

The distribution of *Orthetrum trinacria* Selys, 1841 and *Trithemis annulata* Palisot de Beauvois, 1807 in the Maltese Islands (Odonata: Libellulidae)

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ABSTRACT. Two recently recorded dragonfly species, *Orthetrum trinacria* and *Trithemis annulata*, were observed over several bodies of water in Gozo. The distribution of these species is documented. Moreover, it is suggested that the introduction of these species could have been favoured by changes in the climate, in the light of similar observations made throughout Southern Europe.

KEYWORDS. Odonata, Malta, distribution, *Orthetrum trinacria*, *Trithemis annulata*.

INTRODUCTION

The origins of dragonflies (Order Odonata) go back to the Upper Carboniferous period when giant Protodonata, roamed the Carboniferous forests (TILLYARD, 1917; CORBET 1962, 1999). The group is divided into three suborders: Zygoptera, Anisozygoptera and Anisoptera. All members of the order Odonata are hemimetabolous and amphibiotic insects, inhabiting all kinds of freshwater habitats, whether permanent or temporary. In the Maltese Islands inland surface waters provide highly restricted spatiotemporal habitats and only a few permanent water bodies persist. Consequently, it is not expected to find a large number of dragonfly species on the Islands, as argued by VALLETTA (1949). Indeed, despite the fact that odonates are large, conspicuous, day-flying, easily handled, easily observed organisms (CONRAD *et al.*, 1999) the number of recorded species is small and few studies have been conducted locally on this order. The first publication to mention three Maltese Odonata was that of McLACHLAN (1899) which included: *Ischnura genei* (Rambur, 1842), *Crocothemis erythraea* (Brullé, 1832) and *Sympetrum striolatum* (Charpentier, 1840). The same species were included within Cowley's list of Odonata of the eastern Mediterranean area (COWLEY, 1940). VALLETTA (1949, 1957) published two papers with lists of species that occurred locally. The first article lists nine species: *Ischnura genei*, *Anax imperator* (Leach, 1815), *Anax parthenope* (Selys, 1839), *Crocothemis erythraea*, *Orthetrum cancellatum* (Linnaeus, 1758), *Orthetrum brunneum* (Fonscolombe, 1837), *Sympetrum striolatum*, *Sympetrum fonscolombii* (Selys, 1840) and *Selysiothemis nigra* (Vander Linden, 1825). In his second contribution, VALLETTA (1957) lists two additional species: *Anax ephippiger* (Burmeister, 1839) and *Orthetrum coerulescens anceps* (Fabricius, 1798), formerly identified as *Orthetrum ramburi* (Selys, 1848). A recent work on Maltese Odonata is that of DEGABRIELE (1992) where the distribution of dragonflies and damselflies in freshwater habitats in mainland Malta was investigated. The most recent publication on the Odonata fauna of Malta is the annotated checklist published by EBEJER *et al.* (2008).

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During the past months the author monitored adult dragonfly populations in freshwater habitats within agricultural landscapes. During this study two species of dragonflies, *Trithemis annulata* (Palisot de Beauvois, 1807) and *Orthetrum trinacria* (Selys, 1841) were monitored. After being recorded in semi-popular articles in local newspapers (e.g. SCIBERRAS *et al.*, 2007), the occurrence of these two species was formally recorded by EBEJER *et al.*, (2008).

METHODOLOGY

Observations were made during an ongoing survey which started in April 2008. Standardised survey methodology for adult Odonata involved weekly direct 30 minute timed counts of adults over the water body. Adult Odonata are large, conspicuous and day-flying, making them highly visible and relatively easy to identify in the field (MOORE, 1997; CONRAD *et al.*, 1999; PLANT *et al.*, 2005). Despite a reservoir of individual Odonata dispersed throughout agricultural landscapes and the various microhabitats required throughout their lifecycle (CORBET, 1999), Odonata density within breeding microhabitats, has been shown to remain fairly constant due to territorial behaviour. Thus direct counts over water bodies are considered a conservative measurement of odonate abundance (MOORE, 1953; CONRAD *et al.*, 1999). Similar timed counts were conducted over farmland and semi-natural water bodies within the Maltese agricultural landscapes. Where necessary, a hand-net was used to catch adult Odonata that were later identified to species level and released. However two specimens of *Trithemis annulata* and *Orthetrum trinacria* were taken for record. ASKEW (2004) was used for the identification of Odonata to species level.

Timed counts of these two species have been carried out in four localities:

1. The Qattara pool in Gozo. This is a deep freshwater pool which lies at the foot of the southernmost cliffs at il-Qawra in Dwejra. The Qattara pool receives water which comes from Wied il-Kbir as well as water all the year round from seepage through the overhanging rock face, thus making it a permanent pool. The banks of the pool are colonised by *Cyperus longus* L., *Rumex bucephalophorus* L., *Mentha pulegium* L. and also *Tamarix africana* Poir and *Vitex agnus-castus* L.
2. The permanent freshwater pool at Ta' Sarraflu in Gozo. This large pool is dominated by *Tamarix* spp. Other species commonly recorded from the banks of the pool including *Foeniculum vulgare* L., *Diplotaxis tenuifolia* L., *Inula crithmoides* L. and *Nerium oleander* L. Emergent aquatic vegetation includes *Typha* sp. Two recently introduced species now common in this freshwater pool include the exotic fish, *Gambusia* sp. and the Bedriaga's frog, *Rana bedriagae* Camerano, 1882 (SCIBERRAS & SCHEMBRI, 2006).
3. Tal-Grazzja valley in Rabat, Gozo. This system has been extensively modified in the past, most probably in the 1950s, in order to ensure that it retains a water supply to be used for agricultural practices throughout the year. The valley is dominated by *Cyperus longus* L., but other common vegetation includes *Galactites tomentosa* Moench, *Avena sterilis* L., *Emex spinosa* L., *Foeniculum vulgare* L., *Opuntia ficus-indica* L. and *Ricinus communis* L.
4. The watercourse in Wied il-Lunzjata. This system is directly dependent on springs flowing from the Victoria-Kerċem groundwater body. The dominant vegetation on the sides of the valley investigated include *Arundo donax* L. and *Acanthus mollis* L.

RESULTS

Two Anisopteran species of the family Libellulidae were studied in the water bodies mentioned above.

Orthetrum trinacria Selys, 1841

Short description: *Orthetrum trinacria* is a large and elongate species. Total body length is about 60 mm, making it the largest European species of *Orthetrum*. In both sexes the abdomen is narrow and almost cylindrical but basally swollen at S1-2. The species is characterised by a large yellowish brown pterostigma about 4mm long and a yellowish or olivaceous ground colour in females and immature males. Mature males and old females are darker and covered basally by bluish pruinescence.

Global distribution: This species is widespread in Africa and common in the north extending east to Sudan, Egypt and the Middle East (Palestine and Iraq). In Europe, the species is known from Sicily and recently recorded in Sardinia and Spain (BELLE, 1984; ASKEW, 2004).

Local distribution: The species was recorded from Wied Żnuber, Bahrija, Wied il-Ghasel, in Malta and from Marsalforn and Kerċem (Ghadira ta' Sarraflu) in Gozo between 2003 and 2004 and has since been sighted or taken in various localities across the Islands (EBEJER *et al.*, 2008). During this study, the first observations of *Orthetrum trinacria* were made on the 25th of May, 2008. On this day, three male individuals were observed for the first time at Ta' Sarraflu. A male individual was recorded at Qattara on the 1st of June, 2008. Following these initial recordings, individuals of this species were recorded weekly at Ta' Sarraflu but were only recorded on two sampling occasions at the Qattara freshwater pool, these being the 1st and 11th of June, 2008. *Orthetrum trinacria* individuals were observed in tandem and engaging in reproductive behaviour on the 11th of June sampling visit to the Ta' Sarraflu freshwater pool. Adult individuals were also recorded during a visit to Wied tal-Grazzja, on the 11th, 15th and 21st of June, 2008. The first record of individuals of this species over agricultural water reservoirs was made on the 21st of June 2008. During a visit to an agricultural water reservoir near the Ta' Sarraflu area an adult male individual was observed engaging in territorial behaviour with *Anax imperator* and *Crocothemis erythraea* individuals. A male individual was also observed by the author in mainland Malta at a remnant freshwater pool at the Fiddien valley on the 29th of June and the 24th of July 2008.

Trithemis annulata Palisot de Beauvois, 1807

Short description: Total body length ranges from 32-38 mm. Mature males of this species possess a broad body with a distinctive, vivid violet coloration. The thorax is reddish-brown, frons and vertex have a metallic purple colour. Females are yellow-brown with a narrow mid-dorsal black abdominal band on S8-10. Forewing has 9½ to 10½ transverse antenodals and a reddish pterostigma enclosed by black veins. The hindwing is characterised by a basal orange mark which extends as far as the discoidal cell.

Global distribution: *Trithemis annulata* is common all over Africa, and found in the Middle East, Arabia, western Asia and the extreme south of Europe. However, this species is a generalist which develops in static and slow moving waters with low oxygen concentrations and neutral or slightly alkaline pH, a biotope which is very common in the Mediterranean Region (BONET BETORET, 2000). The species was recently recorded from south-western Iberia, north as far as central Portugal, Sardinia, Sicily, coastal parts of Italy as far north as Tuscany and from southern Greece

(ASKEW, 2004). It has been suggested that this species has undergone a geographic expansion in the countries of southern Europe (BELLE, 1984; BONET BETORET, 2000; DIJKSTRA, 2006).

Local distribution: First recorded from Wied il-Qlejgha and Santa Lucia (Malta), the species has since been observed in increasing numbers in different localities such as at Mistra and Ċirkewwa (EBEJER *et al.*, 2008). During the present study four individuals of this species were first observed on the wing on the 25th of May, 2008 at the Qattara freshwater pool and two males were observed at the freshwater pool at Ta' Sarraflu. Following these initial recordings, the species was recorded weekly at the Qattara freshwater pool. However, no recordings have been made during the following two sampling visits at Ta' Sarraflu on the 7th and 11th of June, 2008. Male individuals were observed in subsequent sampling occasions in the mentioned site on the 15th and 2nd of June. Individuals of this species were also observed at the Lunzjata Valley in Kerċem. The first recordings at the Lunzjata valley were made on the 1st of June when individuals were observed engaged in territorial and also in mating behaviour over an agricultural water reservoir. Individuals were also observed on subsequent sampling occasions, often engaged in territorial behaviour with *Crocothemis erythraea* individuals, over the same agricultural reservoir. Male individuals were also observed engaged in territorial behaviour, with *Crocothemis erythraea*, *Anax imperator* and *Orthetrum coerulescens anceps* over the Lunzjata valley watercourse and regularly using reeds (*Arundo donax* L.) at the sides, as perching sites. *Trithemis annulata* individuals were also observed at the Lunzjata Valley during subsequent weekly visits. Adult individuals were also observed during visits to Wied tal-Grazzja, on the 11th, 15th and 21st of June, 2008.

DISCUSSION

The recent geographic expansion of these two species into Southern Europe could be attributed to the changing climate of the region, which has been marked by a slow ascent of average temperatures together with a diminution of the rainfall, therefore resulting in a greater similarity of the climatic conditions in the south of Europe to those in the area of original distribution of the species. Statistical analysis of past meteorological data indicates a slight increase in the mean annual air temperature within the Maltese Islands (SAMMUT & MICALLEF, 2004).

The males of both species are rather territorial and often attack other males, of similar or different species. This aggressiveness is a factor that favours the colonisation of new areas. BONET BETORET (2000) has observed that initially abundant *Crocothemis erythraea* disappeared after the colonisation of the water body by *Trithemis annulata* individuals.

The hypothesis that African species increased their range recently throughout Southern Europe is supported by the data of the present study. Furthermore, individuals of both species have been observed over farmland reservoirs near semi-natural water bodies colonised by members of the same species. Several agricultural water reservoirs throughout the Maltese Islands which have been monitored for the past months have been observed to provide an adequate habitat for *Crocothemis erythraea* and *Anax* species. The colonisation of agricultural reservoirs may suggest a current expansion in the distribution of *Trithemis annulata* and *Orthetrum trinacria* within the agricultural landscapes of the Maltese Islands. However, further monitoring of Odonata populations is required in order to investigate the local distribution of both species and the ecological consequences of their expansion.

ACKNOWLEDGEMENTS

I am grateful to Dr Louis F. Cassar for comments on an earlier version of the manuscript. Thanks to Prof. Gianmaria Carchini (Università di Roma, “Tor Vergata”) for his help in identification of these species and for providing relevant information on the distribution of both species. Prof. Patrick Schembri deserves special mention for his initial suggestion to conduct research on Maltese Odonata.

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ISSN : 2070-4526

Date of Publication : 31st August 2008

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Received: June 2, 2008

Accepted: July 10, 2008

Revised: July 28, 2008