



Dragonflies (Insecta, Odonata) collected in the Cape Verde Islands, 1960-1989, including records of two taxa new to the archipelago

Andreas Martens¹, Nuno de Santos Loureiro² & Cornelis J. Hazevoet³

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ABSTRACT

Dragonflies from the Cape Verde Islands, collected between 1960 and 1989 and kept in institutes in Portugal and Cape Verde, were studied. The Cape Verde collection at the Centro de Zoologia, Instituto de Investigação Científica Tropical, Lisbon, Portugal, includes eight species of dragonflies represented by 279 specimens collected in 1960-61 and 1969-72. The entomological collection at the Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA), São Jorge dos Orgãos, Republic of Cape Verde, includes four odonate species, represented by 27 specimens, collected in the years 1987 and 1989. *Anax tristis* Hagen and *A. rutherfordi* McLachlan, single male specimens of which were collected in Santo Antão, 27 October 1972, are new taxa for the archipelago. Both are tropical migrants of which the nearest known occurrence in continental Africa is more than 1,000 and 1,500 km, respectively, from the Cape Verde Islands. The two collections contain several specimens from new localities within the archipelago, particularly from the islands of Maio and Fogo. Current knowledge of flight season and island distribution are summarized and updated.

RESUMO

Neste artigo apresenta-se um estudo de libélulas capturadas nas ilhas de Cabo Verde entre 1960 e 1989, e conservadas em institutos em Portugal e Cabo Verde. A colecção de Cabo Verde existente no Centro de Zoologia, Instituto de Investigação Científica Tropical, Lisboa, Portugal, abarca oito espécies, representadas por 279 exemplares, capturados em 1960 e 1961, e entre 1969 e 1972. A colecção entomológica do Instituto Nacional de Investigação e Desenvolvimento Agrário, São Jorge dos Orgãos, República de Cabo Verde, contém quatro espécies de libélulas, representadas por 27 exemplares, capturados em 1987 e 1989. Dois exemplares, ambos machos, de *Anax tristis* Hagen e *A. rutherfordi* McLachlan foram capturados na ilha de Santo Antão a 27 de Outubro de 1972 e constituem novas taxa para o arquipélago. Ambas são tropicais, manifestam comportamentos migratórios conhecidos, e as ocorrências mais próximas, no continente africano, localizam-se respectivamente a mais de 1000 e 1500 km das ilhas caboverdianas. As duas colecções contribuem com novas localizações no arquipélago de Cabo Verde, especialmente nas ilhas do Maio e Fogo. Por fim, é revisto o actual estado de conhecimento sobre a época de voo e a distribuição inter-insular das diversas espécies de Odonata.

¹ Pädagogische Hochschule, Bismarckstraße 10, 76133 Karlsruhe, Germany; martens@ph-karlsruhe.de

² Centro de Biologia Ambiental – ADC, Universidade de Lisboa, and Faculdade de Ciências e Tecnologia, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal

³ Centro de Zoologia, Instituto de Investigação Científica Tropical - Jardim Botânico Tropical, Rua da Junqueira 14, 1300-343 Lisboa, Portugal

INTRODUCTION

During the past decade, knowledge of the Odonata of the Cape Verde Islands has increased significantly. During the late 19th and early 20th century, a small number of publications dealt with Cape Verde dragonflies (Calvert 1894, Kirby 1897, Martin 1908), but, except for a short note by Lobin (1982), nothing was published on these insects during the remainder of the 20th century. Since 2008, a series of papers (Aistleitner *et al.* 2008, Vieira 2008, Martens 2010, Martens & Hazevoet 2010, Bußmann 2012, Loureiro *et al.* 2013) has significantly improved knowledge of habitats, seasonality and

island distribution of Cape Verde Odonata.

The collections at the Centro de Zoologia, Instituto de Investigação Científica Tropical, Lisbon, Portugal, include Cape Verde odonate specimens collected during the years 1960-61 and 1969-72. The collections at the Instituto Nacional de Investigação e Desenvolvimento Agrário, São Jorge dos Orgãos, Santiago, Republic of Cape Verde, contain odonate specimens collected in 1987 and 1989. Here, we present new data on distribution and seasonality of Cape Verde odonates based on specimens in these collections.

MATERIAL AND METHODS

The material in the collection of the Centro de Zoologia, Instituto de Investigação Científica Tropical (CdZ-IICT), consists of two series with independent registration numbers. One series was collected in February 1960 and from November 1960 to March 1961 by Alberto Coutinho Saraiva for the Missão de Estudos Agronómicos do Ultramar (and later transferred to the Centro de Zoologia), while the other resulted from the Missão de Estudos Zoológicos do Ultramar and was collected by Lívio Ernesto Dias Paulos, technician at the Centro de Zoologia, from August to November 1969, in October 1970 and in October and November 1972. The material consists of pinned adult odonates in six insect cases. It has been preserved under rather good conditions and has not been studied before. During work on the collection in August 2012, all specimens could be identified to the species level.

The entomological collection of the Instituto Nacional de Investigação e Desenvolvimento Agrário (INIDA) includes a large number of insects. The collection was initiated by Dutch entomologist Antonius van Harten, who worked at INIDA for the German

GTZ Cape Verde Integrated Pest Management Project from 1982 to 1990. Odonata constitute only a small part of the collection. The pinned specimens are kept under reasonable conditions in two insect cases.

Each of the specimens in both collections have a metadata label fixed on the pin. Label data include locality, island and date of capture. The IICT collections have a register containing additional data. The INIDA collection does not have supplementary data, but additional data were kindly provided by the collector.

The geographical coordinates given in the list of collecting localities are based on the 1:25,000 topographical maps published during the 1960s by the Serviço Cartográfico do Exército, Portugal, on Google Earth imagery, and on the online cartography and aerial photography provided by the Sistema de Informação Territorial de Cabo Verde (<http://visor.sit.gov.cv>). Sometimes, when names of collecting localities could not be found in the topographical maps, we asked people in Cape Verde to identify them. Although spelling of some collecting localities was erroneous, we were able to identify most by phonetic similarity.

COLLECTING LOCALITIES

CdZ-IICT (Lisbon, Portugal), Entomological Collections. Coll. Alberto Coutinho Saraiva: 1-xi-1960 to 25-vii-1961; Lívio Ernesto Dias

Paulos: 13-viii-1969 to 28-xi-1972. Original record numbers are given in square brackets.

SANTO ANTÃO

- (1) Ponta do Sol, Chã: 17°11'56"N, 25°05'24"W, 17-iii-1961 [85]
 (2) Ribeira Grande, Chã das Pedras: 17°08'08"N, 25°06'44"W, 19-ii-1961 [90]
 (3) Ribeira do Paúl: 17°08'20"N, 25°01'36"W, (a) 22-iii-1961, (b) 23-iii-1961 [206, 93]
 (4) Ribeira da Torre, Xôxô: 17°08'26"N, 25°04'04"W, 18-iii-1961 [205]
 (5) Ribeira das Patas, Lajedo: 17°01'18"N, 25°09'59"W, 26-iii-1961 [208, 607]
 (6) Ribeira da Torre: 17°09'17"N, 25°04'17"W, (a) 21-iii-1961, (b) 28-x-1972 [316, 3758]
 (7) Ribeira do Cachaço: 17°03'02"N, 25°11'57"W, 20-x-1972 [3754]
 (8) Ribeira das Fontainhas, Ponta do Sol: 17°11'20"N, 25°06'18"W, 27-x-1972 [3757]
 (9) Paúl: 17°08'58"N, 25°00'57"W, 13-xi-1972 [3769]

SÃO VICENTE

- (10) Ribeiras de Julião e do Seixal: 16°51'23"N, 24°58'51"W, 14-iii-1961 [281, 283]
 (11) Baía das Gatas: 16°53'59"N, 24°54'59"W, 28-xi-1972 [3775]

SÃO NICOLAU

- (12) Ribeira de Maiama: 16°36'00"N, 24°17'07"W, 19-x-1970 [3630]
 (13) Vila da Ribeira Brava: 16°37'02"N, 24°17'28"W, 21-x-1970 [3655]
 (14) Caldeira: 16°36'15"N, 24°11'23"W, 29-x-1970 [3675]

MAIO

- (15) Vila do Maio: 15°08'17"N, 23°12'39"W, (a) 12-xi-1960, (b) 20-viii-1969 [198, 3569]
 (16) Morro, near the sea: 15°10'50"N, 23°13'52"W, 1-xi-1960 [271]
 (17) Monte Penoso: 15°13'38"N, 23°07'26"W, 5-xi-1960 [272]
 (18) between Chico Vaz and Figueira da Horta: 15°09'43"N, 23°09'19"W, 20-xi-1960 [320]
 (19) Lagoa: 15°07'48"N, 23°09'04"W, 13-viii-1969 [3561]
 (20) Monte Batalha: 15°12'11"N, 23°11'03"W, 20-viii-1969 [3570]

SANTIAGO

- (21) Posto Agrícola de São Jorge dos Orgãos: 15°03'12"N, 23°36'15"W, (a) 11-xii-1960, (b) 17-

- xii-1960, (c) 19-xii-1960, (d) 21-xii-1960, (e) 20-ix-1969 [242, 91, 243, 230, 3589]
 (22) Vale Cachopo, São Francisco: 15°00'02"N, 23°30'15"W, 6-vii-1961 [151]
 (23) Achada Mato, São Francisco: 14°56'52"N, 23°29'40"W, (a) 17-vii-1961, (b) 19-vii-1961 [160, 174]
 (24) Mulher Branca, São Francisco: 14°55'02"N, 23°29'09"W, (a) 2-vii-1961, (b) 12-vii-1961 (c) 19-vii-1961, (d) 21-vii-1961, (e) 25-vii-1961 [186, 179, 170, 163, 171]
 (25) Matão: 14°56'60"N, 23°34'15"W, (a) 13-vii-1961, (b) 14-vii-1961 [185, 168]
 (26) Achada da Aguada, São Francisco: 14°57'57"N, 23°29'00"W, 18-vii-1961 [175]
 (27) Cidade Velha: 14°55'05"N, 23°36'06"W, 2-i-1961 [231]
 (28) Pedra Badejo, Santa Cruz: 15°07'43"N, 23°32'02"W, 6-i-1961 [245]
 (29) Ribeira da Longueira, São Jorge dos Orgãos: 15°02'54"N, 23°37'11"W, 31-xii-1960 [286, 349]
 (30) Trindade: 14°57'33"N, 23°33'47"W, 4-ii-1961 [290]
 (31) Ribeira de Sedeguma, Chão Moreno: 15°06'07"N, 23°41'09"W, 3-ix-1969 [3576]
 (32) Achada do Rincão: 15°04'15"N, 23°46'10"W, 4-ix-1969 [3577]
 (33) Boa Entrada: 15°06'59"N, 23°40'08"W, 8-ix-1969 [3582]
 (34) Santa Catarina: 15°06'56"N, 23°40'37"W, 17-ix-1969 [3586]
 (35) Entre Picos: 15°06'47"N, 23°39'10"W, 22-ix-1969 [3591]
 (36) Assomada: 15°05'32"N, 23°39'17"W, 4-x-1969 [3602]

FOGO

- (37) Monte Barro: 14°53'51"N, 24°28'49"W, 27-ii-1961 [71]
 (38) Vila de São Filipe: 14°53'47"N, 24°30'00"W, 2-iii-1961 [348]
 (39) Santuário de N^a Sr^a do Socorro: 14°51'14"N, 24°27'11"W, 4-xi-1969 [3619]

BRAVA

- (40) Ribeira da Furna: 14°53'09"N, 24°41'05"W, 10-x-1969 [3604]
 (41) Vinagre: 14°52'11"N, 24°40'55"W, 14-x-1969 [3609]

INIDA (São Jorge dos Orgãos, Republic of Cape Verde), Entomological Collections. Coll. Antonius van Harten.

SANTIAGO

(42) Santa Cruz: 15°08'03"N, 23°33'44"W, 19-viii-1987

(43) Serrado: 15°04'15"N, 23°34'34"W, 11-xi-1987

(44) São Jorge dos Orgãos: 15°03'12"N, 23°36'15"W, 4-vii-1989 [same coordinates as locality (21)]

SPECIMENS COLLECTED

Anax imperator Leach, 1815

SANTO ANTÃO: (8) 1M 1F.

MAIO: (18) 1F [first record for the island].

SANTIAGO: (29) 3M [first record for the island]; (32) 1M; (44) 1M.

FOGO: (37) 1M [first record for the island].

Anax rutherfordi McLachlan, 1883

SANTO ANTÃO: (8) 1M [first record for the Cape Verde Islands] (Fig. 1).

Anax tristis Hagen, 1867

SANTO ANTÃO: (8) 1M [first record for the Cape Verde Islands].

Crocothemis erythraea (Brullé, 1832)

SANTO ANTÃO: (2) 6M 2F; (3a) 2M; (4) 1M; (5) 2M; (6a) 4M; (6b) 4M 1F; (7) 3M 1F; (8) 2M; (9) 1M 1F.

SÃO VICENTE: (10) 1M; (11) 1M 2F.

SÃO NICOLAU: (12) 4M; (13) 1M; (14) 1M.

MAIO: (17) 1F [first record for the island]; (15b) 7M; (18) 2M; (19) 2M; (20) 4M 1F.

SANTIAGO: (22) 2M; (23b) 3M; (24b) 2M; (24d) 2M; (24e) 1M; (25b) 2M 1F; (26) 1M; (28) 1M; (29) 7M; (30) 1M; (31) 1M; (32) 1M; (33) 2M.

FOGO: (38) 3M.

BRAVA: (41) 1M 1F.

Orthetrum trinacria (Selys, 1841)

SANTO ANTÃO: (2) 1M; (3b) 1M.

SÃO NICOLAU: (13) 1M; (14) 1F.

MAIO: (18) 1M [first record for the island]; (15a) 1M; (16) 1F; (17) 1M.

SANTIAGO: (24c) 2M 2F; (27) 1F; (29) 1M; (30) 3M 1F; (32) 3M 1F; (42) 2M; (44) 1M.

Pantala flavescens (Fabricius, 1798)

MAIO: (18) 1M [first record for the island].

SANTIAGO: (21b) 1F; (33) 1M; (36) 1M; (43) 1M.

BRAVA: (41) 2M.

Trithemis annulata (Palisot de Beauvois, 1807)

SANTO ANTÃO: (1) 2M; (2) 5M; (3a) 1M; (3b) 1M; (4) 4M; (5) 1M; (6a) 1M; (8) 4M; (9) 1M 8F.

SÃO VICENTE: (10) 2M; (11) 2M 4F.

MAIO: (18) 5M 1F [first record for the island]; (15b) 3M; (20) 6M.

SANTIAGO: (21a) 2M; (21c) 1M; (21d) 2M 1F; (22) 1M; (23a) 2M 1F; (23b) 1M; (24a) 1M; (24b) 4M 1F; (24c) 2M; (24d) 1M; (24e) 1M; (25a) 2M; (25b) 1M; (27) 1M; (28) 1M; (29) 27M 3F; (30) 7M; (33) 1M; (34) 1M; (35) 1M; (42) 5M; (43) 17M.

FOGO: (37) 1M [first record for the island].

BRAVA: (40) 2M.

Zygonyx torridus (Kirby, 1889)

SANTIAGO: (27) 1M [first record for the island]; (21e) 1M; (24b) 1M; (31) 1M.

FOGO: (39) 1M [first record for the island].



Fig. 1. Anal appendages of male *Anax rutherfordi*, collected Santo Antão, 27-x-1972 (collecting locality 8).

	StA	SV	SN	Sa	BV	Ma	ST	Fo	Br
<i>Lestes pallidus</i>		+		+	+				
<i>Ischnura senegalensis</i>		+			+				
<i>Pseudagrion glaucescens</i>		+							
<i>Anax ephippiger</i>	+				+	+			
<i>Anax imperator</i>	+	+			+	+	+	+	
<i>Anax rutherfordi</i>	+								
<i>Anax tristis</i>	+								
<i>Brachythemis leucosticta</i>		+							
<i>Crocothemis erythraea</i>	+	+	+	+	+	+	+	+	+
<i>Orthetrum trinacria</i>	+	+	+		+	+	+		+
<i>Pantala flavescens</i>	+	+			+	+	+	+	+
<i>Sympetrum fonscolombii</i>	+	+	+	+	+		+		
<i>Tramea limbata</i>					+				
<i>Trithemis annulata</i>	+	+	+		+	+	+	+	+
<i>Trithemis arteriosa</i>									
<i>Zygonyx torridus</i>	+		+				+	+	+

Table 1. Known distribution of Odonata in the Cape Verde Islands. StA: Santo Antão; SV: São Vicente; SN: São Nicolau; Sa: Sal; BV: Boa Vista; Ma: Maio; ST: Santiago; Fo: Fogo; Br: Brava. New records marked yellow. Data from Calvert (1894), Kirby (1897), Lobin (1982), Aistleitner *et al.* (2008), Vieira (2008), Martens (2010), Martens & Hazevoet (2010), Bußmann (2012), Loureiro *et al.* (2013), and this study. Occurrence of *Trithemis arteriosa* based on a specimen in the Genova museum for which no island locality was given (cf. Martin 1908).

DISCUSSION

The odonate collections reported here fill a significant temporal gap in the Odonata data of the Cape Verde Islands, bringing the number of odonate species known from the islands to 16. We interpret the two new species for Cape Verde, *Anax tristis* and *A. rutherfordi*, as migrants which may not permanently reside and reproduce in the islands. Both specimens were collected at the same locality and date and may have been driven westward from continental Africa by air currents or strong winds. Numerous records of desert locusts in the Cape Verde Islands, as well as further westward over the Atlantic Ocean (e.g. Waloff 1966, Weidner 1969), support this hypothesis.

The range of *A. tristis* includes large parts of sub-Saharan Africa. The species is known as a tropical migrant and it has been reported from a vessel at sea off Angola (Schneider 1982) and from the Indian Ocean islands of Aldabra (Campion 1913) and Réunion (Martiré 2010).

The record nearest to Cape Verde is from coastal The Gambia (Prendergast 1998), a distance of ca. 1,000 km.

The reddish *Anax* specimen in the ICT collection differs from *Anax speratus* Hagen, 1867 - known to us from Namibian specimens - in having a significant longer epiproct (Fig. 1; K.D. Dijkstra *pers. comm.*). The nearest known locality of a reddish *speratus*-like form, described as *Anax rutherfordi*, is from Sierra Leone (McLachlan 1883), a distance of more than 1,500 km from the Cape Verde Islands. Whereas *A. speratus* is primarily a southern and eastern African taxon, the range of *A. rutherfordi* appears to be restricted to West Africa. Apart from Sierra Leone, it has also been recorded from Togo (Karsch 1893).

The first records for the islands of Maio, Fogo and Santiago reported herein are of species well-known from other Cape Verde islands. As a result, distribution of odonates among the islands

becomes steadily better known and we suggest that the odonate fauna of Cape Verde may not differ significantly between different islands (Table 1). However, the recent construction of large watersheds in the islands of Santiago, São Nicolau and Santo Antão – with standing fresh water present throughout the year – may affect future odonate distribution in these islands.

The lack of any record of a zygopteran in the two collections discussed here is of special

interest. The number of records of the damselflies *Ischnura senegalensis* (Rambur, 1842) and *Lestes pallidus* Rambur, 1842 in Cape Verde is very small (Aistleitner *et al.* 2008). This may be due to both species not being permanent residents, but only incidental migrant visitors in the archipelago. Temporal distribution of odonates in the Cape Verde Islands (Table 2) suggests, that resident species are on the wing throughout the year.

	J	F	M	A	M	J	J	A	S	O	N	D
<i>Lestes pallidus</i>												
<i>Ischnura senegalensis</i>												
<i>Anax ephippiger</i>												
<i>Anax imperator</i>												
<i>Anax rutherfordi</i>												
<i>Anax tristis</i>												
<i>Crocothemis erythraea</i>												
<i>Orthetrum trinacria</i>												
<i>Pantala flavescens</i>												
<i>Sympetrum fonscolombii</i>												
<i>Tramea limbata</i>												
<i>Trithemis annulata</i>												
<i>Zygonyx torridus</i>												

Table 2. Known flight season of 13 Odonata species from the Cape Verde Islands (grey fields; new data in yellow). Data from Lobin (1982), Aistleitner *et al.* (2008), Vieira (2008), Martens (2010), Martens & Hazevoet (2010), Bußmann (2012), Loureiro *et al.* 2013, and this study. No seasonal data are available for the >100 year old records of *Brachythemis leucosticta*, *Pseudagrion glaucescens* and *Trithemis arteriosa* (cf. Calvert 1894, Martin 1908).

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