The Central Mediterranean Naturalist	4(4): 275-288	Malta, November 2008

A CONTRIBUTION TO THE KNOWLEDGE OF ODONATA IN THE MALTESE ISLANDS

Arnold SCIBERRAS[1]

ABSTRACT

The present work aims to contribute to and compare existing knowledge on Odonata species occurring in the Maltese Islands by providing additional records collected between the years 2000-2008.

Keywords: Odonata, Maltese Islands

INTRODUCTION

Very limited work has been published to date concerning Maltese Odonata, with basically all literature comprised of a handful of papers. The first Maltese records date back to 1899, by R. Mclachlan, in which the first three Odonata species were recorded locally. The same species were mentioned again by J, Cowley in 1940, when he published a list of the Odonata of the eastern Mediterranean area. A. Valletta in 1949 recorded six species and in 1957 the same author recorded another two species. The latter two papers list the species inhabiting the Islands, and also provide some information about their distribution, together with minimal behavioural observations. Since then, little has been published, mostly in the form of popular articles or a revision of the local Odonata list. In 2008, M.J.Ebejer, G. Degabriele and the author published an annotated checklist of Maltese Odonata, listing four new species for the Islands and an update of records including the observations, flight season data and reasons for the recent increase in the number of species. In the same year, G.Degabriele published an annotated catalogue of the Odonata collection of G.Lanfranco, perhaps some of the oldest preserved Odonata specimens still available in local Maltese collections, now housed at the Natural History Museum. The author of the present study and M. Sammut also documented records of a new vagrant species to the islands in a separate work published in this same issue of the Central Mediterranean Naturalist. .

All the above mentioned work was more focused in listing species. Thanks to the latter, the local species is now comprised of sixteen species. The following works are those which focused more on behavioural aspects. A. Valletta in 1951, J. Sultana and P. J. Schembri in1991, and the present author, J. Sciberras and D. Magro in 2007. The latter two works documented migration of a number of Odonata species, although J. Sultana and P. J. Schembri did not give specific names of the species encountered. G. Degabriele in 1992 laid the preliminary foundations for the behavioural and ecological study of local Odonata, with very useful observations being made in his B.Ed. dissertation. In 2008, M.Balzan published a note on the distribution of two previously recorded Odonata species, as part of a thesis related to local Odonata, but this work was not available at the time of writing of the present paper. The most comprehensive work to date on global Odonata ecology is that of P.S.Corbet (1999).

[1] 131 'Arnest', Arcade Str, Paola – bioislets@gmail.com

AIMS AND METHODOLOGY

The present work aims to supplement existing information on knowledge of Odonata species occurring in the Maltese Islands. All records have been dated by the author between the years 2000-2008. Most Odonata behaviour mentioned in this work tally with those in Corbet's work (1999). In one of his chapters, Corbet indicates the main points of interactions of Odonata with other taxa and the Odonata families involved in such interactions.

All observations listed in this paper are from field observations, unless otherwise indicated. Many Odonata species were easily observed at close range or by means of a pair of binoculars. Some were also marked on the hind wing by a permanent marker to follow behavioural patterns of the same individuals, as well as recording flying and other locomotion patterns. Considerations about age expectancy were also made. All markings on the hind wings of individuals were made just after observation time, so that the individuals would be undisturbed during observations on their flight behaviour. After all relevant data had been recorded, individuals were caught and marked as follows: the hind wing was placed on a solid surface and marked with the initials of genus, species, sex and specimen number as shown in Figure 1.

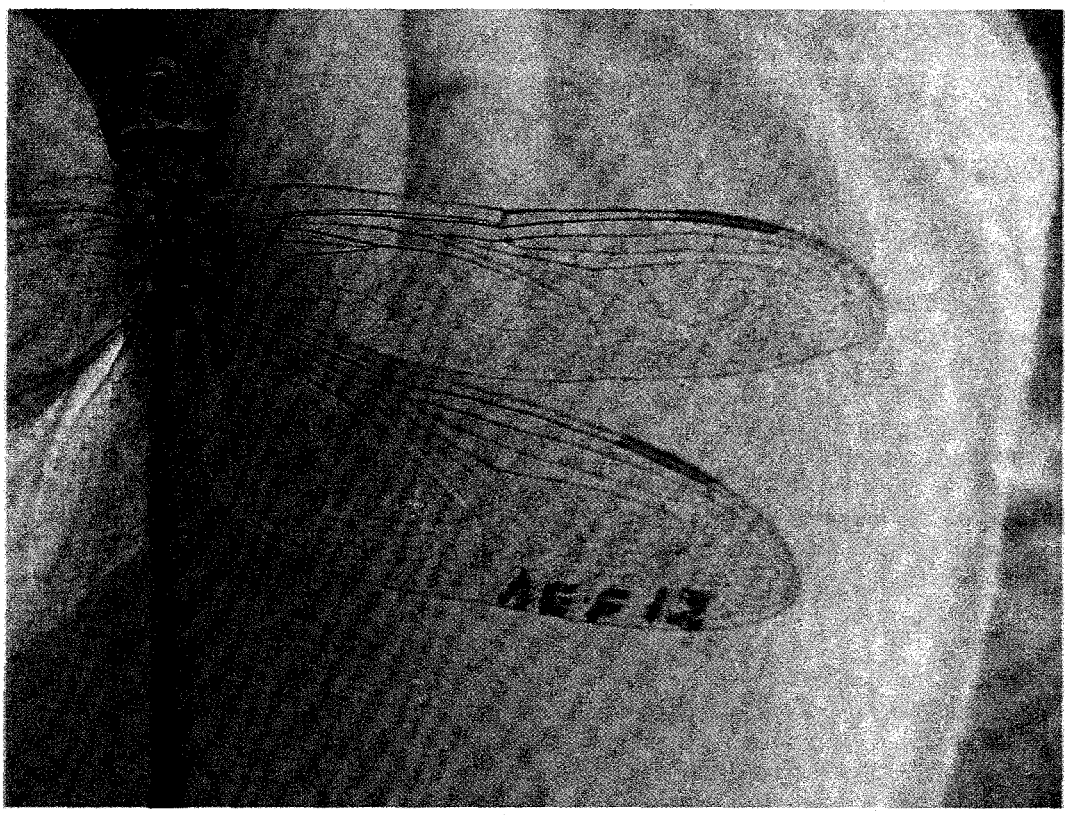

Figure 1: *Anax ephippiger,* retrapped after 22 days (photo credits: Arnold Sciberras).

RESULTS

ZYGOPTERA

Calopterygidea(leach,1815)

Calopteryx virgo(linnaeus, 1758)

Altough three local previous records of this species exist, only Sammut`s record is considered reliable. All specimens belonged to the subspecies *meridionalis* (Sciberras & Sammut 2008).

Coenagrionidae (Charpentier, 1840)

Ischnura genei (Rambur, 1842)

Notes on behaviour

One of the first three arthropod species to be recorded locally (Mclachlan, 1899), the latter species is still widespread and common, being denser in certain ponds in Malta. In Gozo, it is far less widespread, and although Comino holds five distinct records, it not considered to be established on the island. One record of this species from Comino arrived from Cirkewwa, while the other two were from Ghajnsielem. No exuviae were found on Comino. Specimens that seem to be inhabiting water bodies close to shore tend to cross our islands as specimens from Cirkewwa were found at Ghajnsielem pond, and also at Nadur. All specimens that were re-trapped afar from the water bodies, where they were originally caught, were all males. One of these specimens was marked in 6.v.2003 at Mistra on an artificial reservoir and on 8.v.2003 it was caught from a pond in Nadur. Other indications that show that is species is highly mobile, more than was previously thought, is that, both the specimens and their remains were found far from their original water bodies, and sometimes even encountered on the satellite islets of the Maltese archipelago.

At Ghajnsielem pool in May 2006, approximately eighteen specimens of this species were observed gathering on a branch a few centimetres under a perching *Alcedo atthis*. The bird was observed diving for *Gambusia* sp several times, and it is suggested that the damselflies were gathering there for the water droplets that the *Alcedo atthis* was releasing from its feathers when fluttering on the perch every time it comes up again and finished it's meal.

In Gozo, the author to date only observed the dark green form females. From one hundred and five marked specimens only nineteen were re-trapped. The longest time frame of a specimen being re-trapped was of eleven days.

Feeding

This species was locally observed feeding on *Psychoda* sp, *Musca domestica* and other unidentified species of diptera. Generally prey has to be close by for this species to attack it, very unlike most other local Odonata, so most probably all this travelling is in search of a mate and new water bodies, rather than targeting its prey.

Predation

Locally this species was observed being preyed upon by the following avifauna. *Passer hispaniolensis, Sylvia melanocephala, Sylvia conspicillata, Cisticola juncidis, Hirundo rustica, Delichon urbica, Apus apus, Merops apiaster. Chameleo chamaleon* and *Discoglossus pictus* where also observed preying on the latter. When *Ischnura genei* was more abundant at Sarraflu pool, *Pelophylax bedriagae* was recorded preying extensively on it. This Odonata species was also observed at il-Maghluq in Marsascala, being predated by *Mugil cephalus* and *Argiope* sp

(Degabriele 1992). The endemic populations of *Podarcis filfolensis* present on tal-Halfa Rock, Fungus Rock and Large Blue Lagoon Rock, were recorded feeding on this species, as evidenced by some pieces of wing where collected from their faeces. This is very interesting because these lizards are isolated populations and due to their restricted habitat they attempt to prey on a larger range of insect species. In fact, *Ischnura genei* is not recorded as a prey species for mainland lizards.

Copulation and Larvae

From fifteen observed mating patterns followed by copulations of this species, four of these were cannibalistic behaviours, observed taking place in the large rock pool at Ghajsielem. On two occasions during the fight for territory, one male took hold of the other male from the prothorax and started chewing it till it was completely devoured. On another two occasions, while the latter took place, the female joined in and aided in devouring the abdomen of the present victim. Later copulation took place and in most cases if continued being observed, the male will guard the female during deposition of eggs but do not hold in tandem during oviposition. Larvae and exuviae were also found to occur in brackish water at il-Maghluq, Marsascala in 1992 by G. Degabriele. A similar case was observed in Simar Nature Reserve by the author in 2005-2007.

ANISOPTERA

Aeshnidae (Fabricius, 1775)

Aeshna mixta (Latreille, 1805)
Only 1 female specimen recorded locally in 1976 is known to date by Ebejer (Ebejer *et al.* 2008.)

Anax (leach,1815)

Anax ephippiger (Burmeister, 1839)

Notes on Local Behaviour

First recorded locally by Valletta in 1949, this species is a regular migrant in the Maltese islands and although from the 1950`s it was recorded with gaps of up to two decades from each migration, from 2000 to the present this species has reached our islands every year, with the exception of 2006. During the 19th-25th April 2007 period, the largest migration observed locally in the last decade of this species was recorded (there are no previous records of this species older than ten years) due to the fact that hundreds of specimens were observed flying towards Zurrieq and Qrendi from Wied Babu. These continued spreading to many localities including Il-Maqluba and many of these specimens performed interesting hunting patterns feeding exclusively on *Culicidae sp* and other Diptera followed by other insects smaller than themselves.

Many at the same time were hovering in the same direction facing the light breeze and swiftly darting down on the prey, always keeping it's head facing in the opposite direction to the sun. Some other short observations showed that each batch of insects contained approximately twelve insects. These were flying in a certain pattern, where there was one male in front followed by ten females and another male following the rest. The same spectacular scenes where observed at Dwejra and at Ta' Cenc, Gozo, in the evening where hundreds of these specimens were resting on trees and shrubs as the sun was about to set (Sciberras *et al.* 2007). Two marked specimens from Ta' Cenc recorded on the 20th of April 2007 were recollected from Dwejra on the same day and twenty-two days later from Gharb. Out of thirty-four marked specimens, only the present two were retrapped.

Feeding

This species was locally observed feeding extensively on several species of Diptera most of which could not be identified. Out of these *Limonia nubeculosa, Culex pipiens, Bibio siculus* and *Cerdistus sp*, were present. Extracts

from the abdomens were taken and besides the species mentioned here, the latter also contained traces of *Formicidae sp.*

Predation

One specimen of this species was captured by *Manticola solitarius* in the mentioned migration (2007) and three specimens from a group of twenty-one were caught by a pair of nesting *Sturnus vulgaris* on Comino in 2005.

Copulation

Ebejer observed several specimens mating and ovipositing at Fiddien,Wied Ghomor and Simar. In addition, Degabriele observed pairs in tandem but no nymphs or exuviae were ever recorded, such that one cannot establish conclusively whether the species is breeding locally or not (Ebejer *et al.* 2008).

Anax imperator (Leach, 1815)

Notes on Local Behaviour.

First recorded locally by Valletta in 1949, this species is the largest found locally, and according to previous local literature, it was always stated as frequent to very common, giving the impression of being the commonest of the aeshnids. This could be either due to the fact that truly *Anax imperator* was much common in the past or it was misidentified as *Anax parthenope*, which is another locally-occurring species. Local tracking of the specimens show that although this species is widespread and travels great distances in search of food, most of them tend to head back frequently to the same water body either for ovipositing, sometimes guarding for their territory, and usually as a night resting place. Most of the present study was conducted at Chadwick lakes, and hence the name, this valley usually has a deep-water body when compared to other valleys, but still, like all valleys on the islands, most of it dries up due to the summer heat. This is an ideal and preferred habitat of this species. Out of thirty-one marked specimens, seven were traced regularly, and one specimen from here was recorded thirteen days after being marked at Wied is-Sewda and eight days later at the same spot where it was originally marked. From 2005 to date, out of four hundred and fifty captured and marked *Anax* individuals, just fifty-three belonged to the species *A. imperator*, with the rest belonging to the species *A. parthenope.*

The same specimens tend to spend the night on the same branches high up in trees (in this case *Populus alba*) and one specimen was recorded daily for four days as the sun was about to set, finding the same branch and resting on it. While patrolling or on the hunt, other species of Odonata do not seem to interfere, except for *Anax parthenope*. When *Anax imperator* and *Anax parthenope* individuals encounter each other, chasing usually take place, but tangled fights rarely occur, as in most cases within the same species. Sometimes, size issues may also render identifying the species a difficult task – for example, during or after the early emergence from the exuviae (due to drying up of water bodies) *Anax imperator* specimens may be much smaller in size and sometimes are even smaller than *Anax parthenope* specimens. Females of both these species sometimes look alike, because with age colour varies, especially after females of this species have oviposited or in above-average summer temperatures, so it is best that specimens are trapped and the two tubercles on the occiput of the female are actually located, as these are only present in the female of *Anax parthenope*. Females of more than thirty-five days old tend to start having their wings dampening, becoming tinted to a dark yellowish colour, but never dark brown like that of an old female *Anax parthenope*. The longest timeframe over which a female specimen was re-trapped is seventy six days, whilst a male individual of the same species was re-captured ninety-three days later. Most Odonata species tend to coexist, with locally the commonest species being *Crocothemis erythraea*, *Orthetrum coerulescens* and *Trithemis annulata.*

Feeding

This species was observed locally feeding extensively on several species of Diptera, most of which could not be identified. Out of these, *Bibio siculus*, *Calliphora vicina* , *Culex pipiens* , *Lucilia sericata* and *Sacrophaga fertoni*

were present. Lepidoptera in this species diet varies from *Pyralis farinalis, Blepharita deluccai to Colias crocea, Pieris rapae* and *Pieris brassicae*. On separate occasions, a specimen of this species was observed hunting a *Sphingonotus coerulans* and in another case a specimen successfully caught and lifted a *Mantis religiosa* nymph of the 3rd instar.

Predation

Locally, this species was observed being preyed upon by the avifauna species *Merops apiaster* and *Lanius senator*. *Chameleo chamaleon* was observed twice at Ghadira nature reserve feeding on this species. *Anax imperator* was previously more abundant at Ta' Sarraflu freshwater pool, where large females of the frog species *Pelophylax bedriagae* were recorded preying occasionally on it.

Copulation and exuviae

Whilst the unusual (when compared with other aeshnid species) solitary oviposition by females of this species has already been recorded, the persistence on the same branch as the ovipositing female of a male (of the same species) is a rare event. Females were both observed laying their eggs by dipping their abdomen in flight and resting on generally large debris. In 2006, an interesting copulation was observed between a male of this species and a female *Anax parthenope*; the latter specimen was later disturbed in an attempt to gather the ova and the female did lay eggs in captivity two days later but these never hatched. No individual was ever collected in the present study which might suggest the occurrence of hybridisation. This species was also observed ovipositing in brackish water. Moreover, the exuviae of this species were observed clinging to reeds by Degabriele in 1992.

Anax parthenope (Selys, 1839)

Notes on Local Behaviour.

This species was first recorded locally by Valletta in 1949, and the same author in 1951 recorded this species migrating to the Maltese islands. A large migration of this species was recorded by the present author in 2004, where a fairly large number of five hundred individuals where observed at Dingli cliffs. During the 19th-25th period, in concomitance with the largest migration of *Anax ephippiger* observed locally during the last decade, small numbers of *Anax parthenope* were also observed locally. According to the observations of the author conducted in the last four years, this species can be described as being the commonest aeshnid in Malta. This is because in most of the coastal areas where there is at least a vestige of standing water, this species is generally dominant. At least four local water bodies that were previously mostly dominated by *Anax imperator* are increasingly being frequented by *A. parthenope*. *Anax parthenope* is a hardier species than *A. imperator* as evidenced by the fact that it was also noted to patrol areas where water is brackish, ovipositing in them and in some cases, exuviae were collected. One classical place is l-Maghluq ta' Marsaxlokk (also known as il-Ballut). Sometimes, even deposition of ova in saltwater rock pools and in the sea directly was observed but no nymphs were ever collected form such instances. Degabriele (1992) states that exuviae belonging to this species were even recorded in brackish water. Recent observations might suggest that this species is on the increase locally and may be occupying areas previously dominated by *Anax imperator*.

Most other Odonata species tend to coexist more with *Anax imperator* than with this species. Only *Crocthemis erthryrea* and *Iscnura genei* were recorded in abundant numbers along with *A. parthenope*. The longest period of time elapsing between trapping and subsequent retrapping was for a male individual (fifty-six days), whilst a female individual was retrapped after forty-three days.

Feeding

This species was locally observed feeding extensively on several species of Dptera most of them associated with costal habitats Common Diptera prey species included *Exoprosopa jacchus* and *Cerdistus sp.*, whilst common Lepidoptera prey species included *Emmelina monodactyla, Pyralidae sp* and *Pontia daplidice*. The latter was also

observed feeding on *Cercopidae sp. Anax parthenope* was also observed feeding on *Cicada orni* (Borg Cardona, personal communication).

Predation

Locally this species was observed being predated by many species similar to that of *Anax imperator*. At il-Maghluq ta' Marsaxlokk occasionally this species was attacked by *Passer hispaniolensis,* and at is- Simar while ovipositing it eggs, specimens were being devoured by *Aphanius fasciatus.* The same was noted at Ghajnsielem permanent fresh water body but the predator was a *Gambusia sp.*

Copulation

Nearly in all cases, the pair is in tandem and both have a strong grip while female is ovipositing. Only on two cases the pair was observed in tandem and only the male is holding firmly while the female is depending solely on the grip of the male primary genitalia while ovipositing.

Crocothemis (Brauer, 1868)

Crocothemis erythraea (Brulle`, 1832)

Of the three aeshnid species recorded locally by Mclachlan in 1899, this species is by far the commonest one in the Maltese Islands, being present in almost every local water body, easily coexisting with other Odonata species. While males tend to have a specific range of colours and tend to get darker with pruinosity with age, females are extremely variable in their colouration. Local specimens vary from light yellow colours to grey, brown and in two occasions even black specimens occurred. Sometimes they resemble the male's adult colour but never are they as dark red in colour and broad from the abdomen as the male. An interesting note is that the colour of the species is generally similar to the surrounding habitat where they are found, and since most of the local vegetation during the flight period is dry, yellow and brown are the commonest colours observed. This species was also observed ovipositing in brackish water. Moreover, the exuviae of this species were seen clinging to reeds by Degabriele in 1992. The latter behaviour was observed only once by the author at Is-Salina. The longest period of time elapsing between trapping and subsequent retrapping was for a female individual (fifty-four days), whilst a male individual was retrapped after forty-four days. Specimens were never found afar from the location where they were originally trapped and marked.

Feeding

Three species of Diptera were identified as prey of this species: *Musca domestica*, *Sarcophaga fertoni* and at San Anton gardens a female specimen of *C. erythraea* was observed capturing two individuals of *Ornithomyia avicularia* from a *Columbia livia domestica* that had approached a pond. *Cacyreus marshalli, Coenonympha pamphilus, Pyralis farinalis* and *Pieris rapae* are the Lepidoptera that this species regularly feeds upon.

Predation

Locally this species was observed being predated by the avifauna *Merops apiaster, Apus apus, Passer hispaniolensis, and Sylvia melanocephala. Chalcides ocellatus* was observed feeding on a specimen however it is not known if the latter was already dead when located by the reptile. At Sarraflu pool, large females *Pelophylax bedriagae* were recorded preying occasionally on this species. *Carassius auratus, Gambusia sp* and *Dytiscus circumflexus* were observed feeding on nymphs of this species at San Anton gardens.

Orthetrum (Newmann, 1833)

Orthetrum brunneum(Fonscolombe,1837)

Since originally being first recorded locally by Valletta in 1949, only a handful of subsequent records are available of this species. On the 20th of July 2008, this species was sighted once by the author at a pond close to the Roman Villa at Rabat. Due to it's rarity, no present information on it's ecology has been gathered, although in the past, it may have been much commoner – in fact, the same species is mentioned more frequently in Degabriele`s thesis of 1992. Also no confirmed record of this species breeding locally exists.

Orthetrum cancellatum(linnaeus,1758)

Notes on Local Behaviour

This species was first recorded locally by Valletta in 1949, and although in most previous published works, it was recorded as common, the distribution and abundance of this species has either declined or it was originally misidentified with other commoner species. During the current study, this species was recorded in two localities, where lately the abundance of the species has also regressed. The species population on the island of Malta presently extends from Ghadira nature reserve to the valley present at Cirkewwa, with an average of five records per annum. Only one record of the species was made in 2006, that of a female at is-Simar attempting oviposition with no success. In Gozo, until 2006, the species population extended from Ta' Sarraflu pool up to il-Qattara. For the past two years, specimens from Gozo were only sighted and recovered from the latter pool. Only ovipositing by females and the presence of exuviae was recorded from this site. This might be due to the presence of *Orthetrum trinacria* at the other sites, with the latter species being a constant threat to *O. brunneum*. Out of fifty specimens recorded as sightings, fifteen were trapped and marked and of the fifty individuals, only seven were males. The longest period of time elapsing between trapping and subsequent retrapping was for a female individual (fourty-seven days), whilst no male individuals were ever re-trapped. Specimens were never found afar from the location where they were originally marked. Most of the specimens tended to keep away from sources of extraneous movement and unlike most species of Odonata, did not regularly use the same perch.

Feeding

This species was locally observed feeding extensively on several species of diptera , most of them associated with coastal habitat, however none were ever identified.

Predation

This species was observed being predated by *Orthethrum trinacria* at Sarraflu pond on two occasions. One specimen was observed being caught by *Chameleo chamaleon* and during oviposition *Carassius auratus* and *Gambusia sp* were observed swimming around the specimen, presumably feeding on the ova of this Odonata species. At Ghadira nature reserve, one *Fulica atra* was sighted carrying a dead specimen in its beak.

Orthetrum coerulescens anseps (Fabricius, 1798)

Formerly recorded as *Orthetrum ramburi,* this species was first recorded locally by Valletta in 1957. Past literature gives the impression that this species is rare locally, but as from the year 2000, the author has noticed a range expansion of this species and also significant increases in its local abundance. There are several habitats where this species was spotted but the increase was observed mostly at the mouth of temporary freshwater streams, where these discharge into the sea. Two such areas are Ghajn Zejtuna valley and a watercourse close to Selmun. An increase in the abundance of this species was also noted on Comino. Females are highly variable and some specimens resemble immature males. Local studies were conducted by the author and Degabriele to confirm which subspecies is present locally and although two anomalous specimens' secondary genitalia were recorded, subsequent studies showed that to date *Orthetrum coerulescens anseps* is the only subspecies present in the Maltese Islands. The longest period of time elapsing between trapping and subsequent retrapping was for a female individual (thirty-nine days), whilst a male individual was retrapped after twenty days. Specimen females were never found afar from the location where they were originally marked, but males were found at distances as large as 5km from the original point of collection.

Feeding

This species was locally observed feeding extensively on several species of Diptera and micro-species of Coleoptera most of them associated with coastal habitats; however none of these have been identified to date.

Predation

Chameleo chamaleon was observed preying on three individuals of O. *coerulescens anseps* and, during oviposition, *Carassius auratus* and *Gambusia* sp. at il-Qattara, Gozo were observed swimming around the specimen, presumably preying on the ova of the same Odonata species. One shrivelled-up specimen of *O. coerulescens anseps* was recorded at Buskett in an *Argiope lobata* web.

Orthetrum trinacria (Selys, 1841)

Notes on Local Behaviour

This species was first recorded locally in 2003 (Ebejer *et al.*2008) through one individual from Wied Znuber, and a few days later, a whole population was found at Ta' Sarraflu pool. Since then, over a two-year period, other records of the species in Gozo have not been made, but the vast majority of individuals were always recorded at Ta' Sarraflu.

Balzan (2008) also reports records of this species from il-Qattara, Grazzja Valley and Wied il-Lunzjata In Malta, the species was recorded from several other sites but only as single individuals and rarely in pairs. The first confirmed breeding record for this species in Malta was at Majjistral Park in 2007. A few specimens of this species were also noted on Comino. An increase in the distribution of the species was accompanied by a regression of the formerly common species, including *Sympetrum fonscolombii* and *Crocothemis erythraea. S .fonscolombii* was noted to disappear in the presence of *O. trinacria*, as did the occasional species *Sympetrum striolatum* , which in most cases is misidentified as *Sympetrum fonscolombii.* The author observed sixteen cases in which this species hunted and fed upon *Sympetrum fonscolombii*, whilst in three cases, the species impinged in some way or another on *Sympetrum striolatum* and, in two other cases, it impinged upon *Orthetrum cancellatum. Crocothemis erythraea* seem to be the only species to coexist with this species. Occasionally, *O. trinacria* chases *Anax imperator* and *Anax parthenope* individuals in view of its highly territorial nature. Only rarely was *Trithemis annulata* observed in ponds where *O. trinacria* was dominant. Out of seventy-three individuals trapped and marked, only nine were females. The longest period of time elapsing between trapping and subsequent retrapping was for a male individual (eighty-one days), whilst a female individual was retrapped after sixteen days. Specimens were recorded at large distances (up to eight km afield) from where they were originally marked.

Feeding

This species was locally observed feeding extensively on relatively large prey (compared to its size), and exhibited aggressive behaviour. Besides the Odonata species listed above, this species was also observed feeding on *Bibio siculus, Calliphora vicina, Culex pipiens, Lucilia sericata and Sacrophaga fertoni. Colias crocea, Macroglossum stellatarum, Pararge aegeria,Pieris rapae , Pieris brassicae* and *Vanessa cardui* were some of the identified Lepidoptera species preyed upon, whilst similarly, *Evania appendigaster,Chrysis ignita, Polistes omissus, Polistes gallicus, Paravespula germanica* and *Apis mellifera* were the Hymenoptera species regularly preyed upon. A nymph of *O. trinacria* was observed eating a specimen of *Gambusia* sp.

Predation

Locally, this Odonata species was observed being predated upon only by *Pelophylax bedriagae* – however, a *Trachemys scripta elegans* individual was observed feeding on a dead specimen of this Odonata species.

Copulation

During copulations, other males often fly by and constantly attempt to disrupt the mating pair. Immature males have exactly the same colours as females and are frequently chased by males with a higher degree of prunosity.

Selysiothemis (Ris, 1897)

Selysiothemis nigra (Vander linden, 1825)

Notes on Local Behaviour

This species was first recorded locally by Valletta in 1957, through two specimens collected in 1952, and was not collected again till 1996, with just three individuals of this species being recorded to date. In 2007, one specimen was collected in July from Ramla Bay in Gozo, and in August a total of five female specimens were observed in a burnt field in an area known as tas-Sellun in Xaghra, Gozo. Shortly afterwards a permanent population was noted at two large artificial reservoirs in a valley at Marfa, Malta. In 2008, the author and some bird watchers at L-Ahrax and Ghadira nature reserves spotted a number of specimens. From 19th July to 22 August 2008, this species was observed on a daily basis, with records ranging from a single individual up to fifteen in a single day. This species must have been overlooked in these islands, however, as it is very inconspicuous and when in flight it so camouflaged (especially females). Out of thirteen individuals trapped and marked, only two were males. The longest period of time elapsing between trapping and subsequent retrapping was for a female individual (thirteen days), whilst males were never retrapped. Specimens were always found short distances from where they were marked.

Feeding.

This species was locally observed feeding extensively on beeflies (Diptera: Bombyliidae). Out of those identified were *Bombylius medius, Exoprosopa jacchus* and *Heteralonea megerlei.*

Copulation.

Two mating pairs were observed in August 2007. This was the only occasion, besides the instance at L-Ahrax, in which males were spotted and marked. Nymphs and exuviae were collected from Cirkewwa and this is the first record of local breeding of this species.

Sympetrum (Newmann, 1833)

Sympetrum fonscolombii (Selys, 1840)

Notes on Local Behaviour.

This species was first recorded locally by Valletta in 1949, and although in most previous works, it was recorded as very common, nowadays population numbers have decreased drastically, especially in the last three years. This may be attributed to the population increase of *Orthethrum trinacria,* which is normally accompanied by a decline in populations of *S. fonscolombii.* Most of the sites where *S. fonscolombii* is still quite common are coastal ones, which cannot support *Orthethrum trinacria* populations. *S. fonscolombii* individuals tend to hunt their prey away from water and in dry fields. In 2003, at Wied is- Sewda (Malta), the author observed several hundred individuals of this species emerge at the same time. One medium-sized field was replete with this species and exuviae were even packed as much as five on each other. A similar record (but involving smaller individual numbers) was observed by Valletta in 1949 and Degabriele in 1992. Also, on that day, a large number of *Passer hispaniolensis, Apus apus* and

Hirundo rustica were observed preying on the freshly emerged adults of this species. Out of two hundred and nine trapped and marked individuals, only forty-seven were re-trapped. The longest period of time elapsing between trapping and subsequent retrapping was for a male individual (sixteen days), whilst a female individual was retrapped after eleven days. Specimens were found at large distances away from their original marking site – for instance, one individual was marked at Dwejra (Gozo) and was retrapped at Mistra (Malta)

Feeding.

This species was locally observed feeding extensively on several species of Diptera, most of them associated with costal habitats; of these, only *Musca domestica, Mintho compressa* and *Episyrphus balteatus* were identified.

Predation.

Besides the species mentioned above, *Chameleo chamaleon* was observed several times at Ghadira nature reserve feeding on this species of Odonata. When the same Odonata species was more abundant at Sarraflu pool, *Pelophylax bedriagae* was recorded preying occasionally on it. *Podarcis filfolensis filfolensis* on Filfla was also observed preying on *S. fonscolombii.* At the opening to and inside a resting place of *Myotis punicus* and other Chiroptera species, several wings of *S. fonscolombii* were found, along with the droppings of these mammals. On three occasions, Chiroptera species were observed hunting the latter species at Ghadira Nature Reserve.

Copulation.

Mating pairs were generally found far from fresh water bodies. Both Degabriele (1992) and the author observed larvae of this species in brackish water. Many local naturalists including the author have observed such a species ovipositing in open sea.

Sympetrum striolatum(Charpentier,1840)

One of the first three recorded species locally by Mclachlan in 1899, the latter species in recent years has decreased drastically, and this has been observed since the 1990's. The author has observed this species on a handful of occasions, but on one particular occasion, thirty-four specimens were trapped and marked at Cirkewwa, on the 12th of August 2007. None were ever retrapped. *S. striolatum* could easily be overlooked since, unless observed at very close proximity or actually being collected, individuals can easily be misidentified as old *Sympetrum fonscolombii,* as the latter species normally gets darker and the coloured veins and pterostigma dampen.

Trithemis (Brauer, 1868)

Trithemis annulata (Palisot de Beavois, 1807)

Notes on Local Behaviour.

The author first recorded this species locally in 2007 (Ebejer *et al.* 2008) but sightings dates back to 2005. In less than a year this species has flourished throughout the Maltese Islands, and sightings became more regular after the large *Anax ephippiger* migration that occurred in the dates19/iv/2007-25/iv/2007. Before this, the latter species was confined to Chadwick lakes and the Chinese garden at Sta Lucija, were the first exuviae were collected. Nowadays exuviae were also collected from il –Qattara Gozo. Balzan (2008) also reports records of this species from il-Qattara, Grazzja Valley ,Wied il-Lunzjata and in one case at Ta'Sarraflu. Currently, it is the second most common species locally and is usually co-occurs with *Crocothemis erythraea.* While males patrol the area close to water bodies, females tend to stay afar; perching usually occurs quite more inland and only come close for ovipositing. Young males tend to have the thorax striped in black and the purple is only on top of the thorax. After fifteen days of emergence, the pruinosity of purple in males tends to get darker. Out of four hundred and five individuals trapped

and marked, only sixty-three were retrapped. The longest period of time elapsing between trapping and subsequent retrapping was for a female individual (twenty-four days), whilst a male individual was retrapped after twenty-two days. Specimens were always found at short distances from where they were originally marked.

Feeding

This species was locally observed feeding extensively on several species of Diptera. those identified were *Sphaeorophoria scripta, Calliphora vomitoria, Calliphora vicina, Pollenia rudis, Phtyo adolescens, Stevenia deceptoria, Stomoxys calcitrans, Graphomya maculata, Suillia variegata ,Limnophora obsignata, Mintho compressa, Melanophora roralis, Gymnosoma rotundata and, Prosopomyia pallida. Cacyreus marshalli* and *Coenonympha pamhilus* are the only two Lepidoptera known being predated by this species.

Predation

Locally, this species was observed being predated by the following avifauna. *Passer hispaniolensis* and *Sylvia melanocephala. Discoglossus pictus* was also observed preying on the latter. Exotic species such as *Pelophylax bedriagae,Trachemys scripta elegans, Carassius auratus* and *Gambusia sp* are known to take ova and nymphs of this species. On two occasions *Mantissa religiosa* was observed feeding on females of this species.

Copulation

Although few mating pairs were observed in several localities to date exuviae where only found in the two sites mentioned above. It is assumed that this species is not able to cope with conditions of drying water pools to complete its cycle, but requires a permanent fresh water pool.

Trithemis arteriosa (Burmeister, 1839)

Only 1 female specimen of this species recorded locally by the author in 2002 is known, to date, (Ebejer *et al.* 2008). This record has become dubious as re-examination of this specimen by the author and by Degabriele has revealed the identity of this species to be closer to *Trithemis annulata* than to the assigned *T. arteriosa*. This specimen still requires further studies prior to its conclusive taxonomic identification.

CONCLUSIONS

Most of the behaviour recorded in the present study may be habitat-specific or due to certain restrictions found locally. Using *Anax imperator* as an example, this species may reach body sizes less than those of *Anax parthenope,* and this can be due to the lack of food in the water body, or because the same water is being pumped artificially for agricultural use, hence not allowing enough time for the nymphs to develop properly. On the other hand, artificial reservoirs have increased drastically in recent years, presenting an opportunity for most Odonata species, although a percentage of these artificial water bodies are not available to Odonata species, either because they are covered or since they harbour species introduced to control the proliferation of other aquatic life. In the case of *Anax imperator* mating with *Anax parthenope,* this might be due to the recent increase in numbers of the latter species or due to interspecific competition for the same space. Along with natural predators, alien species, such as *Pelophylax bedriagae, Trachemys scripta elegans, Carassius auratus* and *Gambusia sp* certainly do not aid any Odonata species in its early stages.

ACKNOWLEDGEMENTS

The author is indebted to Esther Schembri, Romario and Jeffrey Sciberras for their constant assistance in the field and the latter for his useful comments. Alan Deidun and Paul Gatt are greatly acknowledged for their comments and correction of the script. Appreciation is also reserved to Mario Gauci for his hospitality during Gozo visits. The author would also like to acknowledge all birdwatchers who provided pictures and data of specimens they encountered, especially Matthew Borg Cardona, Chris Cachia Zammit, Dennis Cachia, Victor Falzon and Charlies Gauci (the latter also supplying data from Ghadira Nature Reserve records).

REFERENCES

Askew, R.R. (2004) Dragonflies of Europe, 2nd revised edition. Harley, Colchester.

Balzan, M,V. (2008) The Distribution or *Orthetrum trinacria* Selys,1841 and *Trithemis annulata* Palisot de beauvois,1807 in the Maltese Islands(Odonata:Libellulidae) Bulletin of the Entomological Society of Malta.Vol1:91-96.

Cassar, L.F. (1984) Il-Mazzarell. L-G]asfur u L-Ambjent Naturali. MOS.4:13.

Cilia, J. (1972) An entomologist's diary. *The Maltese Naturalist* 1(3): 37 – 38.

Corbet, P.S. (1999) Behavior and Ecology of Odonata. Harley Books.829pp

Cowley, J. (1940) A list of the Odonata of the Islands of the Eastern Mediterranean area. *Proceedings of the Royal Entomological Society of London* (B) 9: 172 – 178.

Degabriele, G. (1992) Aspects in the ecology of Maltese Odonata. Unpublished B.Ed. Dissertation, University of Malta. 112pgs.

Dijkstra, K.D.B. & Lewington, R (2006) A field guide to the Dragonflies of Britain and Europe. British Wildlife Publishing, Gillingham.

Ebejer, M.J., Degabriele, G. & Sciberras, A. (2008) An Annotated Checklist of Odonata of the Maltese Islands, with evidence for Recent influx of species. Libellula 27 (1/2):133-145.

Falzon, V. (2007) 2 Mazzarelli Godda! *Huttafa* issue 82.Birdlife Malta:2

Mclachlan,R. (1899) Remarque sut qeulques odonates de l' Asie Mineure meridionale comprenant une espece nouvelle por la faune palearctique. Annales de la Societe Entomologique de Belgique.

Sciberras, A. (2007) Xi Haga Fuq Cikku Gwiebi!. L-*Orizzont* 14.03.07: pp: 19

Sciberras, A., Sciberras, J. & Magro, D. (2007) A Celebration of Dragonflies. *The Malta Independent*.19.11.07: pp: 8-9.

Ssiberras, A. & Sammut M. (2008) On The Occurrence of *Calopteryx virgo meridionalis* (Selys,1873) (Odonata: Calopterygidae) in The Maltese Islands. *Central Mediterranean Naturalist* 4(4): 270-287.

Sultana, J. & Schembri, P.J. (1991) An unusual large mixed fall of birds and insects on filfla.*Il-Merill*: 13-15.

Turner, N. (2007) A new Discovery for the Maltese Islands. 'The Maltese Herald', October 23rd: 13.

Valletta, A. (1949) A preliminary list of the Odonata of the Maltese Islands. *The Entomologist* 82: 85 – 87.

Valletta, A. (1951) An unusual migration of *Anax parthenope* Selys in Malta. The *Entomologist* 84: 42.

Valletta, A. (1957) Second contribution to the Odonata of the Maltese Islands. The *Entomologist* 90: 306 – 307.

(Submitted: August 2008)

(Accepted: November 2008)