that it has become established in the surveyed area. It was the second most abundant invader, surpassed only by *D. simulans*, with 162 sampled specimens.

Females of *Drosophila malerkotliana* and *Drosophila ananassae* Doleschall, 1858 are siblings and cannot be reliably separated from each other on morphological grounds. As not even a single male of *D. ananassae* was collected and 34 males of *D. malerkotliana* were sampled among a total of 721 captured drosophilids, it is assumed that the 32 of their females belonged to the latter species. Collections made indoors, mainly in kitchens, in the city of São Paulo (C.R. Vilela, unpublished data) have shown that *D. ananassae* is the second most abundant species only surpassed by *D. melanogaster*, the two species being considered strictly domestic, in the sense they are commonly found indoors, and very, very rarely collected outdoors. Similar condition can be observed in Table 1, regarding the sibling pair *D. simulans*/*D. melanogaster*, where 162 flies were identified as belonging to the first species and only two to the latter. Vilela and Goñi (2015) collected three males of *D. ananassae* from garbage cans in a place (coded M59) adjacent to the present surveyed area (coded M62), but it should be pointed out that although not stated by those authors the cans were standing in a shed behind the cafeteria, therefore partially indoors.

No attempts were made to individually identify *Drosophila willistoni* and *D. paulistorum*, a pair of sibling species, whose anesthetized males can be told apart by means of the analyses of their terminalia (genital chamber contour and the shape and size of hypandrium lobes), provided the aedeagus is not extruded (refer to Spassky, 1957, Figures. 11 and 13 for details); however, this is a very time-consuming process.

It should be pointed out that given the sampling method (swept nets), it is impossible to say with certainty that all the collected species and specimens were really attracted to the fallen, mostly decaying *cajá-manga* fruits, although it is likely they were. There always is a possibility that some of the sampled flies were just flying around, resting on the surrounding vegetation or other overlooked fermenting substrates.

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Richness of drosophilids in a naturally radioactive place in the Caatinga biome, northeast Brazil.

Castro, I.F.A., C.J. Verçosa, R.D. Coutinho-Silva, G.F. Oliveira, A.C.L. Garcia, and C. Rohde*. Laboratório de Genética, Centro Acadêmico de Vitória, Universidade Federal de Pernambuco, Vitória de Santo Antão, 55608-680, Pernambuco, Brazil. *E-mail: claudia.rohde@yahoo.com.br

The Caatinga is a semiarid biome exclusive to Brazil. As the country's fourth largest plant physiognomy (Castelletti *et al.*, 2003), the Caatinga covers approximately 70% of the Brazilian northeast region (Bucher, 1982). The biome's climate is characterized my mean annual temperatures between 25ºC and 29ºC, and considerable oscillations are recorded in annual rainfalls, from 250 mm a year in some sub-regions during the dry season to 1,200 mm between May and August, the rainy period in the biome.

Located in the Caatinga, the urban area of the municipality of Lajes Pintadas (06°08'46,3''S, 36°06'52,5''W, Figure 1) stands out due to the exposure to high Radon radiation levels (Campos *et al*., 2011; Silva *et al*., 2014) from natural ionizing elements such as Uranium and Thorium (Silva *et al*., 2010). These elements and their byproducts are detected in granitic rocks in the Pegmatite Province of Borborema, which stretches across 10,000 km^2 in the Brazilian northeast (Scorza, 1944).

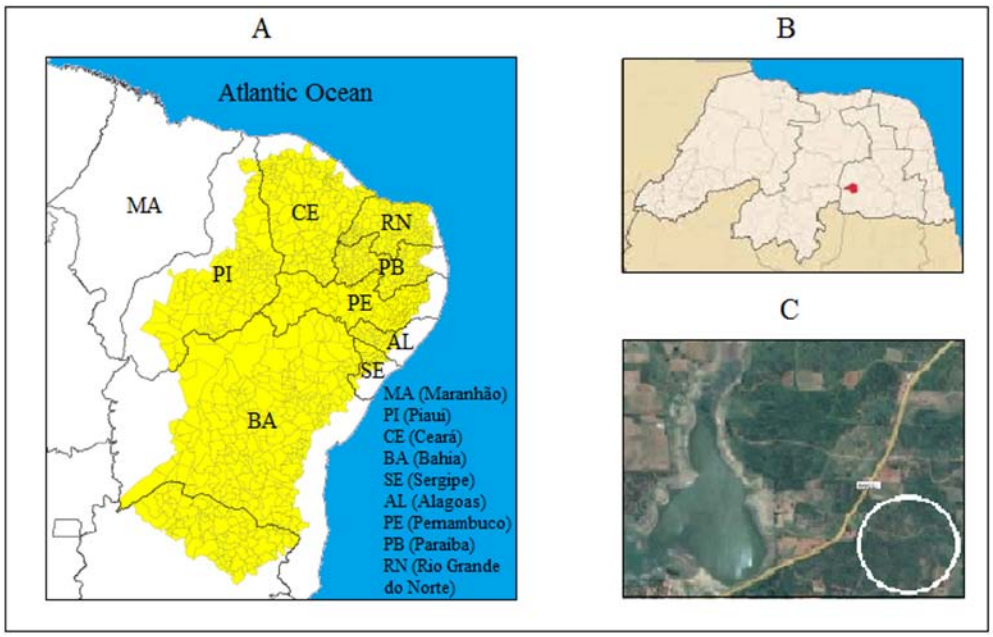

Figure 1. A, Map of the Brazilian northeast region, showing the semiarid zone in yellow. B, Map of the state of Rio Grande do Norte showing the municipality of Lajes Pintadas in red. C, Satellite image showing collection area covered in this study (white circle), near Riacho da Cachoeira, (rc), at 340 m.a.s.l.

As part of an ongoing project to examine the genotoxic effects of radiation on the genome of different drosophilid species in the region, the objective of this study was to investigate the richness and the abundance of drosophilid in Lajes Pintadas. According to Clements (2000) and Mussali-Galante *et al.* (2014), supplementing ecotoxicology data with population data at community and ecosystem levels is essential in any move towards improving robustness of ecological risk assessments. Therefore, here we present preliminary findings about drosophilid richness in this radioactive area of the Caatinga biome, with special emphasis on the abundance of *Zaprionus indianus*, an invader species.

Drosophilids were collected in July 2014 and June 2015 using twenty banana traps (Tidon and Sene, 1988) distributed in an open area distant 1 km from the town's urban area of Lajes Pintadas. The traps remained in place for two days, hanging 1.5 m above the ground and 30 m away from one another. Captured flies were stored in tubes containing ethanol 70% and subsequently identified morphologically. For the analysis of male terminalia of cryptic species, flies were immersed in potassium hydroxide (KOH) 10%, stained in acid fuchsine, and dissected in glycerol (Bächli *et al.*, 2004). The identification of females of cryptic species was carried out considering the proportion of males analyzed.

In total, 7,716 drosophilids of 18 species and five genera were collected (Table 1). *Zaprionus indianus* was the most abundant species (66.7%), followed by *Drosophila malerkotliana* (17.5%), both exotic species of Neotropical region. The other species had relative abundance of 15.8%, 12 of which are native to the Neotropical region: *D. serido*, *D. buzzatii*, *D. borborema*, and *D. mercatorum* (*repleta* group); *D. polymorpha* and *D. cardinoides* (*cardini* group); *D. nebulosa* and *D. willistoni* (*willistoni* group); and *D. sturtevanti* (*saltans* group).

Table 1. Drosophilid species collected listed by abundance during the 2-year collection period in Lajes Pintadas, Caatinga biome, Brazil.

Species	July 2014		July 2015		
	N	%	N	%	TOTAL
*Zaprionus indianus**	2,751	62.9	2,397	71.7	5,148
*Drosophila malerkotliana**	1,037	23.7	315	9.4	1,352
Drosophila serido	159	3.6	189	5.7	348
*Scaptodrosophila latifasciaeformis**	86	2.0	147	4.4	233
*Drosophila simulans**	151	3.4	57	1.7	208
Drosophila nebulosa	86	2.0	77	2.3	163
Drosophila buzzatii	10	0.2	79	2.4	89
*Drosophila melanogaster**	51	1.2	5	0.2	56
Rhinoleucophenga punctulata	12	0.3	20	0.6	32
Drosophila sturtevanti	10	0.2	14	0.4	24
Rhinoleucophenga trivisualis	3	0.1	13	0.4	16
Drosophila willistoni	8	0.2	5	0.2	13
Drosophila polymorpha	7	0.2	3	0.1	10
Drosophila borborema	-	-	10	0.3	10
Drosophila mercatorum	-	-	10	0.3	10
Rhinoleucophenga sp.	-	-	2	0.1	2
Drosophila cardinoides	-	-	1	0.03	1
Leucophenga sp.	-	-	1	0.03	1
Total	4,371		3,345		7,716
S	13		18		18

* Exotic species; *S*, species richness; N, absolute number of specimens; %, relative abundance.

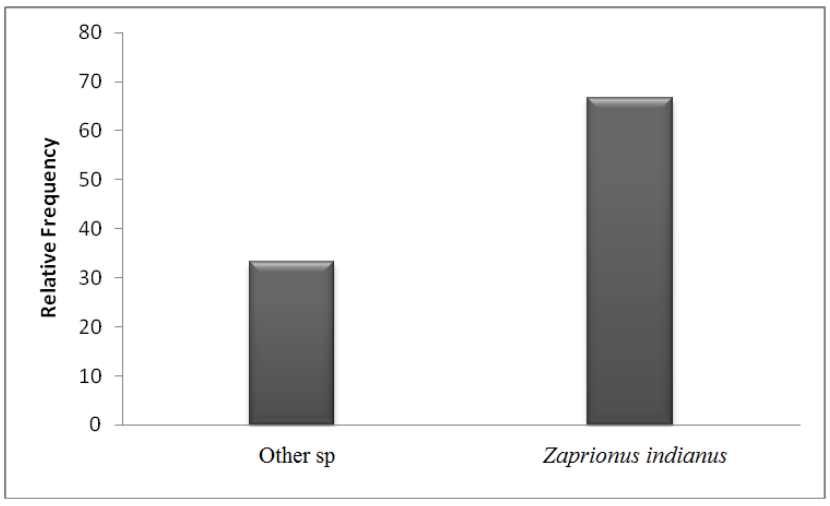

Figure 2. Relative abundance of *Zaprionus indianus* and other species in collections of Lajes Pintadas.

In addition to the considerable local species richness in Lajes Pintadas, the ecological dominance of *Z. indianus* deserves mention. Before a continuous invasion process in America spanning for the past 16 years, the species was first recorded in Brazil in the state of São Paulo in the end of the 1990s (Vilela *et al*., 1999). Since then it has expanded its distribution area, to the point that it was colonizing the states of Goiás in 1999 (Tidon *et al*., 2003), Pará in 2000 (Medeiros *et al*., 2003), and Rio Grande do Sul in 2001 (Castro and Valente, 2001) soon after its arrival to the country, making it a remarkable invader species. In the Brazilian northeast it was found for the first time the Caatinga biome in March 2000, in the municipality of Sobradinho, state of Bahia (Santos *et al*., 2003). Since then it has been collected in essentially all environments surveyed in the Brazilian northeast, even in the ocean island of Fernando de Noronha, located 340 km off the coast (Oliveira *et al*., 2009). However, never before has it been collected in the Brazilian northeast at such high abundance as observed in Lajes Pintadas, even in open environments such as the Caatinga (Santos *et al.*, 2003; Rohde *et al.*, 2010).

The colonization success by *Z. indianus* may be explained in light of a combination of genetic-adaptive traits such as the species' competence in using various food resources (Yassin and David, 2010) and its adaptive plasticity under a set of environmental conditions. Such combination is typically exhibited by a generalist species with remarkable competitive power (Parkash and Yadav, 1993; Setta and Carareto, 2005; Commar *et al.*, 2012). The present study shows that the species

has adapted well to environment with intense natural radiation, as observed in Lajes Pintadas. Such adaptation may indicate a given degree of radioresistance acquired recently, since the species' arrival in the last years in the region, in what should be more thoroughly investigated in future studies.

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Feeding behavior and nutrients act concertedly in determining fecundity and lifespan in *Drosophila nasuta nasuta.*

Neethu, B.K.[1], and B.P. Harini[1*]. [1]Department of Zoology, Bangalore University, Bangalore-560 056, Karnataka, India; e-mail: bpharini@ yahoo.co.in

Abstract

Feeding behavior is an important element in insects which involves the detection, the initiation of ingestion, and the consumption of food. The larval and adult stages of *Drosophila nasuta nasuta* were fed in combination of restricted glucose with varied concentrations of methionine. These enriched nutrients of restricted glucose and methionine showed greater influence on the fecundity of flies, and subsequently was less affected with respect to lifespan along with control and single concentrations of methionine. The gustatory feeding assay was performed in larval and adult stages with combination of restricted glucose and varied methionine concentrations and single methionine concentrations along with control. It revealed that the former diet has led to increased mortality, while decreased mortality with only methionine fed diet (*i.e.*, 0.03% g/L) in absence of glucose and were significant with control. Thus, the present study indicates that the feeding behavior and nutritional composition act concertedly to determine fecundity and lifespan. In addition, the flies fed *ad libitum* are capable of restricting their feeding behavior in response to their nutritional state.

Introduction