2004, Mutation Research 567: 1-61; Herbal Encyclopedia. Available: http://mysticways.wiki.zoho.com/Herbal-Encyclopedia---M.html. Accessed Mar 2013, 10; Vijg, J., 2007, Aging of the Genome: The Dual Role of DNA in Life and Death. New York: Oxford University Press; Koolhaas, J., 2011, Neuroscience and Biobehavioral Reviews 35: 1291–1301; Lowry, O.H., N.J. Rosebrough, A.L. Farr, and R.J. Randall 1951, Journal of Biological Chemistry 193: 265-275; Miller, Lyle H., and Alma Dell Smith 2013, Stress: different kinds of stress, American Psychological Association. Available: http://www.apa.org/helpcenter/stress-kinds.aspx. Accessed on Mar 2013, 10; Maehly, A., and B. Chance 1954, Methods of Biochemical Analysis 1: 357–424; MelindaGrossman 2008, Stress management. Available: http://www.resourcesforattorneys.com/stress/index.php?m=02 &y=08&entry=entry080219-214308. Accessed Mar 2013, 10; Queitsch, C., T.A. Sangster, and S. Lindquist 2002, Nature 417: 618-624; Rotruck, J.T., A.L. Pope, H.E. Ganther, A.B. Swanson, D.G. Hafeman, and W.G. Hoekstra 1973, Science 179: 588-590; Rutherford, S.L., 2003, Nature Review Genetics 4: 263-274; Selye, H., 1938, American Journal of Physiology 123: 758-765; Singh, N., R. Nath, N. Mishra, and R.P. Kohli 1978, Quarterly Journal of Crude Drug Research 3: 125-132; Sowmya, M., and B.Y. Sathish Kumar 2010, Journal of Stress Physiology & Biochemistry 6: 18-27; Wang, T., H. Xu, J. Oberwinkler, Y. Gu, R. Hardie, and C. Montell 2005, Neuron 45: 367–378; Weydert, C.J., and J.J. Cullen 2010, Nature Protocols 5: 51-66.

Occurrence of the genus *Zygothrica* (Diptera, Drosophilidae) in a high-altitude forest in northeastern Brazil.

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Introduction

The genus *Zygothrica* includes drosophilids native to the Neotropical region, apart from some species found in Africa and in the Indo-Pacific region (Prigent and Toda, 2006). From the ecological standpoint, representatives of this genus have traditionally been associated with fungi (Malogolowkin, 1952; Grimaldi, 1987, 1990), though some species use flowers as food resources (Grimaldi, 1987).

In the Neotropical region *Zygothrica* is the second genus in the Drosophilidae family in terms of diversity, after *Drosophila* (Bächli, 2014). The taxonomic history of the genus dates back to 1830, when C.R.W. Wiedemann described the type species *Zygothrica*, *Z. dispar* (Wiedemann 1830), as a subgenus of *Achias* (Platystomatidae). Almost one hundred years later, in a pioneering description of several *Zygothrica* species, Sturtevant (1920) enlarged the taxonomic knowledge on this genus. Following this line of study, Duda (1952) and Burla (1956) collected specimens in Costa Rica and in Brazil, respectively, and described a large number of species in the genus. Subsequently, new species were later described and reviewed by Grimaldi (1987, 1990). Today, *Zygothrica* comprises 124 species (Bächli, 2014), 54 of which occur in Brazil (Gottschalk *et al.*, 2008). In spite of that, Grimaldi (1987) believes that only half of the total number of estimated *Zygothrica* species has been described.

In Brazil, representatives of the *Zygothrica* genus have been increasingly captured in recent years (De Toni *et al.*, 2007; Döge *et al.*, 2007; Gottschalk *et al.*, 2007; Schmitz *et al.*, 2007; Döge *et al.*, 2008; Mata *et al.*, 2008; Gottschalk *et al.*, 2009; Bizzo *et al.*, 2010; Hochmüller *et al.*, 2010; Garcia *et al.*, 2012; Poppe *et al.*, 2012; Roque *et al.*, 2013; Poppe *et al.*, 2014). However, in some of the country's regions, such as the northeast, there is a paucity of information on the genus (Gottschalk *et al.*, 2008). In northeastern Brazil, north of the São Francisco River, two subregions of the Atlantic Forest were outlined, *Pernambuco* and *Brejos de Altitude*. The latter is characterized by wet forest islands surrounded by *Caatinga*, a semiarid biome. These areas are located in plateaus between 500 and 1,000 m above sea level, where orographic rainfall ensures

precipitation levels above 1,100 mm yearly (Andrade-Lima, 1960, 1961).

The present study assesses the richness and abundance of the *Zygothrica* genus in an area in the subregion *Brejos de Altitude*, in the state of Pernambuco, northeastern Brazil.

Materials and Methods

Drosophilids were collected in a high-altitude forest near *Mata do Mucuri* Conservation Unit (08°30'46.7"S; 35°43'19.6"W), municipality of Bonito, state of Pernambuco, northeastern Brazil (Figure 1). Mean altitude in the area of study is 800 m above sea level. The prevailing climate is type As' (rainy tropical with dry season in summer) according to the Köppen classification system. Mean rainfall is 1,157 mm, mean temperature is 21.5ºC and relative humidity is between 40% and 70%. Rain distribution defines two clear seasons: the rainy, between April and August, and the dry season, during the rest of the year (Santiago *et al.*, 2004).

Collections were carried out in August 2010 (end of the rainy season), December 2010 (dry season), and April 2011 (beginning of the rainy season). Drosophilids were captured using 20 traps built as described by Tidon and Sene (1988), containing banana baits. Traps were left hanging in the study site 1.5 m above the ground, 10 m away from one another, for two consecutive days.

The specimens of the *Zygothrica* genus were identified at species level by means of analysis on the external morphology and the male genitalia (Malogolowkin, 1952; Burla, 1954, 1956; Grimaldi, 1987).

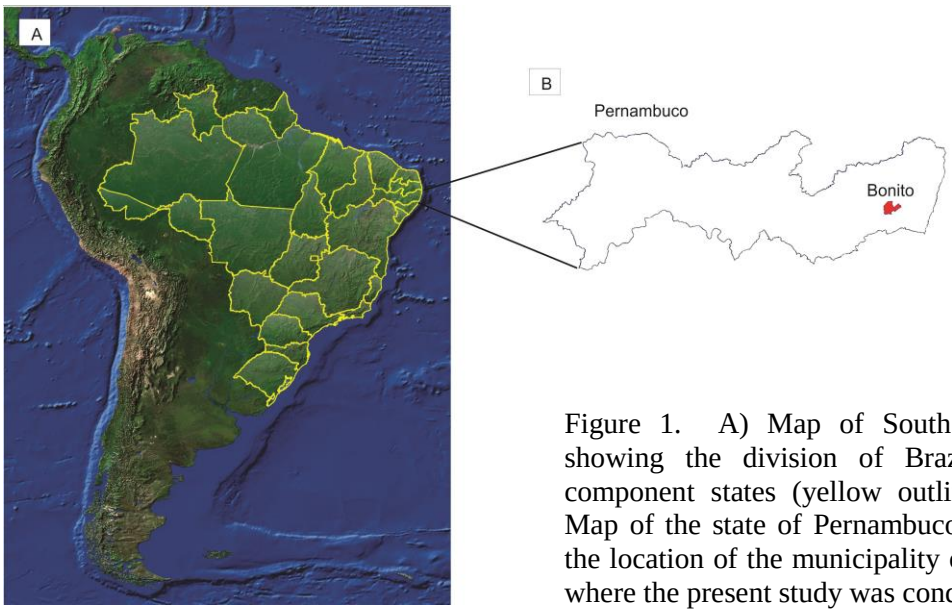

Figure 1. A) Map of South America showing the division of Brazil in its component states (yellow outlines); B) Map of the state of Pernambuco showing the location of the municipality of Bonito, where the present study was conducted.

Results and Discussion

In total, 8,802 drosophilids were collected, and of these 1,782 were *Zygothrica*, represented by: 1,752 individuals of *Z. orbitalis* (Sturtevant 1916); 24 of *Z. dispar* (Burla 1956); and six of *Z. prodispar* Duda 1925 (Table 1).

Table 1. Absolute abundance of *Zygothrica* species in the municipality of Bonito, state of Pernambuco, Brazil.

	August 2010	December 2010	April 2011
Z. orbitalis	1,749	0	3
Z. dispar	23	0	1
Z. prodispar	6	0	0
Other species	3,853	252	2,115

Zygothrica represented 20.24% of the drosophilids collected in the area of *Brejo de Altitude* surveyed. This value is high, compared with samplings carried out in other subregions of the Brazilian Atlantic Forest, where relative frequencies of *Zygothrica* representatives reached up to 11% of all drosophilids collected and, as a rule, represented less than 1% of samples (De Toni *et al.*, 2007; Döge *et al.*, 2007; Gottschalk *et al.*, 2007; Schmitz *et al.*, 2007; Döge *et al.*, 2008; Gottschalk *et al.*, 2009; Bizzo *et al.*, 2010; Garcia *et al.*, 2012). The relative abundance of the genus was also under 1% of drosophilids captured in samplings previously conducted in the *Cerrado* (Mata *et al.*, 2008; Roque *et al.*, 2013) and *Pampa* (Poppe *et al*., 2012, 2014) biomes.

In the present study, the most abundant species of the *Zygothrica* genus was *Z. orbitalis*, followed by *Z. dispar* and *Z. prodispar* (Table 1). This abundance pattern of the first two species has also been reported in other studies carried out in the Brazilian Atlantic Forest (Gottschalk *et al.*, 2007; Döge *et al.*, 2007).

Here, *Z. orbitalis*, *Z. dispar*, and *Z. prodispar* were more abundant in the higher rainfall period (Table 1). The highest abundance of *Zygothrica*, in this period, may be associated with greater availability of food resources and increased humidity. Nevertheless, in other drosophilids samplings in Brazil, these three species did not exhibit any preference for wetter periods (De Toni *et al.*, 2007; Bizzo *et al.*, 2010; Poppe *et al.*, 2014).

Prior to the present investigation, *Z. orbitalis*, *Z. dispar*, and *Z. prodispar* had been sampled in the Brazilian Atlantic Forest, but only in the subregions located in southern and southeastern Brazil (Frota-Pessoa, 1952; Burla, 1956; Grimaldi, 1987; Val and Kaneshiro, 1988; De Toni *et al.*, 2007; Döge *et al.*, 2007; Gottschalk *et al.*, 2007; Schmitz *et al.*, 2007; Döge *et al.*, 2008; Gottschalk *et al.*, 2009; Bizzo *et al.*, 2010; Garcia *et al.*, 2012). This study presents the first record of these species in an Atlantic Forest area north of the São Francisco River, in the subregion *Brejos de Altitude*, and underlines the high abundance of *Z. orbitalis* in the site surveyed.

References: Andrade-Lima, D., 1960, Arquivo do Instituto de Pesquisas Agronômicas de Pernambuco 5: 305-341; Andrade-Lima, D., 1961, An. Assoc. Geograf. Bras. 2: 69-85; Bächli, G., 2014, Taxodros, the database on taxonomy of Drosophilidae. Available from: http://www.taxodros.unizh.ch/. (Accessed on July, 2014); Bizzo, L., M.S. Gottschalk, D.C. De Toni, and P.R.P. Hofmann 2010, Iheringia Ser. Zool. 100: 185-191; Burla, H., 1954, Arq. Mus. Parana. 10: 231-252; Burla, H., 1956, Mitt. Zool. Mus. Berl. 32: 189-321; De Toni, D.C., M.S. Gottschalk, J. Cordeiro, P.R.P. Hofmann, and V.L.S. Valente 2007, Neotrop. Entomol. 36: 356-375; Döge, J.S., V.L.S. Valente, and P.R.P. Hofmann 2008, Revista Brasileira de Entomologia 52: 615-624; Döge, J.S., M.S. Gottschalk, L.E.M. Bizzo, S.C.F. Oliveira, H.J. Schmitz, V.L.S. Valente, and P.R.P. Hofmann 2007, Biota Neotropica 7: 33-36; Frota-Pessoa, O., 1952, Dros. Inf. Serv. 26: 101-102; Garcia, C.F., C.J.C. Hochmüller, V.L.S. Valente, and H. J. Schmitz 2012, Neotrop. Entomol. 41: 1-12; Gottschalk, M.S., D.C. De Toni, V.L.S. Valente, and P.R.P. Hofmann 2007, Neotrop. Entomol. 36(6): 848-862; Gottschalk, M.S., L. Bizzo, J.S. Döge, M.S. Profes, P.R.P. Hofmann, and V.L.S. Valente 2009, Iheringia Ser. Zool. 99(4): 442-448; Gottschalk, M.S., P.R.P. Hofmann, and V.L.S. Valente 2008, Check List 4: 485-518; Grimaldi, D.A., 1987, Bull. Am. Mus. Nat. Hist. 186: 103-268; Grimaldi, D.A., 1990, Am. Mus. Novit. 2964: 1-31; Hochmüller, C.J.C., M. Lopes-da-Silva, V.L.S. Valente, and H.J. Schmitz 2010, Pap. Avulsos Zool. 50(19): 286-295; Malogolowkin, C., 1952, Bras. J. Biol. 12(4): 455-457; Mata, R.A., M. McGeoch, and R. Tidon 2008, Biodiversity Conservation 17: 2899-2916; Poppe, J.L, H.J. Schmitz, D. Grimaldi, and V.L.S. Valente 2014, Zootaxa 3779 (2): 215-245; Poppe, J.L, V.L.S. Valente, and H.J. Schmitz 2012. Pap. Avulsos Zool. 52(16): 185-195; Prigent, R., and M.J. Toda 2006, Entomol. Sci. 9: 191-215; Roque, F., R.A. Mata, and R. Tidon 2013, Biodiversity Conservation 22: 657-672; Santiago, A.C.P., I.C.L Barros, and L.S. Sylvestre 2004, Acta Bot. Bras. 18(4): 781-792; Schmitz, H.J., P.R.P. Hofmann, and V.L.S. Valente 2007, Neotrop. Entomol. 36(1): 53-64; Sturtevant, A.H., 1920, Proc. U. S. Natl. Mus. 58: 155-158; Tidon, R., and F.M. Sene 1988, Dros. Inf. Serv. 67: 89; Val, F.C., and K.Y. Kaneshiro 1988, In: Proceedings of a workshop on Neotropical distribution patterns (Vanzolini, P.E., and W.R. Heyer, eds.), pp. 189-203; Wiedemann, C.R.G., 1830, Achias Dipterorum genus a Fabricio conditum; illustratum novisque auctum et conventui physicorum germanorum oblatum. Mohr, Kiliae.