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Odonata records from southeast Portugal.

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Abstract: An annotated list of 20 species recorded in summer between 2012 and 2016 during several journeys to SE Portugal is presented. The studied localities on the border between Portugal and Spain, rich in thermophilic species, are a favourable biotope for the settlement of African dragonflies. Species of the genera Trithemis Brauer, 1868 and Crocothemis Brauer, 1868 are the most abundant. Additional notes on the abundance and distribution in the region along the summer are given.

Key words: Odonata, Alentejo, Algarve, Guadiana River basin, Portugal.

Introduction

Southwestern Iberia is one of the most interesting European regions from a faunistic point of view, constituting an important contact zone between western Palearctic and Paleotropical faunas but, odonatologically, many parts of this region, which comprises Algarve and Alentejo in Portugal, seem to be only poorly investigated. Some Afrotropical species as Diplacodes lefebervrii (Rambur, 1842) or Brachythemis impartita (Karsch, 1890) were cataloged for the first time to Europe from mainland Portugal (MOURA, 1960; FERREIRA & WEIHRAUCH, 2005) and even FERREIRA et al. (2006) cataloged 63 Odonata species in mainland Portugal but, according to FERREIRA & WEIHRAUCH (2005), WEIHRAUCH & WEIHRAUCH (2003) and DE KNIJF & DEMOLDER (2010), Portugal is still one poorly investigated country in western Europe regarding Odonata. In addition to the mentioned publications other odonatological researches have been carried out in south Portugal (McLACHLAN, 1880; AGUIAR & AGUIAR, 1983, 1985; GARDINER, 1993; GARDINER & STURGESS, 1994, 1995; GARDINER & WALLIS, 1996; HARTUNG, 1996; JAHR, 1996a,b; JÖDICKE, 1996; JONES, 1996; MALKMUS, 1996, 1998; RÖHN, 1996; KAPPES & KAPPES, 1999; BONESS, 2000; LOHR, 2005a, b; MALKMUS & RUF, 2008; FULAN et al., 2008; VIEIRA et al., 2010; MÁRQUEZ-RODRÍGUEZ, 2013, 2014; FONSECA et al., 2017; LESPARRE, 2017).

The Algarve has a year round warm climate with summer temperatures up to 35°C and maximum winter temperatures of 15°C. The Alentejo has a much more severe climate: very hot and dry summers up to 40°C, and relatively cold winters. The western and southwestern part of Portugal has a strong
Atlantic climatic influence, resulting in mild winters and not too hot summers (DE KNIJF & DEMOLDER, 2010). In this study we provide faunistic data on Odonata from Algarve and Alentejo, with special account on the phenology in summer and including a number of biological observations.

Material and methods

Odonata were surveyed in a few selected hot days in the summers from 2012 to 2016 in the two southernmost regions of Portugal, Alentejo and Algarve. We visited Portuguese locations bordering Spain as a working hypothesis, in an attempt to detect the current odonatofauna before the possible arrival of the non-native species Trithemis kirbyi Selys, 1891 to the westernmost region of the Iberian Peninsula. In this way, we continued a distribution study started in 2012, which suggested Guadiana River as a natural dispersion corridor of this species due to the habitat characteristics on the banks. (MÁRQUEZ-RODRÍGUEZ, 2013). Samplings were not performed on a daily basis but this approach was methodical in the way other authors have done before (WEIHRAUCH & WEIHRAUCH, 2003; LOHR, 2005a). For species identification we used ASKEW (2004), DIJKSTRA & LEWINGTON (2006) and MARAVALHAS & SOARES (2013).

The selection of the sampling localities was based on the most obviously suitable for detection of thermophilic dragonflies in the region we were passing by. At each locality we searched for adult dragonflies and exuviae near the water, and above the bank vegetation and in the surroundings. We only collected larvae in a locality by the fact that the water level was very low, making of it an isolated place within a dry watercourse. The survey lasted until we presumed it as thoroughly investigated, or as long as no new species were found anymore. Most of the species were identified through binoculars. Individuals that were difficult to identify such as exuviae, females and tenerals were collected with an insect net for determination.

List of localities visited

Portalegre district, Alentejo:
- Loc. 1: Bridge of Ayuda, over Guadiana River, a big river constituting the border between Portugal and Spain, 38°46'38"N, 7°10'18"W. 15-09-2012, 14:00 UTC. (Fig. 1).

Évora district, Alentejo:
- Loc. 2: Guadiana River, Juromenha. A broad, slow-running river, border between Portugal and Spain, 38°44'07"N, 7°14'34"W. 16-09-2012, 11:00 UTC.
- Loc. 3: Redondo, artificial lagoon with rounded shape in an urban park, 38°39'08"N, 7°32'30"W. 16-09-2012, 12:00 UTC.

Beja district, Alentejo:
- Loc. 4: Pias reservoir, about 60 km N Mértola. A dam with cement blocks. 37°59'33"N, 7°27'55"W. 24-06-2016, 15:00 UTC.
- Loc. 5: Vascão River, about 20 km S Mértola. A small course with large isolated ponds, partly stagnant river, constituting the border between the Beja and Faro districts (and at the same time between the provinces Alentejo and Algarve). Accordingly, the substrate was either sand, pebbles or rock. 37°30'49"N, 7°35'08"W. 02/08/2015, 12:00 UTC.

Faro district, Algarve:
- Loc. 6: Odeleite River. A small course with riparian vegetation upstream of the population. The substrate was sand and pebbles. 37°20'18"N, 7°29'17"W. a) 29/06/2013, 11:00 UTC. b) 02/08/2015, 10:00 UTC.
- Loc. 7: Odeleite River (<50 m to dam). A slow-running downstream of the population, very close to a dam. The substrate was sand and pebbles or rock. 37°19'58"N, 7°29'09"W. 01/08/2014, 11:00 UTC.
- Loc. 8: small pond, Almada de Ouro. A puddle of a dried-up brook connected to Guadiana River, border between Portugal and Spain. Only from this sampling location were collected adults and larvae. 37°17'49"N, 7°27'12"W. 03-08-2014, 18:00 UTC.
- Loc. 9: Beliche River (<50 m to dam), exit of the reservoir. An almost stagnant, highly eutrophic drainage artificial ditch, close to a dam. 37°16'39"N, 7°30'27"W. 01/08/2014, 13:00 UTC.
- Loc. 10: Beliche River. A slow-running, small course with riparian vegetation and abundant macrophytes. 37°15'54"N, 7°28'22"W. 30/06/2012, 14:00 UTC.
- Loc. 11: small pond. A small, shallow pond feeding to a small brook in the hillside near Beliche River in the Guadiana basin. 37°15'49"N, 7°27'30"W. 03/08/2014, 16:00 UTC.
- Loc. 12: two artificial ponds, Castro Marim. Two ponds of a golf club. 37°15'07"N, 7°27'15"W. 03-08-2014, 15:00 UTC.
- Loc. 13: beach, Monte Gordo-Vila Real de Santo António. Sandy area on the dune. 37°10'36"N, 7°26'19"W. 04-08-2014, 14:00 UTC.
- Loc. 14: Pego do Inferno and Gilão River, 37°09'19"N, 7°41'44"W. Water spring with waterfall and 300 m stretch of Gilão River with big ponds almost stagnant, highly eutrophic. 37°09'19"N, 7°41'43"W. 02-08-2014, 12:00 UTC. (Fig. 2).
- Loc. 15: Olhos de Água. Urban area next to a beach. 37°05'30"N, 8°11'36"W. 29-08-2015, 14:00 UTC.
- Loc. 16: channel, Lagoa. Artificial channel: an almost stagnant, drainage ditch. 37°07'31"N, 8°27'14"W. 27-08-2015, 14:00 UTC.
- Loc. 17: Arade River, Silves. A small course with riparian vegetation. 37°11'11"N, 8°26'21"W. 29-08-2016, 14:00 UTC.
- Loc. 18: Odelouca River, Odelouca. A big lagoon with riparian vegetation connected to Odelouca River. 37°11'18"N, 8°29'18"W. 29-08-2016, 15:00 UTC.

Results

During five years we visited Portuguese locations occasionally and 20 odonate species were recorded in summer on the wing or as exuviae. An Anax Leach, 1815 species was recorded as larvae in Loc. 8. We also included absolute data of the species observed in the Loc. 10 (MÁRQUEZ-RODRÍGUEZ, 2014). A list of all records is given below. Abbreviations: ♂: male; ♀: female; Ex.: exuviae; La.: larvae (only sampled in Loc. 8); Td.: tandem observed.

List of records and observations

**Calopteryx haemorrhoidalis** (Vander Linden, 1825)
- Loc. 10: 2♂♂, 5♀♀.

**Chalcolestes viridis** (Vander Linden, 1825)
- Loc. 6: b) 1♂♂.
- Loc. 8: 2♂♂.
- Loc. 11: 1♂, 1♀♀.
- Loc. 14: 3♂♂, 2♀♀.

**Platycnemis latipes** Rambur, 1842
- Loc. 5: 2♂♂.
- Loc. 14: 10♂♂, 6♀♀ (Td.: 3).

**Ceriagrion tenellum** (Villiers, 1789)

**Erythromma lindenii** (Selys, 1840)
- Loc. 14: 8♂♂, 2♀♀.
Ischnura graellsii (Rambur, 1842)

Loc. 2: 5♂♂, 14♀♀.
Loc. 4: 3♂♂.
Loc. 6: a) 1♂, b) 10♂♂, 3♀♀ (one teneral).

Loc. 8: 5♂♂, 6♀♀, 1 La.
Loc. 11: 3♂♂, 2♀♀ (Td.: 1).
Loc. 14: 6♂♂, 3♀♀ (Td.: 1).

Anax imperator Leach, 1815

Loc. 1: 2♂♂, 1♀ (Td.: 1).
Loc. 3: 11♂♂.
Loc. 5: 2♂♂.
Loc. 6: a) 1♂, b) 10♂♂, 3♀♀ (one teneral).
Loc. 8: 1 La.
Loc. 11: 1♂.
Loc. 14: 2♂♂, 1♀ (Td.: 1).
Loc. 1: 2♂♂, 1♀.
Loc. 7: 2♂♂.
Loc. 8: 2♂♂, 2 La.
Loc. 9: 6♂♂.
Loc. 14: 3♂♂, 1♀.
Loc. 6: a) 8♂♂, 3♀♀ (Td.: 1); b) 16♂♂, 3♀♀.

Together with Odonata larvae of the Locality 8, several specimens of different sizes (36 to 92 mm) of the fish Cobitis paludica (de Buen, 1929) were observed, registered in this paper because of the ecological importance of the breeding site of this species (Fig. 4).

Diplacodes lefebrii (Rambur, 1842)

Loc. 14: 5♂♂ (Fig. 5).

Orthetrum brunneum (Fonscolombe, 1837)
Loc. 10: 1♂.

Orthetrum coerulescens (Fabricius, 1798)
Loc. 6: a) 5♂♂, 2♀♀ (Td.: 1).
Loc. 10: 2♂♂.
Loc. 11: 1♂.

Orthetrum cancellatum (Linnaeus, 1758)
Loc. 4: 1♂.
Loc. 5: 1♂.
Loc. 14: 5♂♂, 2♀♀ (Td.: 1).

Orthetrum chrysostigma (Burmeister, 1839)
Loc. 3: 3♂♂, 1♀.
Loc. 4: 1♂.
Loc. 5: 1♂.
Loc. 6: a) 1♂; b) 1♂.
Loc. 10: 2♂♂.
Loc. 14: 5♂♂, 2♀♀ (Td.: 1).
Orthetrum nitidinerve (Selys, 1841)
Loc. 10: 1♀ (teneral).

Sympetrum fonscolombii (Selys, 1840)
Loc. 1: 8♂, 7♀ (Td.: 1).
Loc. 2: 6♂, 3♀.
Loc. 3: 15♂, 10♀ (Td.: 3).
Loc. 13: 2♂♂.
Loc. 16: 1♂.
Loc. 17: 2♀♀.

Sympetrum striolatum (Charpentier, 1840)
Loc. 1: 1♂.

Trithemis annulata (Palisot de Beauvois, 1805)
Loc. 4: 4♂, 1 Ex.
Loc. 5: 6♂, 13♀ (Td.: 3), 32 Ex.
Loc. 6: a) 4♂; b) 5♂♂.
Loc. 7: 2♂♂.
Loc. 12: 5♂♂.
Loc. 14: 4♂, 2♀♀ (Td.: 1).
Loc. 17: 1♂, 1♀.
Loc. 18: 1♀.

Discussion

Portugal is the southwesternmost country of the European continent. Many species of the Mediterranean basin are also restricted to this region and, therefore, it is part of a global biodiversity hotspot with a high level of endemism (MYERS et al., 2000). Until recently, the odonatofauna of Portugal received little attention, despite its diverse fauna. It was only in 2005 that a first bibliography of the odonatological literature of Portugal was published (FERREIRA & WEIHRAUCH, 2005), followed in 2006 by a revised checklist of the Odonata fauna of Portugal (FERREIRA et al., 2006). The southern part of Portugal has a distinct climate, much warmer and drier than the rest of the country. Consequently, several species with an African origin are observed in this region of Portugal (DE KNIJF & DEMOLDER, 2010; VIEIRA et al., 2010) and our faunistical results support this idea. This is the case of Trithemis annulata: the first records in the Iberian Peninsula consisted of larvae and teneral adults, collected in Sierra Morena (Cádiz, Spain) in 1978 (FERRERAS-RODRÍGUEZ, 1981); nowadays, nearly four decades later, this species is abundant and easily breeding throughout this mountain system, including the extreme west on the Spain-Portugal border.

WEIHRAUCH & WEIHRAUCH (2003) mention two exuviae collected from Ribeira do Vascão (Loc. 5), which were later revised by FERREIRA & WEIHRAUCH (2005) as Trithemis annulata. Later, DE KNIJF & DEMOLDER (2010) observed more than 100 adults, constituting one of the most abundant species in this river. Our research confirms its excellent breeding success with many exuviae observed and collected (Fig. 6). This thermophilic species could compete with Trithemis kirbyi, a similar species present in the peninsula, for resources in the future. In fact, T. kirbyi is a libellulid which is in expansion in the Iberian Peninsula since 2007 (CHELMICK & PICKESS, 2008), a process of faster advance following the latitude (MÁRQUEZ-RODRÍGUEZ, 2014). For example in Spain, in 2012, when the species was observed in two extreme points with coastal influence: Tarragona (Mediterranean coast) (HERRERA-GRAO et al., 2012) and Huelva (Atlantic influence) (OBREGÓN-ROMERO et al., 2013; MÁRQUEZ-RODRÍGUEZ, 2013), where it seems to advance more slowly; the distance to north country is greater to west starting from the first point of observation in Andalusia (CHELMICK & PICKESS, 2008). On the other hand, this species had not been recorded in the dragonflies catalog of Portugal (MARAVALHAS & SOARES, 2013). The first observation of an isolated male is from Mértola (30 May 2016), in Ribeira das Carreiras valley belonging to the Guadiana River basin (LESPARRE, 2017). It would be advisable to carry out new samplings in the next few years to know the dynamics of the odonates from southeast Portugal, especially in the localities 4 and 5, near to the Guadiana River basin, and to know the balance between the two species of Trithemis Brauer, 1868 in the area. Likewise, this species
had not yet been observed in France until Chris Abbott documented this species in 2017, with photographs taken from Couiza in the Aude River valley (GROUPE SYMPETRUM, 2017).

Pego do Inferno and the Gilão River stretch studied (Loc. 14) were the most biodiverse localities, with eleven species (55% of the total observed). The presence of dams and reservoirs produces changes in the hydraulic regime from running to nearly standing water and changes of sediment discharges. This also has consequences for the lifecycles in dragonfly communities. Rheophilous species are declining or even becoming locally extinct and several multivoltine species typical of standing waters, such as Crocothemis erythraea, Trithemis annulata and Sympetrum fonscolombii, are becoming omnipresent along streams and rivers (DE KNIJF & DEMOLDER, 2010), as for example in Loc. 7, 9 and 18. There is a great difference in Odeleite River with respect to a nearby site located upstream (Loc. 6) where the odonate richness is greater. The most extreme situation is reached in artificial ponds with high anthropogenic influence (Loc. 12).

Some localities should be taken into account for their possible environmental protection, based on the diversity of their fauna (Loc. 5) or the existence of species with ecological interest (Loc. 8 and 10) which are more sensitive to habitat alteration.

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References


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**Fig. 1.** The bridge of Ayuda, over Guadiana River: an ideal breeding habitat for *Trithemis* spp.
Fig. 2.- Pego do Inferno: an ideal breeding habitat to native species.

Fig. 3.- Brachythemis impartita (male) in Guadiana River.

Fig. 4.- Cobitis palludica cohabiting with Crocothemis erythaea in Loc. 8.
Fig. 5. - *Diplacodes lefebvrei* in Gilão River.

Fig. 6. - Exuviae of *Trithemis annulata* collected from Ribeira do Vascão.