

THE ODONATA OF TUNISIA¹

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Received 14 December 1999; revised 19 April 2000; accepted 02 May 2000.

Key words: Odonata, dragonfly, Tunisia, distribution, phenology, voltinism.

Abstract

Between 1987 and 1999 several visits to 69 localities in Tunisia were made. Altogether 46 species of Odonata, including 10 new to Tunisia, were recorded, raising the Tunisian checklist to 52 species. Our observations cover early May to mid June and late September to early November. Using as a basis for inference data from nearby Numidia that cover the period missing from our own observations, we assume that many species have a long flight period. Among such species, some are known to be univoltine, exhibiting protracted aestivation as a prereproductive adult, whereas some others, we suggest, may be bivoltine.

Introduction

Tunisia is one of the Maghreb countries where the western Palaearctic is bounded by the Sahara Desert. The odonate fauna contains several endemics as well as a mixture of Palaearctic and Ethiopian elements. The only thorough odonatological investigation preceding ours is that by Dumont (1977). Using data from the literature and from his own extensive material, Dumont compiled a checklist of 45 Tunisian species. Some, which have been mentioned in early references, are questionable and urgently need confirmation. On the other hand, several species recorded nearby in Libya and Algeria, are absent from Dumont's checklist. Since Dumont's survey only a few reports of Tunisian dragonflies have been published (Koch 1979; Carchini & di Domenico 1992; Mauersberger 1994; Klingenberg 1994). These papers deal with only four species whose occurrence in Tunisia is well known. As a result of our visits between 1987 and 1999 we provide new information about Tunisian Odonata.

¹Dedicated to the late Dr Elliot Pinhey who strongly influenced our interest in African Odonata.

Material and methods

Our results derive mainly from seven visits to Tunisia:

- 7-18 June 1987 (Seidenbusch)
- 23 May-1 June 1988 (Seidenbusch)
- 10-15 June 1996 (Arlt)
- 5-11 May 1998 (Arlt, Jödicke)
- 7-15 October 1998 (Arlt, Jödicke, Kunz, Lopau)
- 27 September-3 October 1999 (Arlt, Jödicke)
- 3-6 November 1999 (Kunz).

All species recorded, except *Pantala flavescens*, *Selysiothemis nigra* and *Urothemis edwardsii*, are authenticated by photographs and by voucher specimens, and most of the species also by final-stadium exuviae. All specimens collected by Seidenbusch are deposited in the Bayerische Staatssammlung München. All exuviae from the third and later visits are in the Arlt collection, and the adults are in the Jödicke collection. Additional data have been provided by other workers who also visited Tunisia during this 13-year period.

List of localities

All localities where dragonflies were recorded are grouped in three blocks: (1) northern localities south to 36°30'N; (2) central localities between 36°30'N and 35°N; and (3) southern localities south of 35°N. Within each block all localities are listed from west to east. Several places investigated previously by Dumont (1977) are additionally characterized with Dumont's numbering combined with the prefix "D". Names of localities are broadly derived from the "Carte Touristique et Routière 1/500 000" which is available from booksellers. In rare cases we also used names from local place-name signs. When a compass point (e.g. N, SW etc.) immediately precedes another word, usually a named place, the word 'of' is understood. Thus, under locality 1, '3 km S Fernana' signifies '3 km S of Fernana'.

The northern localities

1. Two confluent rivers 3 km S Fernana, W crossing with main road Jendouba-Aïn Draham, one of them — Oued Ghezala (D14) — with muddy ground and extended *Typha* stands and Oleander bushes, the other with a stony river bed and sparse vegetation, 36°38'N, 8°41'E: 11 vi 1996, 9 v 1998, 13 x 1998.
2. Spring 4 km N Aïn Draham at road Aïn Draham-Tabarka, 36°47'N, 8°41'E: 11 vi 1996.
3. Small ponds in the stream bed 5 km N Babouch at road Aïn Draham-Tabarka, 36°51'N, 8°43'E: 11 vi 1996.
4. Oued el Kebir (D16) 5 km S Tabarka, coastal river with sandy bed and steeply rising banks which are completely covered with bushes, 36°55'N, 8°45'E: 11 vi

- 1996, 10 v 1998, 14 x 1998.
5. Western tributary of Barrage Bou Heurtma, stony bed lined with Oleander, 1 km before inflow to the reservoir, 36°40'N, 8°45'E: 9 v 1998.
 6. Barrage Bou Heurtma, shallow northern shore with flooded tamarisks, 36°40'N, 8°46'E: 9 v 1998.
 7. Brooklet W Ain Sebaa at road Tabarka-Nefza, 36°57'N, 8°54'E: 10 v 1998.
 8. Woodland brook at Ouchtata 8 km W Nefza, 36°58'N, 9°01'E: 10 v 1998.
 9. Oued Maden 2 km SE Nefza, rich stands of *Typha* and sedges, *Potamogeton*, lined with Oleander, 36°57'N, 9°06'E: 10 v 1998.
 10. Oued Béja 4 km N Béja at intersection with railway bridge and main road Nefza-Beja, 36°46'N, 9°12'E: 14 x 1998.
 11. Oued Ziatine, brook from the garrigue 5 km S Cap Serrat, some ponds with spring water, 37°11'N, 9°13'E: 31 v 1988.
 12. Oued Sejenane at road Sejenane-Cap Serrat, W and E of bridge including a nearby ditch and pools, 37°07'N, 9°16'E: 25 v 1988, 12 vi 1996.
 13. E road to Cap Serrat, nearly dry brook in the garrigue reduced to shallow pools without vegetation, 37°12'N, 9°16'E: 27 v 1988.
 14. Rush swamp at road 6 km N Sejenane, 37°07'N, 9°16'E: 12 vi 1996.
 15. Ditch with stagnant water at road 4 km N Sejenane, 37°06'N, 9°16'E: 12 vi 1996.
 16. Small reservoir 3 km E Sejenane, only sparse *Typha*, 37°04'N, 9°17'E: 11/12 vi 1996.
 17. Oued Zarga, upper course, along road Beja-Mateur, 36°49'N, 9°22'E: 1 vi 1988.
 18. Oued Zarga, lower course, at intersection with road Beja-Mejez el Bab, 36°42'N, 9°24'E: 1 vi 1988, 10 vi 1996, 14 x 1998.
 19. Barrage Sidi Salem, flat northern shore just E of mouth of Oued Zarga with flooded tamarisks, 36°41'N, 9°25'E: 10 vi 1996, 14 x 1998.
 20. Eastern tributary of Oued Zarga, 36°44'N, 9°26'E: 18 vi 1987.
 21. Barrage Sejnane, northern shore with some tamarisks, 37°09'N, 9°25'E: 12 vi 1996.
 22. Brook and small reservoir near road 15 km W Teskraia, 45 km SW Bizerte, 37°11'N, 9°26'E: 12/13 vi 1996, 15 x 1998.
 23. Lac Ichkeul, shallow NW shore with extended reeds, and the mouth of a river, 37°11'N, 9°38'E: 26 v 1988.
 24. Small reservoir 17 km W Bizerte, 1 km N road Bizerte-Teskraia among farmland, poor vegetation, 37°13'N, 9°40'E: 13 vi 1996, 11 v 1998, 15 x 1998.
 25. Oued Toubia 5 km S Villa Fontana at road Mateur-Tebourba, lined with reeds, 36°59'N, 0°41'E: 11 v 1998, 15 x 1998.
 26. Oued Gra'a 15 km W Bizerte, N road Bizerte-Teskraia, lined with reeds, 37°15'N, 9°42'E: 23 v 1988.
 27. Swamp N Tinja, on both sides of the railway between Lac Ichkeul and Lac de Bizerte, 37°11'N, 9°46'E: 11 v 1998, 15 x 1998.
 28. Water tanks in a dry wadi at Cap Blanc 1 km N Bizerte, 37°19'N, 9°52'E: 29 v 1988.
 29. Oued Mejerda at road Tunis-Bizerte, muddy banks with poor vegetation, 37°01'N, 10°04'E: 30 v 1988.
 30. Ditch 1 km N loc. 28, rich reed vegetation, 37°01'N, 10°04'E: 30 v 1988.

31. Barrage Chiba 25 km SW Menzel, both sides of the dam, 36°42'N, 10°46'E: 12 vi 1987.

The central localities

32. Oued Remel 8 km SW El Kef, after a flood, 36°07'N, 8°38'E: 13 x 1998.
33. Small reservoir (near D11) 2 km S Thala at road El Kef-Kasserine, without aquatic vegetation except some patches of floating *Ranunculus*, 35°33'N, 8°41'E: 8 v 1998, 13 x 1998, 1 x 1999.
34. Oued Mellegue at road El Kef-Jendouba, lee side in the extended shrubs, 36°24'N, 8°45'E: 13 x 1998.
35. Oued el Hattab (D10) 15 km NW Kasserine, 35°16'N, 8°45'E: 8 v 1998, 13 x 1998, 1 x 1999.
36. Oued el Hajeb, ca 4 km SW mouth into Barrage Sidi Saad, sandy and almost without vegetation, 35°15'N, 9°33'E: 2 x 1999.
37. Small and short brook with reeds and aquatic plants 8 km E Hajeb El Ayoun, 35°23'N, 9°38'E: 2 x 1999.
38. Barrage Sidi Saad, banks without vegetation, 35°19'N, 9°39'E: 2 x 1999.
39. Oued Marguellil at bridge 3 km NW Haffouz, 45 km W Kairouan, 35°39'N, 9°39'E: 5 v 1998.
40. Oued el Hammam near Zriba Village at road Zaghuan-Enfidaville, 36°20'N, 10°15'E: 16 vi 1987.
41. Small reservoir near Takrouna, 6 km NW Enfidaville, 36°39'N, 10°20'E: 15 vi 1996.
42. Tributary of Oued er Rmel near Hammam Jedidi, 25 km W Hammamet, 36°23'N, 10°22'E: 8 vi 1987.
43. Oued er Rmel 2 km E Bou Fichta (near to D5), dammed section with stony banks, 36°18'N, 10°28'E: 14/15 vi 1996, 15 x 1998.
44. Barrage Sidi Jedidi 12 km WNW Hammamet, 36°27'N, 10°31'E: 7 v 1987.

The southern localities

45. Nefta oasis, with central stream in the upper part "Corbeille" and irrigation ditches in the lower part (D29), 33°52'N, 7°53'E: 29 ix 1999, 5 xi 1999.
46. Mountain oasis Mides, small basin (D24), 34°25'N, 7°55'E: 12 x 1998.
47. Mountain stream 4 km SW Tamerza with rocky bed, 34°23'N, 7°56'E: 7 v 1998, 30 ix 1999.
48. Mountain stream and spring 1 km SW Tamerza (D24), 34°23'N, 7°57'E: 7-V-1998, 12 x 1998, 30 ix 1999, 6 xi 1999.
49. Mountain oasis Tamerza, irrigation ditches and stream (D24), 34°24'N, 7°58'E: 7 v 1998, 6 xi 1999.
50. Mountain oasis Chbika, irrigation ditch, 34°19'N, 7°58'E: 12 x 1998.
51. Tozeur oasis (D28), main irrigation ditches along the southern periphery of Tozeur city and a net of smaller ditches in between the palm oasis, 33°55'N, 8°09'E: 6 v 1998, 11 x 1998, 29 ix 1999, 5 xi 1999.
52. Tozeur oasis, ditch along a swamp with *Salicornia* and *Juncus* in the transition

- zone between palm-trees and the salty steppe of the dry margin of Chott el Jerid, 33°55'N, 8°11'E: 6 v 1998, 10/11 x 1998, 29 ix 1999, 5 xi 1999.
53. Gorge Oued Selja 8 km W Metlaoui, 34°21'N, 8°21'E: 8 v 1998.
 54. Oued el Melah at its intersection with road between Metlaoui and Gafsa, 34°08'N, 8°19'E: 6 xi 1999.
 55. Ditch leaving Ghidma oasis and feeding a shallow brackish lake, 20 km W Douz, 33°26'N, 8°49'E: 9/10 x 1998, 28 ix 1999, 4 xi 1999.
 56. Ditches at Blidet 22 km SW Kebili, 33°34'N, 8°51'E: 10 x 1998.
 57. Zaafrane oasis, irrigation ditches, 33°27'N, 8°56'E: 28 ix 1999.
 58. Brackish lake near Bchelli oasis 10 km SW Kebili, 33°37'N, 8°56'E: 4 xi 1999.
 59. Salty lakes with *Salicornia* 4 km W Douz, 33°28'N, 9°00'E: 9 x 1998, 28 ix 1999.
 60. Swamp with *Salicornia* and reeds fed by ditches from Jemna oasis, 2 km SW Jemna between Kebili and Douz, 33°33'N, 9°00'E: 9 x 1998, 28 ix 1999.
 61. Oued el Leben at bridge 7 km N Meknassy, rich reed stands and submerged vegetation, 34°39'N, 9°36'E: 3 x 1999.
 62. Oued Akarit near Akarit at road 30 km WNW Gabès, 34°07'N, 9°59'E: 7 x 1998, 27 ix 1999, 3 x 1999.
 63. Oued leaving Ou Dref oasis (near D33), shallow lakes and brook W road Sfax-Gabès, 34°00'N, 9°59'E: 7 x 1998, 27 ix 1999.
 64. Oued Oudrane 150 km S Kairouan, 34°32'N, 10°04'E: 7 x 1998.
 65. Irrigation stream leaving the oasis of Ksar el Hallouf, 33°18'N, 10°06'E: 3 xi 1999.
 66. Coastal brook along the southern outskirts of Gabès, dense reed stands, 33°50'N, 10°07'E: 27 ix 1999.
 67. Oued Djir el Ferch at Kettana with rich vegetation, 18 km SE Gabès, 33°45'N, 10°13'E: 8 x 1998, 27 ix 1999, 3 x 1999.
 68. Spring with *Salicornia* swamp and tamarisk shrubs at road Tataouine-Remada (D38), 40 km N Remada, limnological description in Carchini & di Domenico (1992), 33°45'N, 10°13'E: 8 x 1998, 3 xi 1999.
 69. Artificial water body containing a 5-m high fountain at northern outskirts of Tataouine, 32°57'N, 10°28'E: 3 xi 1999.

The species, with annotations

The citation of a locality without further specification signifies that the species was present (as adults) in low or medium numbers (Zygoptera: <100 individuals, Anisoptera: <30 individuals). Several localities were visited several times. In such cases the number of the locality is combined with 'm' for May, 'j' for June, 's' for September, 'c' for October and 'n' for November and, if necessary, the year of the observation. Other abbreviations are: abun — abundant; apps — anal appendages; exuv — exuvia/ae; loc. — locality/ies; mfl — maiden flight (i.e. teneral adult); juv — immature adult; ovip — copulation and/or oviposition; S — abdominal segment. We use the term 'decade' to signify a period of about 10 days. 'Tell' and 'Tell-Atlas' are equivalent terms. The aeshnid usually called *Hemianax ephippiger* (Burmeister) has been re-assigned to the genus *Anax* (see Gentilini & Peters 1993).

The previous records are based on Dumont (1977) and on literature not cited by Dumont. Early records which have not been confirmed by Dumont's data are here referred back to the original publications.

Our own records lack observations through mid- and late summer (i.e. from 19 June to 26 September). Consequently we cannot necessarily infer that a species flying before and after these dates was also flying during the period for which we lack observations. For some species, recorded regularly during mid- and late summer in nearby Numidia by Samraoui & Corbet (2000), we have inferred that the flight period in Tunisia also covers this period.

ZYGOPTERA

CALOPTERYGIDAE

Calopteryx exul Sélys

Own records: 1j; 5; 9 also mfl, exuv; 17; 18j-88; 20 abun.

Previous records: Oued Ghezala, our loc. 1 (Dumont 1977).

This Maghreb endemic seems to be confined to the spur of the Tell-Atlas mountains in northern Tunisia. It occurred in more or less unpolluted streams with reeds along the banks, sometimes accompanied by *C. h. haemorrhoidalis*. In Algeria, a serious decline has been reported by Samraoui & Menai (1999): all previous localities of the species have been polluted, and no population has been confirmed since 1990. We saw patrolling males in the first decade of May, but no more in October; so the flight period may be confined to spring and summer. The species has been recorded in May (McLachlan 1897; Martin 1901; Lieftinck 1966; Dumont 1977), in June and July (Morton 1905; Dumont 1972, 1977; Jacquemin 1994), and perhaps in August (Kolbe 1885). Jacquemin & Boudot (1999) observed it between late May and early August. No description of the exuvia has been published. We found one exuvia (Fig. 1), assigned to this species on two counts: many maiden flights of *C. exul* were taking place, and the exuvia's characters did not match those of *C. h. haemorrhoidalis*. The exuvia is characterized by rather narrow fore wing sheaths (ratio width:length, 1:4); and the caudal appendages are rather long compared to the length of the antennae or labium. More material is needed to construct a reliable catalogue of characters for separation from other *Calopteryx* species.

Calopteryx h. haemorrhoidalis (Vander Linden)

Own records: 1j; 4j; 5; 8; 9; 17; 18j-88; 20; 25m/c; 42; 61.

Previous records: Several localities in the northern Tell-Atlas (Dumont 1977).

The flying season seems to be longer than in *C. exul*, since we encountered the species still in mid-October. Almost all known records relate to the northern localities subject to a Mediterranean climate where the species conspicuously co-exists with *C. exul*. Especially noteworthy is the southern record at loc. 61 where *C. h. haemorrhoidalis* was moderately abundant at the beginning of October. This locality is at the southern edge of the central steppe which borders the Sahara. Likewise in Algeria and Morocco the species is found up to the edge of the Sahara (Jödicke 1995; Jacquemin & Boudot 1999; Samraoui & Menai 1999).

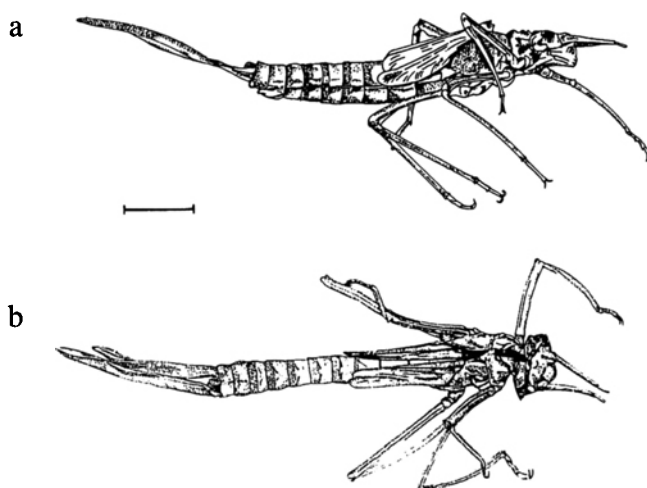


Figure 1. General appearance of final-stadium exuvia of *Calopteryx exul*, collected 10 v 1998 at loc. 9; (a) lateral view from right and (b) dorsal view. Scale line: 5 mm. Drawn by H. von Hagen.

LESTIDAE

Lestinae

Lestes barbarus (Fabricius)

Own records: 12m; 14 juv; 27m mfl.

Previous records: Bou-Kornine (Dumont 1977). The locality "Suttra" (Spagnolini 1877) cannot be identified. All known localities are in the flat foothills of the Tunisian Tell near the Mediterranean coast.

Lestes sponsa (Hansemann)

No new record.

Previous record: Aïn Draham region (Gadeau de Kerville 1908).

The Tunisian record coincides with further Maghreb records from Algeria (Martin 1910; Lacroix 1925). One cannot dismiss the possibility that the species had settled in north Africa during the beginning of the 20th Century, although the Mediterranean region is not included in its general range (Jödicke 1997). However, the presence of *L. sponsa* in the Maghreb remains doubtful, unless the identity of voucher specimens can be confirmed.

Lestes v. virens (Charpentier)

Own records: 12m exuv, juv; 26 mfl; 27m mfl;

Previous records: Oued Kebir, our loc. 4 (Dumont 1977).

All known records are confined to the coastal region. Our observation of emergence on 11 May is by no means the earliest. Other authors have observed the species already

in April: Ferreras-Romero & Puchol-Caballero (1984) in Andalusia, and Samraoui & Menaï (1999) in Algeria.

Lestes v. viridis (Vander Linden)

Own records: 1c; 3 juv, exuv; 4c; 12m; 18j-96 mfl, exuv; 19c ovip; 22c; 23; 25c; 27c; 42.

Previous records: Several localities in the northern and central parts of Tunisia (Dumont 1977).

Unlike *L. barbarus* and *L. v. virens* this species is not confined to the coastal region in the north, but occurs also in the central steppe. Its presence is most conspicuous during the reproductive period in autumn.

Sympecmatinae

Sympecma fusca (Vander Linden)

Own record: 24j mfl, exuv.

Previous record: "Tunisia" (Spagnolini 1877).

This is the first record after more than a century. Although there is still no record from Libya, the species can be assumed to be distributed over all coastal regions around the Mediterranean Sea (Jödicke 1997). A comparably early emergence in June has been reported from the Moroccan Rif (Jacquemin 1994; Jacquemin & Boudot 1999).

PLATYCNEMIDIDAE

Platycnemis subdilatata (Sélys)

Own records: 1m mfl, ovip; 1j also mfl, exuv; 4m; 4j ovip; 5 ovip, juv, exuv; ; 8 ovip; 9 ovip, mfl; 11; 12m/j; 17; 18j-88, 18j-96 ovip, mfl, exuv; 20; 25m abund, ovip, mfl; 27m mfl; 29; 35m mfl; 39 juv; 40 abund; 43j ovip, exuv.

Previous records: Several localities at streams which run to the Mediterranean coast in north Tunisia (Dumont 1977).

The species is common by running waters in northern and central Tunisia. However, we have also observed emergence from a stagnant temporary pond (loc. 27m). The exuvia (Fig. 2), which is undescribed, was assigned to this species on two counts: many individuals were emerging at the site, and no other platycnemidid is known from Tunisia. The morphological characters are in agreement with those of the group of European congeners which are difficult to distinguish (Martens 1996). We are unable to detect any species-specific larval characters of *P. subdilatata*. We witnessed oviposition already on 9 May, but there was no record in October. This conforms with other phenological data (Martens 1996; Jacquemin & Boudot 1999). In Numidia reproduction was recorded in August (Samraoui & Corbet 2000).

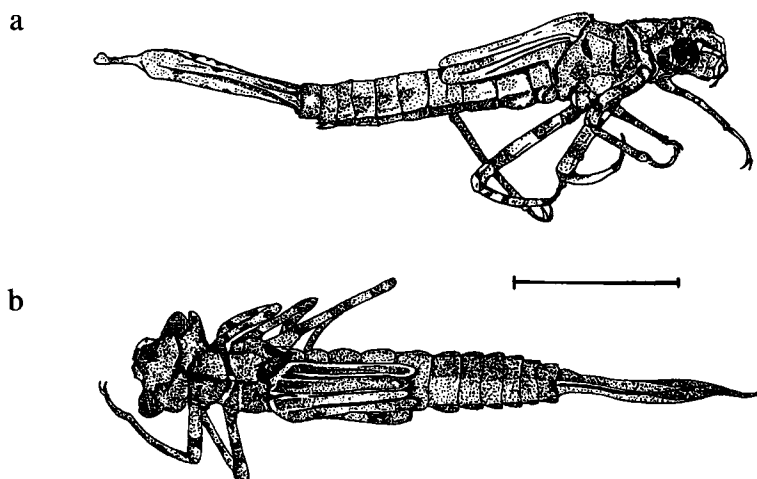


Figure 2. General appearance of final-stadium exuvia of *Platycnemis subdilatata*, collected 10 v 1998 at loc. 9; (a) lateral view from right and (b) dorsal view. Scale line: 5 mm. Drawn by H. von Hagen.

COENAGRIONIDAE

Coenagrioninae

Cercion lindenii (Sélys)

Own records: 1m/j ovip; 3 ovip; 4m; 5 ovip; 6 ovip; 8 ovip; 9 ovip; 10 ovip; 12m/j; 16; 18j-96; 19j/c; 20 abund; 22j; 22c ovip; 23; 24m/j ovip; 25m ovip; 25c; 26; 29; 30; 31; 40 abund; 41; 43j ovip; 44 abund; 61.

Previous records: Many localities throughout the country (Dumont 1977).

The records by Dumont (1977) in southern Tunisia are not confirmed by our data. This may reflect the season because we made observations only during spring and autumn. Our southernmost record at loc. 61 is outside the area containing oases. The species is widespread and occurs at stagnant and running waters. It has a long flying season: we observed reproductive activity from the beginning of May until mid-October. There are several records from March until October in the Mediterranean range of distribution (Ferrerías-Romero & Puchol-Caballero 1984; Jacquemin 1994; Jödicke 1996; Jacquemin & Boudot 1999). The species can be bivoltine in southern Spain (Ferrerías-Romero 1991). At loc. 24m we collected a completely blue androchrome female.

Coenagrion caerulescens (Fonscolombe)

Own records: 17; 25m/c ovip; 35m ovip; 35c-99; 48m also mfl; 48c; 67s.

Previous records: Several localities in central and south Tunisia (Dumont 1977).

Our data demonstrate that the species inhabits well vegetated springs and streams throughout the country. We observed oviposition early in May as well in mid-October, implying a long annual flying season which might reflect a bivoltine life cycle in the Maghreb, as proposed by Conesa García (1995). In contrast to this situation the

populations in southwest Europe are reported to be univoltine (e.g. Ferreras-Romero & García-Rojas 1995).

The Maghreb populations of *C. caerulescens* have been the subject of taxonomic consideration. Schmidt (1959) erected ssp. *theryi* from north Africa, and ssp. *caesarum* from Italy and Sicily, whereas the nominate form was assigned to southwest Europe. The subspecific status of *theryi*, based mainly on colour differences, has been critically discussed by several authors (e.g. Lieftinck 1966; Dumont 1972; Ocharán Larrondo 1987; Jödicke 1995). However, Conesa García (1995) re-established ssp. *theryi* on structural characters, and additionally erected spp. *isabelae* from Morocco. After thorough examination of our material (coll. Jödicke — (1) Spain, Tarragona prov.: 11 males, 6 females; (2) Morocco, Oued Sous and Oued Ziz (type loc. of *isabelae*): 33 males, 9 females; (3) Tunisia: 17 males, 5 females) we can confidently state that the subspecific characters given by Conesa García (1995) insufficiently reflect the wide structural variation within each population. The features of those specimens documented by SEM photographs (Conesa García 1995: figs 9a-c, 11a-c), and which are said to represent a certain subspecies, we can identify in each of our Spanish, Moroccan and Tunisian series with a comparable frequency. Thus the specimens in Conesa García's photographs can be interpreted neither as representative of a certain subspecies nor as an example typical of a certain region; they seem to be merely a random selection from a highly variable population. We therefore synonymize *theryi* Schmidt and *isabelae* Conesa García with *caerulescens* (Fonscolombe). The subspecific status of *caesarum* also needs confirmation because the coloration is not homogeneous in Italy (e.g. Terzani 1986). Unless reliable diagnostic characters of *caesarum* are defined, *C. caerulescens* should rather be considered a monotypic species. This agrees with the criticism by Jacquemin & Boudot (1999) of Conesa García's conception.

Coenagrion mercuriale (Charpentier)

No new record.

Previous records: Aïn Draham region (Gadeau de Kerville 1908); Thala, near to our loc. 33 (Dumont 1977).

This species is considered to be uncommon in Algeria (Samroui & Menai 1999) though probably under-recorded in the Moroccan Rif (Jacquemin 1994). There are several records from the Middle Atlas (Jacquemin & Boudot 1999).

Coenagrion puella kocheri (Schmidt)

No new record.

Previous records: Aïn Draham region; Aïn Hameraia (Gadeau de Kerville 1908).

This somewhat contentious taxon (Lieftinck 1966) still occurs in streams of northwest Algeria (Samroui & Menai 1999) and Morocco (Jacquemin 1994).

Coenagrion scitulum (Rambur)

Own records: 12j; 16; 22j ovip; 24j; 31; 41; 42 abund.

Previous records: Several localities in northern and central parts of the country (Dumont 1977).

The species is rather common and prefers standing waters. Our lack of autumn records agrees with data from Algeria (Samroui & Menaï 1999) and Morocco (Jacquemin & Boudot 1999).

Erythromma najas (Hansemann)

No new record.

Previous records: Ain Draham region (Gadeau de Kerville 1908); Martin (1910) mentioned "Tunisie", very probably referring to the former record.

We consider the existence of this species in Tunisia to be highly questionable because the species broadly avoids the Mediterranean region (D'Aguilar & Dommanget 1998). Martin (1910) also listed an occurrence at the Algerian Lac Tonga. According to Samraoui & Menaï (1999) this is a doubtful record which needs confirmation; see also the remark on *E. viridulum*. Dumont (1977) reported that Martin had identified the collection of Gadeau de Kerville which was perhaps Martin's only source of information about Tunisian Odonata.

Erythromma viridulum (Charpentier)

Own records: 16 fl; 22c; 24j; 31; 41 ovip.

New to Tunisia. — That this widespread and locally abundant species has been hitherto overlooked may support the hypothetical misidentification of *E. najas*. We recorded it in mid-June and mid-October.

Ischnurinae

Enallagma deserti (Sélys)

Own records: 18j-1996; 24m/j ovip; 33m ovip, juv; 33c-99.

New to Tunisia. — It seems to be to the advantage of this Maghreb inhabitant that small reservoirs, which have recently increased in regions used for agriculture, can be suitable habitats. At the Barrage Béni M'Tir near Ain Draham we saw an unidentified species of *Enallagma* which almost certainly belonged to *deserti*. In the reservoirs frogs (*Rana saharica* Boulenger) were extremely abundant in the few places with floating *Ranunculus*. All tandems of *E. deserti* landing for oviposition separated immediately, and the females quickly climbed under the water to lay eggs. Gynochrome females outnumbered androchrome females; immature individuals of the latter were pale whitish-blue. The record from loc. 33 on 1 October — a sunless day with a strong wind — refers to a single male perching near the water surface.

No specimen within our series is pale as described by Sélys-Longchamps (1871) and Ris (1928). The extension of black markings perfectly corresponds to specimens from Algeria and Morocco described by Lieftinck (1966). *E. cyathigerum* from Spain (Tarragona province) cannot be distinguished solely by colour characters, i.e. in colour Spanish *E. cyathigerum* and Tunisian *E. deserti* are indistinguishable. On the other hand, both sexes possess structural diagnostic characters. The shape of the male superior appendage was figured by Ris (1928), Lieftinck (1966), Jurzitza (1975) and Seidenbusch (1997). The structure of the female mesostigmal laminae reveals

a difference between *E. deserti* and *E. cyathigerum*. Generally, specimens of *E. deserti* are larger than those of *E. cyathigerum* from Spain.

Measurements (in mm; arithmetic mean followed by range in parentheses)

deserti. Males (n = 15) — abdomen (without apps) 27.2 ± 1.0 (25.5-29.0); hindwing 20.9 ± 0.6 (19.5-21.5). Females (n = 5) — abdomen 27.3 ± 0.9 (26.0-28.5), hindwing 21.8 ± 0.9 (21.0-23.0).

cyathigerum. Males (n = 29) — abdomen 25.6 ± 1.2 (22.5-27.5); hindwing 19.1 ± 0.9 (17.5-21.0). Females (n = 21) — abdomen 24.9 ± 1.2 (22.5-27.5), hindwing 19.2 ± 0.8 (18.0-21.0).

Ischnura fountaineae Morton

Own records: 36; 37 exuv, juv, ovip; 38; 52c; 55s; 55c ovip; 59s ovip; 60s/c abun, ovip, mfl, exuv; 63s; 64 also exuv; 65 also exuv; 68c abun, also juv.

Other records: Mlelhel oasis 8 km S Douz: 11 iv 1994; our loc. 57 and 59: 29 iv 1994 leg. D. Kock (W. Schneider in litt.). Mahdia: xi 1997 (R. Stephan in litt.).

Previous records: Nefta (Schmidt, 1939); many localities in the oases of south Tunisia, but a single male at El Fahs in the central region (Dumont 1977); again at our loc. 68 (Carchini & di Domenico 1992)

Typical habitats were the *Salicornia* swamps and lakes near oases where the irrigation water trickled away, or springs which dried up. It also occurred at streams with sparse vegetation in southern regions. At loc. 37 — a well vegetated stream — it surprisingly replaced *I. saharensis*. We consider the species to be tolerant of high salinity, and we expect it to occur also in suitable habitats in the eastern central steppe. The findings at brackish lakes near Mahdia where it co-existed with *I. graellsii*, conform with our expectation. Likewise the record from a saline lake on the island of Pantelleria (Lohmann 1989) — about 70 km away from the Tunisian coast — may be interpreted in terms of a closed range of distribution in eastern Tunisia.

Apart from the clearly structural differences — in males the anal appendages, and in females the mesostigmal laminae as well as the hind lobes of the prothorax (Dumont 1977, 1991) — both southern species can be easily distinguished in the field (cf. the colour characterization of *I. saharensis*). *I. fountaineae* is on average larger, but there is an obvious size variation. Mature males are blue with an orange abdominal ventrum and a shining black dorsum; teneral males are pale bluish. Antehumeral stripes and postocular spots can be of medium size, but are often variably reduced and in a few specimens lacking altogether. Almost all females are gynochrome with a small black dorsal stripe on the thorax. Immature individuals of this colour morph are vividly orange (“aurantiaca”) and mature females are brownish or greenish. The dorsum of S8 is always at least partly black. Among many hundreds of females we saw only one androchrome colour morph which resembles the males in all colour characters (cf. Dumont 1991). This specimen had minute postocular spots, only traces of antehumeral stripes, and S8 completely blue.

***Ischnura graellsii* (Rambur)**

Own records: 1m/j ovip; 1c also juv; 3 ovip; 4m/j/c; 5; 6 ovip; 7; 8 ovip; 9 ovip; 10 ovip; 11; 12m/j; 13; 14; 15; 16 ovip; 17; 18j-88; 18j-96 ovip; 18c; 19j ovip; 19c also juv; 20; 21 ovip; 22j ovip; 22c also mfl; 23 abund; 24m/j; 25m/c; 26; 27m also mfl, exuv; 27c also juv; 29; 30; 32; 33m ovip; 33c-99 also mfl, exuv; 34; 35m/c-98/99; 39; 40; 41 ovip; 42; 43j ovip; 44.

Other records: Mahdia: xi 1997; Mahdia: 07 xi 1998 (R. Stephan in litt.).

Previous records: Many localities in the central and northern regions (Dumont 1977).

This west-Mediterranean species is common at standing and running waters in the north. Its distribution extends far into the central steppe where it overlaps with the southern *Ischnura* species.

***Ischnura saharensis* Aguesse**

Own records: 35m; 36; 45s, 47m/s; 48m also mfl; 48s/c ovip; 51m mfl, ovip; 51s/c/n; 52m also mfl; 52c; 55r; 60s/c; 61 abund, ovip; 62s/c-98/99; 63s; 63c also mfl; 67s/c-98/99 abund, ovip.

Other records: Mlehel oasis 8 km S Douz: 11 iv 1994, our loc. 59: 29 iv 1994 leg. D. Kock; near Museum of Natural Park de Bou Hedma: 05/06 x 1999, Oued bou Hedma in Natural Park: 07 x 1999, our loc. 48: 08 x 1999, oasis between Bechni and Derguine near our loc. 55: 10 x 1999, Natural Park de Jebil 50 km S Douz: 11/15 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Many localities in the oases of south Tunisia (Dumont 1977).

The species is common in the southern oases. Its range extends to streams in the southern central steppe. We found it at irrigation ditches and ponds with a low salinity, especially those with dense vegetation. In such habitats it seldom co-existed with *I. fountaineae*. We tested this inference across a salinity gradient along ditches leaving the oasis and trickling away to a *Salicornia* swamp, for instance at loc. 52, 55 and 60. In those sections of the ditch with *Juncus* spp., near palm trees, *I. saharensis* dominated. In the brackish *Salicornia* swamps almost all individuals belonged to *I. fountaineae*.

Mature males have a green face (i.e. the frontal region of the frons, the genae, most parts of the compound eyes, the anteclypeus and the labrum), a green thorax and abdominal base. Blue is confined to the tip of the abdomen and sometimes to the postocular spots, which may also be green, and sometimes to the upper parts of the compound eyes. The antehumeral stripes are narrow, and the postocular spots small. In May we collected one male with minute postocular spots and only a trace of antehumeral spots. This finding agrees with Dumont's (1972) report of a tendency towards increased melanization in the spring generation.

Four female colour morphs could be distinguished. (1) The "rufescens-obsoleta" morph (sensu Parr 1999) lacking the humeral stripes in the immature stage, and with the postocular patches large and widely open to the postocular lobes. The thorax is rose-ochre. During maturation the colour changes to brownish or greenish; the secondary lateral stripes that develop never become as complete and black as in the morphs with primary stripes, and the postocular patches narrow to small blue spots. S8 always lacks black spots. This morph and its colour development during maturation have been discussed in more detail by Dumont (1972) and Jödicke (1995). (2) The "infuscans" morph has primary humeral stripes

as in the male, but is dull brownish or greenish in the mature stage. This colour morph has hitherto not been described in *I. saharensis*. (3) The androchrome female resembles the male in all colour characters and is easily distinguished from “infuscans” females by the vividly green thorax. (4) We saw several individuals, all females, that were completely blue except for the black markings. With regard to the female colour morphs of other species of *Ischnura*, blue females are the typical androchrome colour morph. Blue females of *I. saharensis* should be therefore interpreted as a second form of androchromatism although the blue coloration is not manifest in males. Jödicke (1995) also grouped green and blue females in the androchrome morph. We saw no intermediates between both androchrome morphs, but cannot exclude the possibility that both colours have an identical genetic base and are age dependent. However, the blue morph falsifies the current hypothesis that androchrome females mimic males (Robertson 1985). Among 26 females, six belong to the “rufescens-obsoleta” morph, seven to the “infuscans” morph, four to the green morph and nine to the blue androchrome morph. However, due to its conspicuous colour, the blue morph was probably collected by us selectively, thus causing its apparent frequency to be exaggerated.

Pseudagrioninae

Ceriagrion tenellum (de Villers)

Own records: 3; 11; 13; 31; 42 abund; 48m mfl.

Previous records: A few localities in the north (Dumont 1977).

The occurrence of this species at the mountain spring of loc. 48 confirms its distribution up to the edge of the Sahara, as found also at Oued Massa in south Morocco (Jödicke 1995; Jacquemin & Boudot 1999). There were no records in September and October. Several authors referred the Maghreb populations to ssp. *nielsenii* Schmidt, a contentious taxon (e.g. Ottolenghi 1991).

ANISOPTERA

GOMPHIDAE

Gomphinae

Gomphus lucasii Sélvs

Own records: 1m mfl, exuv; 1j; 4m mfl, exuv; 4j; 5 mfl, exuv; 9 also exuv; 12m/j; 17 also exuv; 18j-96; 20; 25m.

Previous records: A few localities in the northern coastal region (Dumont 1977).

The Maghreb endemic seems to be still rather common and locally abundant along streams of the Tell-Atlas slopes. Here the flying season was obviously over in October: in Numidia it was observed only in May and June (Samraoui & Corbet 2000).

Gomphus simillimus maroccanus Lieftinck

No new record.

Previous record: Aïn Drahem, sub *G. simillimus* (Le Roi 1915).

In conformity with Jacquemin (1994) and Samraoui & Menai (1999), the co-existence of *G. s. maroccanus* and *G. lucasii* has nowhere been confirmed; thus the former taxon is very probably restricted to Morocco. We therefore consider the record published by Le Roi (1915) to be very questionable and probably the result of a misidentification.

Onychogomphinae

***Onychogomphus costae* Selys**

Own records: 18j-88 exuv, mfl; 43j ovip, exuv.

Previous record: Tozeur (Campion 1914).

The old record at Tozeur might be due to confusion with *Paragomphus genei* which is very abundant along the irrigation ditches in the oasis (Lacroix 1925, listed sub *Onychogomphus pumilio*; Lieftinck 1966; Dumont 1972; this paper).

***Onychogomphus forcipatus unguiculatus* (Vander Linden)**

Own records: 1m/j mfl, exuv; 9 exuv; 20.

Previous record: Oued Gezhala, our loc. 1 (Dumont 1977).

All hitherto known localities are situated in the northwestern parts of the Tell-Atlas.

***Onychogomphus lefebvrei* (Rambur)**

No new record.

Previous records: Aïn Drahem region (Gadeau de Kerville 1908); also listed by Martin (1910).

According to the argument of Suhling & Müller (1996) and Samraoui & Menai (1999), all Maghreb records should be treated as equivalent to *O. forcipatus unguiculatus*. For background to Martin's remarks on the Tunisian dragonfly species see the annotation for *Erythromma najas*.

***Onychogomphus uncatus* (Charpentier)**

No new record.

Previous record: Aïn Drahem region (Gadeau de Kerville 1908); repeated by Martin (1910).

Although no recent information about this species exists, the findings in nearby Numidia (Samraoui & Menai 1999) support its possible occurrence in Tunisia.

***Paragomphus genei* (Selys)**

Own records: 4c; 12m/j; 16 exuv; 22c; 36 abun; 38; 45s; 45n exuv; 48s/c also juv, exuv; 48n; 51m mfl; 51s/c/n; 62c-99 mfl.

Other record: Our loc. 48: 08 x 1999 leg. W. Pohl (W. Schneider in litt.).

Previous records: Several localities in the oases of the northern Sahara fringe (Dumont 1977).

The species is widespread and, especially in the south, rather abundant. This is the only gomphid which we recorded also in autumn. Because emergence was observed in November, as well as in July (cf. loc. 16), we suspect that this species could be bivoltine.

AESHNIDAE

Aeshninae*Aeshna affinis* (Vander Linden)

Own records: 2; 4c; 12m exuv.

Other records: Mahdia: 07 xi 1997; Lac Ichkeul: 13 xi 1997 (R. Stephan in litt.).

Previous record: Barrage Mellègue (Dumont 1977).

The extension of the flying season until November is noteworthy.

Aeshna isoceles (O.F. Müller)

Own record: 22j.

Previous record: Oued el Abiod (Dumont 1977).

Both localities are situated near the northern coast of the Mediterranean Sea.

Aeshna mixta Latreille

Own records: 1c; 4c; 12m exuv; 24j exuv; 27m exuv;

Other records: Mahdia: 07/11 xi 1998 ovip; Bir Bou Rekba W Hammamet: 09 xi 1998; Oued el Mekta 20 km S Kairouan: 21 xi 1998 (R. Stephan in litt.).

Previous records: Tunis (Spagnolini 1877); Oued el Kebir, our loc. 4 (Dumont 1977).

This is the commonest *Aeshna*, having a flying season extending to at least November. In Morocco and Algeria it is on the wing until December (Jacquemin 1994; Jacquemin & Boudot 1999; Samraoui & Menaï 1999). All Tunisian records are from northern and central regions.

Anax ephippiger (Burmeister)

Own records: 2; 4c; 5; 6 ovip; 13; 19j; 19c ovip; 27c ovip; 33m; 35m; 47m; 52c/n; 54; 55c; 55n abun; 58; 59c; 60s ovip; 68c.

Other records: Mahdia: xi 1997, on 23-XI juv, ovip; 05/08/11 xi 1998; Tabarka: 13 xi 1998; Aïn Draham: 14 xi 1998 (R. Stephan in litt.).

Previous records: Oued el Fedja in southeast Tunisia (Dumont 1977); Djebel Ichkeul (Koch 1979).

We have sometimes seen additional individuals far from water, foraging or migrating along roads. Known localities occur throughout the country.

Anax imperator Leach

Own records: 8; 4c; 12m; 14; 16 also exuv; 17; 13; 21; 22j ovip; 22c; 23; 24m; 25c; 27c; 28; 30; 31; 33m/c-98; 34; 35c-99; 36; 38; 41; 44; 47m; 48s/c; 51m/s; 52m; 60c; 61; 62c-98/99; 67c-99.

Other records: Douz oasis: 11 iv 1994; our loc. 59: 29 iv 1994 leg. D. Kock (W. Schneider in litt.). Mahdia: xi 1997, 07-19 xi 1998 exuv, ovip; Bir Bou Rekba W Hammamet: 09 xi 1998; Sousse: 10 xi 1998; Oued el Mekta 20 km S Kairouan: 21 xi 1998 (R. Stephan in litt.).

Previous records: Many localities throughout the country (Dumont 1977).

This species is widespread, but not as common as *A. parthenope*.

Anax parthenope Sélys

Own records: 2; 4m; 6 ovip; 12m; 14 ovip; 15; 16; 18c; 19j; 19c ovip; 21; 22j ovip; 22c; 23; 24m/j abun, ovip; 24c; 25m/c; 26; 27m; 27c ovip; 28; 30; 36 ovip; 37 ovip; 38 ovip; 41; 43c; 44; 45s abun, ovip; 45n; 47m/s; 48m/s/c; 51m; 51s/c ovip; 52m; 52s/c abun, ovip; 52n; 53; 55s/c/n abun, ovip; 56; 57; 58 ovip; 59s abun, ovip; 59c; 60s abun, ovip; 60c abun, exuv; 61 abun; 62s/c-98/99 ovip; 63s ovip; 63c; 64; 66; 67s abun, ovip; 67c-98/99 ovip, exuv; 68c ovip; 68n.

Other records: Our loc. 59: 29 iv 1994 leg. D. Kock; Douz: 10 x 1999, oasis between Bechni and Derguine nr our loc. 55: 10 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Many localities throughout the country (Dumont 1977).

In the southern oases this was by far the commonest aeshnid, being especially abundant during autumn.

Brachytroninae

Boyeria irene (Fonscolombe)

No new record.

Previous records: Two localities in the north (Dumont 1977).

Occurrence of this mid-summer species is probably under-recorded. It is fairly common in Algeria (Samraoui & Menai 1999), the Rif (Jacquemin 1994) and the Atlas Mountains (Jacquemin & Boudot 1999).

LIBELLULIDAE

Libellulinae

Orthetrum brunneum (Fonscolombe)

Own records: 36; 37; 42; 44.

Previous record: Spring at Decouk, our loc. 68 (Dumont 1977).

This species is common in south Europe and on Mediterranean islands, but incorrectly classified as circum-Mediterranean (e.g. D'Aguilar & Dommanget 1998) because it is rare in north Africa. In the Maghreb it has been recorded at a few localities in Morocco (Jacquemin & Boudot 1999) and at only three localities in Algeria (Ris 1909; Navás 1922). No record exists from northeastern Africa. The next known eastward localities are on the Asiatic Sinai (Sélys-Longchamps 1887; Dumont 1991). The local occurrence in Tunisia is therefore very interesting. Two adults collected in October at loc. 36 (female) and loc. 37 (male) are noticeably small: abdomen 24 mm each, hindwing 27 and 28 mm, respectively. Pinhey (1970) recorded a hindwing length of 32-35 mm in material from Spain, France and Turkey.

Orthetrum cancellatum (Linnaeus)

Own records: 12m; 16 ovip, exuv; 19c; 21; 22j ovip, exuv; 23; 24j ovip; 30; 44.

Previous records: A few localities in northern and central regions (Dumont 1977).

Our observations confirm the distributional assessment by Dumont (1977). Standing water and sparse vegetation characterise the typical habitat of this species. The single

male observed on 14 October seems to represent the hitherto latest known record of an adult which, seen in context of adult sightings during July and August in Numidia (Samraoui & Corbet 2000), makes it highly probable that under Tunisian climatic conditions more than one generation can be completed in a year, an inference that applies also to the Mediterranean coast of Spain (Jödicke & Jödicke 1996).

***Orthetrum chrysostigma* (Burmeister)**

Own records: 1j ovip; 4j; 5 juv; 12m/j; 13; 22c juv; 30; 35m/c-99; 37 exuv, juv; 39; 40; 43j ovip; 44; 46 ovip; 47m/s; 48m ovip; 48s/c abund, ovip, juv, exuv; 48n; 49n; 50; 51m/s; 51c ovip; 52m/s/n; 52c ovip; 55c mfl; 56 also juv; 60r mfl, exuv; 61; 62c-98 ovip; 63c; 64; 67s/c-99; 68c; 68n ovip; 69.

Other records: Mlelhel oasis 8 km S Douz: 11 iv 1994, our loc. 55 and 59: 29 iv 1994 leg. D. Kock (W. Schneider in litt.). Mahdia: xi 1997, 06/08/11 xi 1998 ovip (R. Stephan in litt.); near Museum of Natural Park de Bou Hedma: 05/06 x 1999, Oued bou Hedma in Natural Park: 07 x 1999, our loc. 48: 08 x 1999, oasis between Bechni and Derguine near our loc. 55: 10 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Many localities throughout the country (Dumont 1977); again at our loc. 68 (Carchini & di Domenico 1992).

Especially in the south this is one of the commonest Tunisian species. We saw immature and mature adults in spring as well in the autumn. Because in Numidia adults have been sighted during April through November (Samraoui & Corbet 2000), the species is probably on the wing all year round, a situation also supposed to obtain in Sinai (Dumont 1991). At loc. 68c we collected a female with a completely pruinose body and aberrant white wing membranules. The normal colour of the membranule is "grey, or grey outwardly with white inner edge" (Pinhey 1970) or "dark brown" (Dumont 1991).

***Orthetrum coerulescens anceps* (Schneider)**

Own records: 11; 12m; 17; 20; 31; 37; 40; 42; 48m; 48s also juv, exuv; 48c ovip; 51m/s/c; 52m ovip; 52s; 52c abund, ovip, mfl; 52n juv; 60s; 61; 62s/c; 65 abund, exuv; 66; 67s/c-98/99.

Other records: Mahdia: 05 xi 1998 (R. Stephan in litt.); near Museum of Natural Park de Bou Hedma: 05/06 x 1999, Oued bou Hedma in Natural Park: 07 x 1999, Dar Fatma nature reserve nr Aïn Draham: 20 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Many localities throughout the country (Dumont 1977); Tozeur (Mauersberger 1994); Oued Bézikh near Menzel Bouzelfa and two other northern streams (Klingenberg 1994).

Springs, streams and ditches with dense vegetation were the typical habitat of this species. In the southwestern oases it was abundant in May as well as autumn, and emergence was recorded in November. The possibility of a second annual generation of the nominotypical subspecies existing in Spain has been discussed by Jödicke (1996).

Orthetrum nitidinerve (Sélys)

Own records: 17; 18j-96 juv; 20; 25m also mfl; 25c; 37; 42; 44; 47s; 48s mfl, exuv, ovip; 48c; 62s/c-98; 62c-99 also mfl; 67s.

Other record: Our loc. 48: 08-X-1999 le. W. Pohl (W. Schneider in litt.).

Previous records: Many localities throughout the country (Dumont 1977).

Although we recorded this species at several localities, it has been nowhere as abundant as described by Dumont (1977). All our findings refer to lotic habitats. Emergence was occurring in September and October.

Orthetrum sabina (Drury)

Own records: 59s abun, ovip; 62c-98/99; 63s ovip; 63c; 64; 68c abun, also juv, exuv.

New to Tunisia. — For a long time the Algerian Temacin was the only known Maghreb locality for this species (Le Roi 1915). Now Samraoui & Menaï (1999) give further localities with recent records, all from the Grand Erg Oriental. Our records from southeastern Tunisia give an interesting completion of the distribution in northwest Africa. It might be argued that the records from the oases in Libya and Egypt (Kimmins 1950) indicate a corridor north of the Sahara which is settled by the species and which leads to the populations in Sinai and northeast Africa (Dumont 1991). Due to the limited occurrence of this species in the western Palaearctic, we consider it helpful to illustrate the exuvia again in this paper (Fig. 3). It was identified from an earlier description (Seidenbusch 1995).

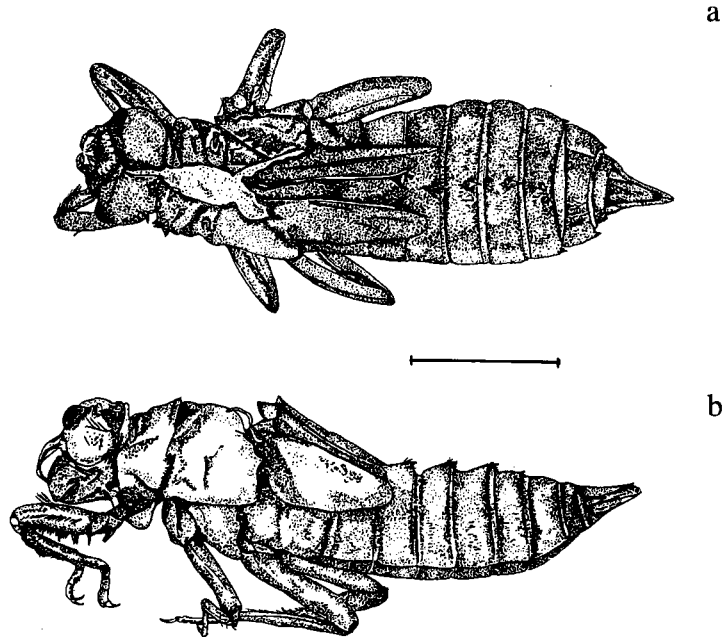


Figure 3. General appearance of final-stadium exuvia of *Orthetrum sabina*, collected 08 x 1998 at loc. 68; (a) dorsal view and (b) lateral view from left. Scale line: 5 mm. Drawn by H. von Hagen.

Orthetrum trinacria (Sélys)

Own records: 22j ovip; 59s; 60c exuv; 62c-98 also juv.

New to Tunisia. — We recorded this species at southeastern localities and also in the north near the Mediterranean coast. In Algeria it is “never abundant but widespread” (Samraoui & Menaï 1999). Our data show a long flying season and autumn emergence.

Sympetrinae

Brachythemis leucosticta (Burmeister)

Own records: 16; 18j-96 juv; 19j abun, exuv; 19c abun, ovip; 22 exuv; 36; 38.

New to Tunisia. — In October we counted many more females than males (ratio ca 5:1) on the sandy shore of loc. 19. We observed hundreds of females, many of which, as evident from their dark body and by their copulation, were mature. No female showed a trace of an (androchrome) wing band, all wings being entirely clear. This finding contrasts with Nigerian material in which 37% of females show a wing band; so female wing pigmentation seems to be independent of age (Adetunji & Parr 1974). Wing bands in females are also reported from the Jordan Valley (Dumont 1991). In conformity with the foregoing reports, all European field guides which deal with *B. leucosticta* mention the existence of wing bands in females. However, we suggest that female wing bands are not typical of populations from the Maghreb and south Europe, in which there is not a single report of an androchrome female — among many gynochrome ones — in the literature; and the sex identification of the banded individual mentioned by Galletti et al. (1987) has not been confirmed by capture. Several authors stress the existence of clear wings in all females (Compte Sart 1962; Belle 1984; Ocharán Larrondo 1987; in a limited sense also Crucitti et al. 1981), an attribute confirmed by further experience from Sicily, Andalusia and Morocco (J.-P. Boudot, G. Jacquemin, R. Jödicke & J. Kähler publ.). The long flying season, from June to October, reported here seems to be typical: Jacquemin (1987) recorded this species from mid-April until the end of October in Morocco, and Ferreras-Romero & Puchol-Caballero (1984) as late as November in Andalusia.

Crocothemis erythraea (Brullé)

Own records: 7; 11; 12m; 16; 17; 18j-88; 19c; 22j; 23; 24m; 25m; 27m/c; 30; 31; 41; 43j; 44; 45s; 47m/s; 48s juv; 48c; 51m ovip; 51s juv; 51c ovip, mfl; 52m juv, ovip; 52s; 52c abun, mfl, ovip; 54; 55s/c also exuv; 55n abun, also juv; 56; 57; 59s; 60s/c abun, ovip, mfl, exuv; 61; 62s/c-98/99; 63s abun; ovip; 63c; 64; 65; 67c-98 exuv; 66 ovip; 67s/c-99 abun; mfl, exuv, ovip; 68c; 68n also juv.

Other records: Mlelhel oasis 8 km S Douz and Douz oasis: 11 iv 1994 leg. D. Kock (W. Schneider in litt.). Mahdia: 05/19 xi 1998 ovip; Bir Bou Rekba W Hammamet: 09 xi 1998; Sousse: 10 xi 1998 (R. Stephan in litt.); oasis between Bechni and Derguine near our loc. 55: 10 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Many localities throughout the country (Dumont 1977).

This is one of the commonest species in Tunisia. Androchrome females (Kotarac 1996) were not rare; we collected voucher specimens which oviposited at loc. 60c and 67.

At loc. 60c we also collected several males with differing hamule structure. Of seven such males only three showed the typical bifid apex of the inner hamule (Morton 1920). Three other males showed undivided tips, and the seventh was only unilaterally bifid. The occurrence of males with undivided hamule tips was mentioned by Buchholz (1954). This character should be kept in mind if *C. erythraea* is differentiated from *C. servilia* solely by means of the hamule shape (cf. Schneider 1985; Dumont 1991).

***Diplacodes lefebvrei* (Rambur)**

Own records: 52m; 55s/c abun, also juv; 60s/c abun, ovip, juv, exuv; 62s/c-98; 63s/c; 67s/c-99.

Other record: Oasis between Bechni and Derguine nr our loc. 55: 10 x 1999 leg. H. Pohl (W. Schneider in litt.).

New to Tunisia. — We found this species in the regions of Gabés and the oases near Douz, sometimes in abundance, where we recorded emergence in September and October. We lack spring and summer records from there, but it is noteworthy that Dumont (1977) made no record when he visited these regions in March and June. In May we saw a single male at Tozeur (loc. 52).

***Sympetrum fonscolombii* (Sélys)**

Own records: 1j ovip; 4j; 6 ovip; 12m/j ovip; 14 ovip; 15 ovip, mfl, exuv; 16 ovip, exuv; 18j-96 ovip; 19j abun, ovip; 19c ovip; 22j; 22c ovip; 24m abun, ovip; 24j abun, mfl, exuv; 24c also mfl, exuv 15 m away from the water; 25c ovip; 26; 27m ovip, mfl, exuv; 27c ovip; 31; 33m ovip; 33c-99; 35m; 37; 38; 41 also exuv; 43j; 44; 47m; 52m mfl, exuv; 52s/c; 55s/c; 55n abun; 58; 59s/c; 60s/c; 62c-98; 63s/c; 64; 66; 68c/n; 69.

Other records: Our loc. 59: 29 iv 1994 leg. D. Kock (W. Schneider in litt.). Mahdia, Monastir, Sousse: xi 1997, Mahdia: 05/19 xi 1998 mfl, ovip; Bir Bou Rekba W Hammamet: 09 xi 1998; Sousse: 10 xi 1998; Oued el Mekta 20 km S Kairouan: 21 xi 1998 ovip (R. Stephan in litt.); beach near Nabeul: 03/04 x 1999, Natural Park de Jebil 50 km S Douz: 11/15 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Tozeur (Ris 1919); many localities throughout the country (Dumont 1977).

This species is common and widespread in Tunisian at standing and running waters.

***Sympetrum meridionale* (Sélys)**

Own records: 1r; 4c; 10 ovip; 23; 25c.

Previous records: Several localities throughout the country, except the oases (Dumont 1977).

We encountered this species only in the northern region. It seems to be not as common as *S. striolatum* which has a rather similar seasonal distribution.

***Sympetrum sanguineum* (O.F. Müller)**

No own record.

Previous records: Aïn Draham region, Tabarka region (Gadeau de Kerville 1908).

The previous records are probably valid because the species occurs in northeastern Algeria (Samraoui & Menaï 1999), in the Moroccan Rif and in the Middle Atlas (Jacquemin 1994; Jacquemin & Boudot 1999).

Sympetrum sinaiticum Dumont

Own records: 35c-98; 48c ovip; 52m mfl; 52c ovip; 52n abund; 68n.

Other records: Natural Park de Jebil 50 km S Douz, far from water in sand dunes: 11/15 x 1999, Oued Ahmadi nr Tamezret: 16/17 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Tozeur (Dumont 1977).

The taxonomy and biology of this species in Tunisia have been discussed in detail by Jödicke et al. (2000). We can additionally say that we did not find any individual during late September at places where females oviposited during October and November. We recorded emergence in May (loc. 52) and reproduction in October (loc. 48, 52), and we lacked opportunity for observations during July and August. We therefore think it likely that the prereproductive period lasts at least five months, namely significantly longer than the corresponding period in *S. meridionale* and *S. striolatum* in northeastern Algeria (Samraoui et al. 1998).

Sympetrum striolatum (Charpentier)

Own records: 1c; 10 ovip; 12m exuv; 13; 14 juv; 19c ovip; 22j mfl, exuv; 22c ovip; 24c; 25c ovip; 26 mfl; 27m juv, exuv; 27c ovip; 42 mfl.

Other records: Tabarka: 13 xi 1998 (R. Stephan in litt.).

Previous records: Several localities throughout Tunisia, except the oases (Dumont 1977).

This species is common in the north. The southern records near Gabés (Dumont 1977) could not be confirmed. The early emergence in May and late oviposition in October are consistent with the postponed sexual maturation described from Algeria by Samraoui et al. (1998).

Trithemistinae*Trithemis annulata* (P. de Beauvois)

Own records: 1j/c; 4j; 12j; 16 exuv; 18j-88; 19c also juv; 22j also exuv; 22c ovip; 23; 29; 30; 31; 35m/c-99; 36; 37; 38; 41; 43j; 44; 45s/n abund, ovip, exuv; 47m/s; 48m/c; 48s abund, mfl, exuv; 49m/n; 51m/s/n abund, ovip; 51c abund, ovip, mfl; 52m/s/c ovip; 52n abund; 56; 57; 59s; 60s; 61; 62s/c-98/99; 63s/c-98/99; 67s/c-99; 68c.

Other records: Our loc. 55 and 59: 29 iv 1994 leg. D. Kock; spring in Natural Park de Bou Hedma: 06/07 x 1999, our loc. 48: 08 x 1999 leg. H. Pohl (W. Schneider in litt.).

Previous records: Several localities in north and south Tunisia (Dumont 1977).

This widespread and common species occurred at running as well as stagnant water bodies and was very abundant along irrigation ditches in the oases. We have seen oviposition in early May and emergence as late as November. From observing emergence in early summer and then again in early autumn Jacquemin (1994) inferred that this species can be bivoltine in Morocco; and Agüero-Pelegrin & Ferreras-Romero (1992), on the basis of its long flight season, thought it might be wholly or partly bivoltine in southern Spain.

Trithemis arteriosa (Burmeister)

Own records: 4m/j/c; 8; 17; 31; 40; 43j.

Previous records: Two localities in northwest Tunisia (Dumont 1977).

Most known localities are close to the Mediterranean coast in northerly regions, in contrast to Morocco where the species is absent from the Rif (Jacquemin 1994; Jacquemin & Boudot 1999) and Algeria where it is rare in the Tell (Samraoui & Menai 1999). If, as in Numidia, the flying season encompasses July through September (Samraoui & Corbet 2000), the flying season in Tunisia, which features records in May, June and October, would be long enough to suggest that this species might be bivoltine there.

Trithemis kirbyi ardens Gerstäcker

Own records: 1m; 35m/c-99; 45s/n; 47s; 48s/c also juv; 51s/c/n; 54; 69.

Other records: Spring in Natural Park de Bou Hedma: 06/07 x 1999, our loc. 48: 08 x 1999 leg. H. Pohl (W. Schneider in litt.).

New to Tunisia. — This species is typical of streams with rocky beds and sand banks. At the irrigation ditches in the oases it perched on concrete banks. We recorded emergence in autumn (loc. 48), and “immature” adults were encountered in autumn in Morocco by Jacquemin (1994) and Jacquemin & Boudot (1999). If the immature adults seen in Morocco had emerged recently (as distinct from having aestivated), these combined records indicate a long flying season (cf. our loc. 35) and thus support the notion that this species may be bivoltine in both countries.

Trameinae

Pantala flavescens (Fabricius)

Own record: 52s.

New to Tunisia. — One mature male, probably a migrant, flew along the ditch in a northwesterly direction. Although we monitored the locality for several hours no further individual was seen. A record of this species in north Africa beyond the Sahara must be judged as rare. Among findings in the central Sahara, for instance in the Ahaggar Mountains (Kimmins 1934), it has been observed only in south Morocco (Jödicke 1995).

Urothemistinae

Selysiothemis nigra (Vander Linden)

Own record: 63s.

New to Tunisia. — One male persistently patrolled over submerged vegetation at a saline lake. This record corresponds with the situation in Algeria where the species seems to be confined to the adjacent eastern part of the Sahara (Dumont 1978; Samraoui & Menai 1999). Also in Libya and Egypt the species has been collected only in oases (Kimmins 1950), and it is noteworthy that there is no north African record from the Mediterranean coast, even though *S. nigra* has been recorded on islands close to Tunisia (Malta, Valetta 1949; Sardinia, Bucciarelli et al. 1983; Sicily, Carfi & Terzani 1993).

Urothemis edwardsii (Sélys)

Own record: 17.

New to Tunisia. — A single male, impossible to catch, flew over deeper water and perched on the outermost twigs of the shoreline vegetation. *U. edwardsii* seems to be one of the rarest and most endangered odonate species in Africa north of the Sahara Desert where only a small population at Lac Bleu in Numidia has survived (Samraoui et al. 1993), after another population at Lac Noir — persisting until 1990 — was destroyed (Bélair & Samraoui 1994).

Conclusions

Altogether 55 species have so far been recorded in Tunisia, but this number needs revision. As argued in our annotations, at least *Erythromma najas*, *Gomphus simillimus* and *Onychogomphus lefebvrei* have to be deleted from the checklist under suspicion of misidentification. Records for four other species — *Lestes sponsa*, *Coenagrion puella kocheri*, *Onychogomphus uncatus* and *Sympetrum sanguineum* — are based solely on the collection of Gadeau de Kerville (1908) whose material was identified by R. Martin, who was also responsible for the misidentification of *E. najas* and *O. lefebvrei* (Dumont 1977). The specimens collected by Gadeau de Kerville, which may be in the Museum Nationale d'Histoire Naturelle, Paris, urgently require re-examination. In the meantime they must not be deleted from the Tunisian checklist while they occur in adjacent regions of Algeria. This being so, we provisionally accept a checklist of 52 Tunisian species. Forty-eight of these have been recorded by Dumont (1977) and by us in the present paper. Their occurrence in the northern, central and southern regions of Tunisia is shown in Table 1.

Odonatological research in Tunisia is still in its infancy. Most of the streams that have been investigated have been inspected only along short stretches within easy reach; the odonate fauna of other streams remains unknown. The same is true for most natural lakes and water catchments, as well as for suitable habitats in the oasis regions. Accordingly the checklist of Tunisian Odonata can be expected to increase in future. In the first place we have to consider the eligibility of all those species that occur in adjacent regions of Algeria (Samraoui & Menai 1999): *Ischnura pumilio* (Charpentier), *Aeshna cyanea* (O.F. Müller) and *Acisoma panorpoides ascalaphoides* Rambur. The last species is known also from northern Libya (Ris 1911). Samraoui & Menai (1999) also list several species that have been recorded previously from northern Algeria: *Calopteryx splendens xanthostoma* (Charpentier), *C. virgo meridionalis* Sélys, *Lindenia tetraphylla* (Vander Linden), *Cordulegaster boltonii algerica* Morton, *Cordulia aenea* (Linnaeus), and *Rhyothemis semihiyalina* (Desjardins). Very questionable is the record of *Sympetrum depressiusculum* (Sélys) which dates back to Martin (1910; see Samraoui & Menai 1999). *Lestes macrostigma* (Eversmann) would be an interesting addition to the African fauna. There is no reliable record of this species, although it also has been listed by Martin (1910) for Algeria. Further to the south in the Algerian and Libyan Sahara occur *Agriocnemis sania* Nielsen (Nielsen 1959), *Pseudagrion hamoni* Fraser (Nielsen 1935; Dumont in Samraoui & Menai 1999),

Table 1. The distribution of Tunisian Odonata. North: localities south to 36°30'N; Central: localities between 36°30'N and 35°N; South: localities south of 35°N. X = recorded; - = not recorded; ? = record needs confirmation; ?? = questionable record. Three species, *Erythromma najas*, *Gomphus simillimus maroccanus* and *Onychogomphus lefebvrei*, though recorded, have been omitted from the Table because we doubt the reliability of the records (see text).

Taxon	North	Central	South
<i>Calopteryx exul</i>	X	-	-
<i>C. h. haemorrhoidalis</i>	X	X	X
<i>Lestes barbarus</i>	X	-	-
<i>L. sponsa</i>	?	-	-
<i>L. v. virens</i>	X	-	-
<i>L. v. viridis</i>	X	X	-
<i>Sympecma fusca</i>	X	-	-
<i>Platycnemis subdilatata</i>	X	X	-
<i>Cercion lindenii</i>	X	X	X
<i>Ceriagrion tenellum</i>	X	X	X
<i>Coenagrion caerulescens</i>	X	X	X
<i>C. mercuriale</i>	X	X	-
<i>C. puella kocheri</i>	?	-	-
<i>C. scitulum</i>	X	X	-
<i>Erythromma viridulum</i>	X	X	-
<i>Enallagma deserti</i>	X	X	-
<i>Ischnura fountaineae</i>	-	X	X
<i>I. graellsii</i>	X	X	-
<i>I. saharensis</i>	-	X	X
<i>Gomphus lucasii</i>	X	-	-
<i>Onychogomphus costae</i>	X	X	??
<i>O. forcipatus unguiculatus</i>	X	-	-
<i>O. uncatus</i>	?	-	-
<i>Paragomphus genei</i>	X	X	X
<i>Aeshna affinis</i>	X	X	-
<i>A. isoceles</i>	X	-	-
<i>A. mixta</i>	X	X	-
<i>Anax ephippiger</i>	X	X	X
<i>A. imperator</i>	X	X	X
<i>A. parthenope</i>	X	X	X
<i>Boyeria irene</i>	X	-	-
<i>Orthetrum brunneum</i>	-	X	X
<i>O. cancellatum</i>	X	X	-
<i>O. chrysostigma</i>	X	X	X
<i>O. coerulescens anceps</i>	X	X	X
<i>O. nitidinerve</i>	X	X	X
<i>O. sabina</i>	-	-	X

Table 1. Continued.

Taxon	North	Central	South
<i>O. trinacria</i>	X	-	X
<i>Brachythemis leucosticta</i>	X	X	-
<i>Crocothemis erythraea</i>	X	X	X
<i>Diplacodes lefebvrei</i>	-	-	X
<i>Sympetrum fonscolombii</i>	X	X	X
<i>S. meridionale</i>	X	X	X
<i>S. sanguineum</i>	?	-	-
<i>S. sinaiticum</i>	-	X	X
<i>S. striolatum</i>	X	X	X
<i>Trithemis annulata</i>	X	X	X
<i>T. arteriosa</i>	X	X	-
<i>T. kirbyi ardens</i>	X	X	X
<i>Pantala flavescens</i>	-	-	X
<i>Selysiothemis nigra</i>	-	-	X
<i>Urothemis edwardsii</i>	X	-	-
Σ	44	34	26

Orthetrum ransonneti (Brauer) (Samraoui & Menaï 1999) and *Crocothemis sanguinolenta* (Burmeister) (Nielsen 1935). It is not unlikely that these species also occur in southern Tunisia. The record of *Pseudagrion sublacteum* Karsch in Morocco (Jacquemin & Aguesse 1987) is a good example of the occasional presence of an Afrotropical species in the Maghreb. Some other species seem to be confined to the western Maghreb in Morocco, namely *Lestes dryas* Kirby, *Pyrrhosoma nymphula* (Sulzer), *Enallagma cyathigerum* (Charpentier), *Gomphus simillimus maroccanus* Lieftinck, *Cordulegaster princeps* Morton, *Oxygastra curtisii* (Dale), *Libellula quadrimaculata* Linnaeus, and *Zygonyx torridus* (Kirby) (Lieftinck 1966; Dumont 1972; Lohmann 1990; Jacquemin 1994). It is less likely that the ranges of these species extend to Tunisia, a supposition that applies also to two further *Ischnura* species which have been reported from eastern Libya: *I. senegalensis* (Rambur) (Navás 1932) and *I. evansi* Morton (Kimmins 1950). Due to our poor knowledge of this region it is an open question how far these species extend their ranges towards the Tunisian part of the Maghreb. The record of a female *I. senegalensis* from Traghen in southwestern Libya (Nielsen 1935) needs confirmation because of the danger of confusing this species with *I. fountaineae*.

Our phenological observations were made in two blocks: spring and early summer (early May until mid-June) and autumn (late September to early November). Of the 46 species we recorded during all visits, 41 were on the wing in spring and early summer. During autumn we recorded 34 species, and 29 species were active as adults in both blocks. The life cycle associated with a long flying season can entail different patterns of voltinism. One group, exclusively univoltine in Algeria, is represented by

Aeshna mixta, *Sympetrum meridionale* and *S. striolatum*. These species feature a long prereproductive aestivation (Samraoui et al. 1998). Our results make it probable that *Lestes v. viridis*, *A. affinis* and *S. sinaiticum* also belong to this group. Some species that have a long flying season in low temperate latitudes can be bivoltine (see Ferreras-Romero 1991; Corbet 1999: fig. 7.19, species 8 and 9). All seven species that were already ovipositing in the first decade of May and that also emerged in autumn, namely *Ischnura graellsii*, *Anax parthenope*, *Orthetrum chrysostigma*, *O. coerulescens anceps*, *Crocothemis erythraea*, *Sympetrum fonscolombii* and *Trithemis annulata*, probably belong to this group, an inference strengthened by the knowledge that in neighbouring Numidia all these species except *O. coerulescens anceps* (for which data were insufficient) showed no discontinuity in the flying season during the period between our two blocks of observations (Samraoui & Corbet 2000) and by the detection of emergence in early June and then in September and October by *Trithemis annulata* during its long and continuous flight period in Morocco (Jacquemin 1994: 233). Though at present lacking data supporting such an inference, we predict that the following additional species will be found to be bivoltine or multivoltine in Tunisia: *Calopteryx haemorrhoidalis*, *Ischnura fountaineae*, *I. saharensis*, *Coenagrion caerulescens*, *Paragomphus genei*, all *Orthetrum* species, *Diplacodes lefebvrei*, *Trithemis arteriosa* and *T. kirbyi ardens*. As more phenological data become available, we expect the same prediction will apply to *Enallagma deserti*, *Cercion lindenii*, *Erythromma viridulum*, *A. imperator* and *Brachythemis leucosticta*. We exclude *Anax ephippiger* from this expectation because we do not know whether larvae of this tropical migrant can survive winter temperatures in Tunisia. A thorough investigation of voltinism of Tunisian odonates presents an interesting task for the future. In particular, data are now needed on the presence and developmental status of Odonata in Tunisia during mid-summer and mid-winter.

Acknowledgements

Herbert von Hagen illustrated the exuviae. Wolfgang Schneider provided the Tunisian material which is in the Hessisches Landesmuseum Darmstadt and was collected by Dieter Kock and by Hans Pohl and Ulrich Joger with their students. Rainer Stephan let us have his Tunisian data. The Maghreb specialists, Henri Dumont, Gilles Jacquemin and Boudjéma Samraoui, helped with discussion of specific problems, and Andreas Martens with copies of several publications. Philip S. Corbet gave numerous comments to improve an earlier draft of this paper. We are greatly indebted to them all for their help.

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