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First record of *Pantala flavescens* from the Azores (Odonata: Libellulidae)

Virgílio Vieira¹ & Adolfo Cordero-Rivera²

¹Departamento de Biologia, Universidade dos Açores, Rua de S. Gonçalo, Apartado 1422, PT-9501-801 Ponta Delgada, Açores, Portugal, and CE3C – Centre for Ecology, Evolution and Environmental Changes, Departamento de Biologia, Universidade dos Açores, PT-9501-855 Ponta Delgada, Açores, Portugal; <vvieira@uac.pt>

²Grupo de Ecología Evolutiva e da Conservación, Departamento de Ecología e Bioloxía Animal, Universidade de Vigo, EUE Forestal, Campus Universitario A Xunqueira s/n, ES-36005 Pontevedra, Spain; <adolfo.cordero@uvigo.es>

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Abstract. A male of *Pantala flavescens* (Fabricius, 1798) was collected on São Miguel island, Azores, on 02-xi-2014. This specimen constitutes both the first record of the species in the Azores and its northernmost record in Macaronesia. The distribution of the species in the Macaronesian islands and the possible origin of the Azorean specimen is briefly discussed.

Key words. Dragonfly, Anisoptera, migration, island, Macaronesia

Introduction

The Azores is a volcanic archipelago situated in the Atlantic Ocean (37°–40°N, 25°–31°W) approximately 1,600 km of mainland Portugal, Europe. The archipelago is composed of nine islands. The Azores constitute the northern limit of the Macaronesian biogeographical region, which also includes Madeira, the Savage Islands, the Canary Islands, and the Cape Verde Islands. These archipelagos share similar evergreen forest, known as *lauri-silva*, even though the distance between them is great: Madeira and the Canaries are more than 800 km and 1,640 km away from the Azores, respectively, and Cape Verde is at a distance of about 2,500 km, with the most easterly island located about 460 km from Senegal (Africa).

In comparison to other oceanic islands and European countries systematic field mapping in Azorean arthropod fauna, including the Odonata, is

still relatively poor (see BORGES et al. 2010). Currently, four odonate species have been recorded from the Azores (VALLE 1940; GARDNER 1959, 1960; BELLE 1992; CORDERO RIVERA et al. 2005; LORENZO-CARBALLA et al. 2009, 2011; TAVARES et al. 2010; WEIHRAUCH 2011; VIEIRA & CORDERO RIVERA 2013): *Ischnura hastata* (Say, 1839) and *I. pumilio* (Charpentier, 1825) (Coenagrionidae), *Anax imperator* Leach, 1815 (Aeshnidae), and *Sympetrum fonscolombii* (Selys, 1840) (Libellulidae). *Ischnura hastata* is native to the Americas (BELLE & VAN TOL 1990) and is the only known case of parthenogenesis in the order Odonata (CORDERO RIVERA et al. 2005; LORENZO-CARBALLA et al. 2009), whereas the other three species belong to the Old World fauna.

In this paper, we present the first record of *Pantala flavescens* (Fabricius, 1798) for the Azores.

Material and methods

The identification of *Pantala flavescens* was done with the key in DIJKSTRA & LEWINGTON (2006). The first author (VV) re-examined all the Odonata in the entomological collections of the Natural History Museum Carlos Machado of Ponta Delgada (Azores) and of Funchal's Municipal Museum of Natural History (Madeira). The odonates preserved in the Zoology department of the University of Madeira were revised by the second author (ACR) in September 2004. No specimens of *P. flavescens* were found.

Meteorological data for the North Atlantic Ocean were obtained from the Portuguese Sea and Atmosphere Institute IPMA (www.ipma.pt) and IPMA/Azores (www.facebook.com/dra.ipma.pt). Calendar daily averages of temperature, wind speed and predominant direction, precipitation and atmospheric pressure were also confirmed by a study of data provided by WindGURU (www.windguru.cz) and by the monthly climatological bulletin elaborated by IPMA/Azores based on weather stations on the Azores, particularly in São Miguel island.

Results

One male of *Pantala flavescens* was collected by VV in the city of Ponta Delgada, in São Miguel island, Azores, at Avenida Infante D. Henrique, perched on the wall of a Hotel (37°44'25"N, 25°39'43"W), on 02-xi-2014 (Fig. 1).

The collected individual was outwardly in good condition, but it was apparently without the energy to make any effort to fly or be able to feed on the flies that were offered and died two days after capture.

A meteorological study of the North Atlantic and Atlanto-Mediterranean region, including the two weeks that had preceded the capture of the male in Ponta Delgada, indicates that between 20- and 24-x-2014, the temperature was 19–21°C, there was strong wind blowing at a speed of 16–67 km/h from the East, and daily precipitation was continuously between 0.4–4.8 mm. A week later, on 30-x-2014, the sky was cloudy at dawn and early morning and mostly sunny in the afternoon, the temperature was 19–21°C, and there was a moderate wind from the south-west at 20–40 km/h with some

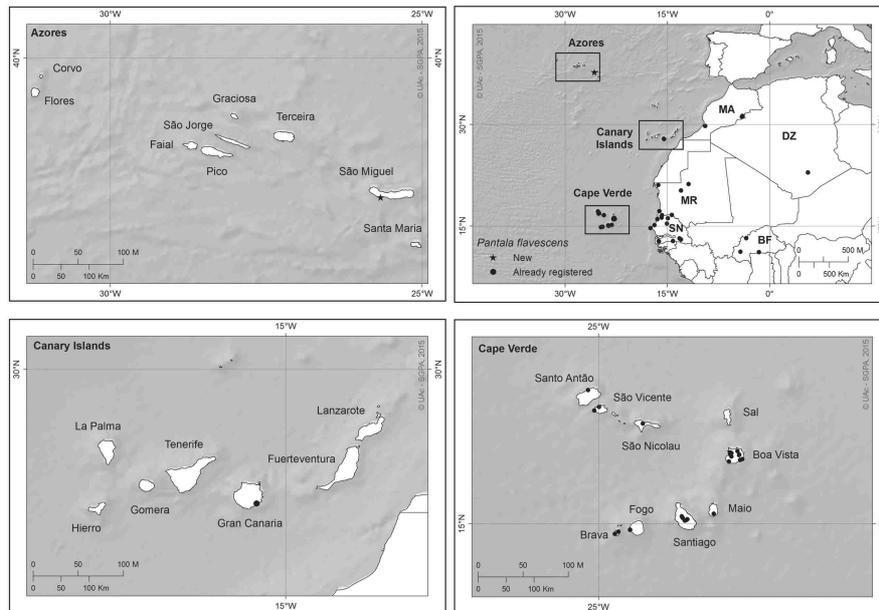


Figure 1. Records of *Pantala flavescens* from Macaronesia and western parts of the African continent (●), including the northernmost record in Macaronesia from São Miguel island, Azores (★). MA – Morocco; MR – Mauritania; SN – Senegal; DZ – Algeria; and BF – Burkina Faso. African data based on BOUDOT et al. (2009) and J.-P. Boudot (pers. comm.); Macaronesian data based on KIRBY (1897), AIST-LEITNER et al. (2008), MARTENS (2010), MARTENS & HAZEVOET (2010), BUSMANN (2012), LOUREIRO (2013), MARTENS et al. (2014) (Cape Verde), MARTÍNEZ-DARVE SANZ & CANO-VILLEGAS (2014) (Canary Islands), and this study (Azores).

gusts up to 60 km/h. The atmospheric pressure was low (1,015 hPa). On 01- and 02-xi-2014, the temperature was 19–20°C, the wind blew at a moderate speed of 11–25 km/h, from the north-west, the atmospheric pressure was high (1,028 hPa), the relative humidity was 77.3% and there was no precipitation.

Discussion

Pantala flavescens is a circumtropical species, widely distributed throughout the tropics and many temperate areas, ranging from 40° S to 40° N (WALKER & CORBET 1975). No previous records of this species could be found in the literature for Madeira (FERREIRA & WEIHRAUCH 2005; MARAVALHAS & SOARES 2013). It has been recorded in the Canary Islands only recently in January 2013 (MARTÍNEZ-DARVE SANZ & CANO-VILLEGAS 2014). The species is nevertheless abundant in Cape Verde (KIRBY 1897; GARCÍA et al. 2005; AISTLEINER et al. 2008; MARTENS 2010; MARTENS & HAZEVOET 2010; WEIHRAUCH 2011; BUSSMANN 2012; LOUREIRO 2013, MARTENS et al. 2014).

Pantala flavescens undertakes migrations following the Inter-tropical Convergence Zone, a meteorological phenomenon marked by a band of clouds around the globe near the Equator, which moves North and South with the seasons (SAMWAYS & OSBORN 1998; HOBSON et al. 2012). It is an abundant dragonfly throughout the tropics in Africa, Asia, and America, but there are only occasional records from the Western Palaearctic, where the extent of its regular migration range covers the southeast of Europe only (BOUDOT et al. 2009, 2013; BUCZYŃSKI et al. 2014). Records from Spain, France and the United Kingdom are considered as doubtful (BOUDOT et al. 2009; BUCZYŃSKI et al. 2014). The northernmost record of *P. flavescens* in Europe was registered in the Kaliningrad Oblast, Western Russia (55°05'N, 20°44'E) (BUCZYŃSKI et al. 2014). In America, the northern boundary of its distribution (ca 51°30'N) is Husavick, Manitoba (WALKER & CORBET 1975). The distribution patterns of *P. flavescens* in at least some parts of northern Africa and the Arabian Desert are relatively well known and it can be expected all year in the Sahara (DIJKSTRA & LEWINGTON 2006).

The origin of the Azorean male is uncertain. The dispersion of winged species could be due to active flight or passive transport by strong winds or favourable seasonal air currents, other animals, boats, and/or airplanes. One

possibility is that the dragonfly was passively transported by ships, which at this time of year arrive at Ponta Delgada on the way to America or towards the Mediterranean, coming from Central America where *P. flavescens* is also present. A second possibility, as suggested by the meteorological data, is a passive wind-borne migration. In fact, the appearance of some insect migrant species in Macaronesia often coincides with winds from an easterly direction. *Pantala flavescens* is a strong flyer, which is often encountered by ships at sea (PECK 1992; FENG et al. 2006). Therefore, given the prevalent meteorological conditions before the finding, the most likely origin for this specimen is sub-Saharan Africa, perhaps via the Canaries.

In the literature, there are some examples of other Odonata species that have reached the northern Macaronesian islands by migration. GARDNER (1963) collected specimens of *Anax ephippiger* (Burmeister, 1839) in Porto Santo in 1958 (Madeira archipelago) and several hundred individuals were recorded on Madeira (SMIT 1998). A completely worn out *Anax parthenope* Selys, 1839 male on Porto Santo in 2005 was the first record of the species for the Madeira archipelago (PELNY 2006) and BÁEZ (1985: 39) reports the observation of a migrating *Anax cf. imperator* Leach, 1815 on Selvagem Grande of the Savage Islands, which are situated half-way between Madeira and the Canaries and lack permanent freshwater. WEIHRAUCH (2011) and KALKMAN & SMIT (2002) consider wind-borne transport of a male *Platycnemis subdilatata*, a Maghreb endemic odonate, to Tenerife over a distance of approximately 500 km »absolutely plausible«. Finally, recent photographic evidence shows the presence of *Ischnura senegalensis* in the Canaries (PEELS 2014), records that have been confirmed by morphological and genetic data (SÁNCHEZ-GUILLÉN & CORDERO RIVERA 2015), suggesting colonization from Mauretania.

In America, the conditions for tropical cyclones can develop in the Caribbean Sea and follow the Gulf Stream to the Gulf of Mexico or the Florida Current to the eastern coast of the United States. In particular along the Atlantic coast, the migrant populations may be entrained in the outer winds of cyclonic storms of the western North Atlantic and transported well northward, perhaps by the prevailing south-western air flow, from populations in northern Mexico and the southernmost United States and/or are brought into this flow by Atlantic trade winds from northern South America or the

Caribbean (MAY 2013). In this way, wind driven flights must occasionally lead to the Atlantic crossing of excellent fliers, such as the appearance of *Anax junius* (Drury, 1773) in Cornwall, UK, which probably was forced eastward across the Atlantic in strong winds associated with the remnants of two successive hurricanes that swept up the east coast of the United States (PELLOW 1999; DAVEY 1999).

FENG et al. (2006) observed in China that seasonal migration of *P. flavescens* over the sea occurs during the night, often in association with monsoon fronts (DUMONT & VERSCHUREN 1991) and/or followed the passage of synoptic-scale cold fronts (MAY 2013 and references cited therein). Nocturnally migrating dragonflies generally fly at altitudes of up to 1,000 m above sea level, and can migrate 150–400 km in a single flight (FENG et al. 2006; ANDERSON 2009). If that was the case for the male collected at São Miguel, this could explain why it was unable to fly.

In conclusion, we suppose that this *P. flavescens* individual in the Azorean islands migrated from localities situated as far as Africa (tropical and nearest Sahara), the Cape Verde islands, or more unlikely from America. The male *P. flavescens* constitutes both the first record of this species the Azores and its northernmost record in entire Macaronesia. We expect that *A. ephippiger* might be the next species to be found in the Azores.

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