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ODONATA OF THE RIF, NORTHERN MOROCCO

G. JACQUEMIN
Biologie des Insectes, Université de Nancy I, B.P. 239
F-54506, Vandoeuvre-lès-Nancy, France

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During 1982-1985, the region has been systematically surveyed, and at 39 localities, 49 spp. were recorded, 17 of which are additions to the regional fauna. *Calopteryx virgo meridionalis* and *Sympetrum sanguineum* were not previously reported from Morocco. Including the earlier records, the odon. fauna of the Rif now rises to 52 spp., but the records of *Lestes macrostigma* and *Aeshna cyanea* are in need of confirmation. Detailed data are provided on regional distribution, habitat requirements and on adult phenology. The biogeographic composition of the Rifan fauna is compared with that of Andalusia (Spain).

INTRODUCTION

The Rif originates in the Alpine orogeny and forms a bow along the Mediterranean coast of northern Morocco. In its structure and landscape, it shows some resemblance to the Andalusian mountains in Spain. The main peaks, in the central part of the range, exceed the elevation of 2000 m (highest top: Jbel Tidighine, 2448 m). The northeastern (Mediterranean) side, with short and torrent-like streams (= *oueds*), is steep and hardly penetrable. The external, southwestern, more developped flank, abuts on hills of the Prerif and on those of the Atlantic seabord. There are no natural lakes in the Rif, but some ancient dams or reservoirs offer quasi-natural habitats. Small marshes (= *merjas*) are fed by some springs, and in the hollows the trickling waters gather into more or less temporary pools (= *dayas*). According to its geography, geology and hydrology, the Rif can easily be divided into 6 zones, as shown in Figure 1.

The climate is Mediterranean, with numerous local variations. Rain is brought by Atlantic disturbances from the West, which are producing a strong gradient of rainfall and humidity from the West to the East of the chain. It goes without saying, the local climatic features are conditioned by various factors, including

the altitude, valley or slope orientation, and wind. The Mediterranean versant is much drier than the S-W flank. Some climatic features are given in Table I, based on the 1933-1963 data. Most of the massif is rather moist, the highest tops and the westernmost versants are well watered. On the other hand, a narrow zone along the Mediterranean coast, the eastern part of the range and its southern fringe are more arid.

Table I

Some climatic data, 1933-1963

M = maxima average; – m = minima average; – av. = average temperature ($\frac{M+m}{2}$)

Meteorological station	Alt. (m)	Annual precipitation (mm)	Temperature in °C: January M	January m	January av.	August M	August m	August av.	Year M	Year m	Year av.
ATLANTIC COAST											
Tanger	15	765	15.8	8.1	*12.0*	28.7	19.4	*24.1*	21.6	13.5	*17.6*
Larache (loc. 38)	12	683	17.2	6.0	*11.6*	31.0	18.0	*24.5*	23.9	11.8	*17.8*
MEDITERRANEAN COAST											
Ceuta (= Sebta)	200	580	14.2	9.6	*11.9*	27.8	18.6	*23.2*	20.4	13.9	*17.2*
Tetouan	5	747	16.4	8.0	*12.2*	30.7	18.8	*24.8*	23.1	13.2	*18.2*
Emb. oued Laou	3	440	-	-	-	-	-	-	-	-	-
Al Hoceima	12	327	17.2	9.9	*13.6*	28.9	21.6	*25.2*	22.6	15.6	*19.1*
RIF RANGE											
Arbawa (loc. 19)	184	713	-	-	-	-	-	-	-	-	-
Ouezzane (loc. 25)	164	885	16.2	5.3	*10.8*	36.0	16.2	*26.1*	27.5	10.6	*18.2*
Souq El Had (loc. 7)	140	1280	-	-	-	-	-	-	-	-	-
Zoumi (loc. 27)	350	1285	15.9	4.0	*10.0*	36.4	14.6	*25.5*	25.7	9.1	*17.4*
Chefchaouen (loc. 6)	280	1072	14.6	5.6	*10.1*	29.9	21.6	*24.4*	22.6	15.6	*17.0*
Talembote (loc. 3)	500	825	-	-	-	-	-	-	-	-	-
Bab Taza (loc. 9)	880	1386	-	-	-	-	-	-	-	-	-
Ghafsaï (loc. 12)	345	912	-	-	-	-	-	-	-	-	-
Outka (loc. 13)	1085	1805	-	-	-	-	-	-	-	-	-
Tawnat	668	904	12.8	5.5	*9.2*	36.1	18.9	*27.5*	23.4	11.4	*17.4*
Ketama (loc. 14)	1520	1369	-	-	-	-	-	-	-	-	-
Targuist	1020	363	-	-	-	-	-	-	-	-	-
Aknoul	1210	529	9.9	1.9	*5.6*	34.0	17.8	*25.9*	20.4	9.3	*14.8*
SOUTHERN FRINGE											
Fes (loc. 35)	415	573	15.2	4.5	*9.5*	35.7	18.2	*27.0*	24.6	11.1	*17.8*
Taza	510	699	14.1	4.2	*9.2*	37.0	19.1	*28.0*	24.1	11.3	*17.7*
Guercif (loc. 37)	360	199	16.3	3.8	*10.0*	37.7	20.3	*29.0*	26.3	11.8	*19.0*

LIST OF LOCALITIES

For each locality, the number of identified odonate species is stated.

(1) Oued Smir mouth, N of Mdiq. – Large wet complex, probably brackish, with a zone of vast temporary marshes, with reed-beds. The area is threatened by touristic development projects. – [5 spp.]

(2) 2 short rivers, flowing into the Mediterranean, W of Aarabene. – Deeply embanked, wooded and steep valleys. River bed with pebbles and rocks, largely shaded. Alt. 50-400 m. – [14 spp.]

(3) Reservoir of Talembote. – Little irrigation dam, empty at the end of summer. Two streams feeding the reservoir, flowing throughout the year, deeply embanked, swift and cool. The outlet river. Alt. 350-450 m. – [9 spp.]

(4) Oued El Haricha, E of Dar Chaoui (road P 37). – Lowland river, bordered with fields and hedges or bushes. Bed of silt or pebbles. Alt. 50 m. – [5 spp.]

(5) NE flank of the Jbel Bou Hachim (= Bou Hassim), above Tayenza. – Deciduous oak forest dayas and nearby tracks. Semi-permanent marsh, surrounded by a heath (*Cistaceae, Pteridium*), the outlet brook, bordered with remnants of forest (oaks, alders, *Osmunda, Sphagnum*). Some little dayas and marshy areas. Springs. Alt. 1000-1500 m. – [16 spp.]

(6) Oued Laou near Chefchaouen. – Rather important river, with a good flow, even in summer, and a swift current. Bed with pebbles and rocks. In places, calmer zones bordered with grass and trees (alders). Alt. 300-450 m. – [18 spp.]

(7) Oued Loukkos, W of Souq-el-Had (= "Pont du Loukkos"), along the road P 28. – Embanked wooded valley (holm-oak). Broad bed with pebbles. Flow variable, very reduced in summer. Alt. 100 m. – [4 spp.]

(8) Oued Zendoula (road P 28), between Ouezzane, or Wezzan, and Chefchaouen). – Little stream with a strong incline. Embanked wooded valley (holm-oak). Alt. 150 m. – [2 spp.]

(9) NE slope of the Jbel Khizana, near the track from Bab Taza to Fifi. – Deciduous oak forest (*Quercus zeen, Q. faginea*), degraded in places (holm-oak, cork-oak, *Cistaceae, Pteridium*): (a) Large pool (80 m x 30 m, depth: 0,5 m) almost dry in summer; alt. 1200 m. – (b) Complex of springs, rivulets, marshy meadows and dayas on the slope above Bni Watli; alt. 1100-1200 m. – [22 spp.]

(10) Road from Bab Taza to Bni Ahmed. – A few pools along the road and the oued Awdour below. Alt. 400-700 m. – [10 spp.]

(11) Deep permanent pool W of Bab Berret (road P 39), bordered with reeds and surrounded by marshy meadows. – In- and outlet rivulets. Alt. 1245 m. – [15 spp.]

(12) Oued Awlai, near Ghafsai. – Large stream with a broad pebble bed. Alt. 150-200 m. – [9 spp.]

(13) Jbel Outka: (a) 3 forest dayas (deciduous oaks), and springs, rivulets and little boggy areas; alt. 1000-1200 m; – (b) Permanent pool near the small lake named Hofrat n'Joum, (without interest); surrounding area degraded into grazings and heaths of *Cistus* and *Pteridium*; alt. 1400 m; – (c) A daya, alt. 800 m. – [22 spp.]

(14) Oued Ketama, S of Ketama (road S 302). – Slow rivulet almost drying up in summer, with aquatic weed, in a clear cedar forest. Alt. 1450 m. – [5 spp.]

(15) Northern flank of the Jbel Tidighine. – Some forest torrents with very strong incline, originating from cold springs (temperature below 10°C), and small boggy areas. Cedar forest with oaks and birches. Alt. 1400-1900 m. – [6 spp.]

(16) Small streams (oued Islane) near Zrirar, with contiguous spring and marshy area. Alt. 350 m. – [4 spp.]

(17) Oued Sra above the Sker bridge (road S 304 from Tawnat to Tahar Souq). – Broad stream, fairly swift, in a bed of pebbles and rocks. Alt. 300 m. – [7 spp.]

(18) Oued Wargha at Tahar Souq. – Very broad bed with pebbles and sandy banks, bordered with tamarisk. Rapid current, alt. 500 m. – Another site, 10 km downstream, river narrow with

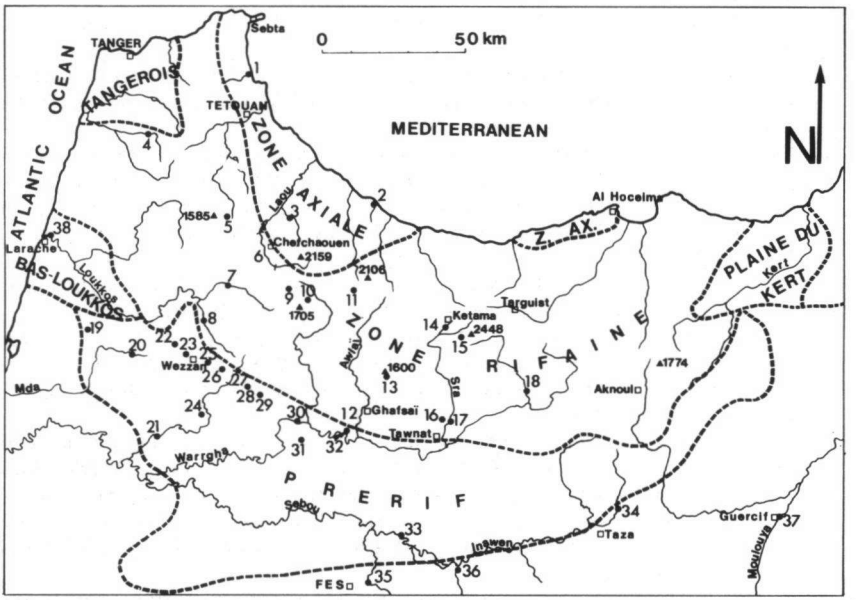

Fig. 1. Map of the considered region, with the localities prospected.

bushes, alt. 350 m. – [4 spp.]

(19) Arbawa. – Springs, brooks and a small swamp, and 3 successive little weirs. Alt. 100 m. – [9 spp.]

(20) Oued Mda, along the road P 23 (from Souq-el-Arbaa to Ouezzane). – Narrow stream between deep earth banks, reduced to water holes in summer, surrounded by grazings. Alt. 180 m. – [16 spp.]

(21) Oued Rdat (road S 211, from Khenichet to Had Kourt). – Rather deep, with earthy banks. Alt. 30 m. – [4 spp.]

(22) Oued Zaz, NW of Ouezzane. – Very similar to the oued Mda, but a little larger. Banks with rose-laurel, tamarisk and other bushes. Alt. 80 m. – [10 spp.]

(23) Oued Salda. – Temporary brook, flowing into the oued Zaz. Alt. 100 m. – [6 spp.]

(24) Marsh, N of Ain Deffali, on the road P 28, fed by springs. – Weak current, abundant vegetation. Alt. 100 m. – [7 spp.]

(25) Lake of Ouezzane, 4 km E of the town. – Reservoir of water created in 1936 and today well integrated in a landscape of fields, grazings, and olive-plantations (capacity: 360 000 m^3). Alt. 200 m. – [18 spp.]

(26) Oued El Biod. – Temporary brook, east of Ouezzane (road P 26), nearly dry in summer. Bed with sand and pebbles, shaded by thick bushes. Alt. 215 m. – [8 spp.]

(27) Oued Es-Sabbanyine, along road S 307 to Zoumi, and at crossing with P 26. – Embanked river, rather rapid, with a bed of pebbles and sand. Bushes on the sides. Reduced flow in summer. Alt. 170-200 m. – [13 spp.]

(28) Bab Ain Assel, little col next to the loc 27. – No water. Olive-trees, bushes. Alt. 380 m. – [3 spp.]

(29) Oued Drader, along road P 26. Alt. 240 m. – [3 spp.]
(30) Oued Wargha, along road P 26. – Very broad stream, with a bed of pebbles and sand. Cultivated area. Alt. 100 m. – [2 spp.]
(31) Merja Bridya. – Beautiful swamp, fed by a powerful spring (Ain Belait). Broad reed-bed, surrounded with a sedge or rush belt in a grazing area. The reeds are cut every year. Outlet rivulet. Alt. 230 m. – [18 spp.]
(32) Small irrigation ditch (= seguia) in an orange grove, near Ourtzagh. Alt. 140 m. – [2 spp.]
(33) Oued Inawen (crossed by road S 302). – Broad plain stream with earth banks. Rather high flow. Water warm in summer (30°C on the 6.06.84). Poor vegetation. Alt. 200 m. – [6 spp.]
(34) Oued Larbaa, NE of Taza, along road S 312 to Aknoul. – Small temporary stream with earth banks and poor vegetation. Alt. 500 m. – [6 spp.]
(35) Oued Sebou, E of Fes. – Rather broad river with a strong flow. Station of *Pseudagrion sublacteum*, described in JACQUEMIN (1987a). Alt. 170 m. – [6 spp.]
(36) Oued El Ammar (= O. Bou Zemlane?) flowing into the oued Inawen, at the level of Abjelil, on road P 1. – Grassy banks in a cultivated area. Alt. 250 m. – [11 spp.]
(37) Oued Moulouya at Guercif. – Large subdesertic stream in a very broad sandy bed. Vegetation rare. Alt. 330 m. – [3 spp.]
(38) Lower valley of the oued Loukkos, near Larache. – Noteworthy complex of marshes along the last section of the stream (which is canalized at this level). Springs, brooks, flooded meadows and vast marshes with a very rich vegetation (*Utricularia, Marsilea, Nymphea, Phragmites, Typha, Cladium, Dactylorhiza, Salix*, etc.). Very rich waterfowl. Surroundings of fields and grazings. Salinity very reduced (in the Ain Ech-Chouq marsh, 0.12 g NaCl/l measured on 22-IX-1984). – [27 spp.]
(39) Merja Zerga. – Large lagoon, open to the ocean. A few rapid observations at the southern extremity, near the issue of a fresh water canal into the salted lagoon. – [5 spp.]

ANNOTATED AND COMMENTED LIST OF SPECIES

CALOPTERYGIDAE

Calopteryx exul Selys, 1853

Loc. 6, 12, 35 (6 contacts). – New for the Rif.

This superb species is not confined to the Middle-Atlas (LIEFTINCK, 1966; DUMONT, 1972), but also inhabits the Rif and even the oued Sebou, which is not in a mountainous area. As Dumont points out, this species has a rapid flight, contrary to *C. hemorrhoidalis* with which it generally co-exists. *C. exul* probably often passes unnoticed because of its habit of skimming the water surface and resting very near the banks, often under shaded overhangs, when the wheather is warm.

Flying period. – Observations in June and July.

C. hemorrhoidalis (Vander Linden, 1825)

Loc. 2, 3, 4, 5, 6, 8, 9b, 11, 13a, 14, 19, 22, 25, 26, 27, 31, 36, 38 (33 contacts). – Previous records: McLACHLAN, 1889: Ceuta; – DUMONT, 1972: O. Laou (loc. 6), Merja Zerga (loc. 39).

Very common and most widespread on running waters, even at some altitude

(4 loc. above 1000 m, highest loc. 11, 1250 m). The populations are sometimes considerable.

Flying period. – From April (immatures on 7-IV-1985, loc. 31) to the end of September (26-IX-1983, loc. 12)

C. virgo meridionalis Selys, 1873

Loc. 5, 15 (3 contacts). – New for Morocco

This species is here at its southern limit. Rare and localized in southern Spain, it is only known from 2 specimens from Algeria (Oran: SELYS, 1871; Constantine: MARTIN, 1910), referred to the subspecies *meridionalis* Sel. The Moroccan individuals (2 ♂ plus an isolated wing) show very broad and rounded, particularly short wings. In Morocco, *C. virgo* is probably rare; I only met single individuals (loc. 15) or very small populations (loc. 5), at high altitude, and many fitting biotopes were not inhabited.

Flying period. – From mid June (adults on 22-VI-1983, loc. 5) to the second half of September (1 wing on 23-IX-1985, loc. 5). A teneral individual on 3-VII-1984, loc. 15.

LESTIDAE

Chalcolestes viridis (Vander Linden, 1825)

Loc. 2, 3, 5, 6, 9b, 10, 13a, 20, 23, 25, 27 (15 contacts). – Previous record: DUMONT, 1972: oued Laou (loc 6).

Common at the end of summer, near running waters (it does not frequent stagnant water as in Europe). It must occur in the trees and bushes along most of the streams, from July. Oviposition takes place from August to September; eggs are laid in tamarisks or rose-laurel boughs (on 22-X-1983, a female was ovipositing in a tamarisk above a then completely dry brook, at loc. 25).

Flying period. – From June (5-VI-1983, loc. 23) to the end of December (old ind. on 23--XII-1983, loc. 25). Still observed on 12-XI-1982 up to an elevation of 800 m (loc. 10).

Lestes barbarus (Fabricius, 1798)

Loc. 13c, 25, 38 (4 contacts). – Previous records: McLACHLAN, 1889: "Esmir" (loc. 1); – LE ROI, 1915: Tanger; – VALLE, 1933: Tanger; – DUMONT, 1972: Mdiq (loc. 1), O. Laou (loc. 6), Merja Zerga (loc. 39).

Mostly localized in the stagnant (or very slowly flowing) waters at low altitude; out of 7 localities (including those from the literature), 4 are situated on the coast, 2 at about 200-300 m, and only one at 800 m. When scarce, this species easily escapes notice among rush and high grass. Enormous population at loc. 38.

Flying period. – From the end of May (25-V-1983, loc. 13) to the end of September (28--IX-1983, loc. 38).

L. dryas Kirby, 1890

Loc. 5, 9a-b, 10, 13a (5 contacts). – New for the Rif.

A boreal species, confined to the montane standing waters, even if temporary

(500-1200 m). The Rifan individuals are morphologically quite similar to those from NE France.

Flying period. – From the end of May (25-V-1983, loc. 13) to August (still numerous on 5-VIII-1985, loc. 13a, dried up daya).

L. macrostigma (Eversmann, 1836)

No record

Reported by MARTIN (1910) from Morocco, without locality, as follows: "observé au Maroc". The same author said later (1931): "elle est commune à Chypre et au Maroc". We have no other data. Nevertheless the species is known from southern Spain (low Guadalquivir; DUFOUR, 1978). I vainly searched for it at loc. 38.

L. virens (Charpentier, 1825)

Loc. 5, 9a, 10, 11, 13a, 38 (9 contacts). – Previous records: McLACHLAN, 1889: Esmir (loc. 1); – DUMONT, 1972: Qsar-el-Kebir (near loc. 38).

Typical of stagnant, generally temporary waters (3 loc. out of 6), this species reaches high altitudes (4 loc. above 1000 m), but also regularly inhabits the coastal marshes (loc. 1, 38). It has been observed ovipositing in dried up places, on 5-VIII-1985 (loc. 13) and 18-IX-1983 (loc. 9a).

Flying period. – From mid June (19-VI-1984, loc. 38) to the end of September (23-IX--1984, loc. 5)

Sympecma fusca (Vander Linden, 1823)

Loc. 5, 13a, 15, 24, 25, 38 (9 contacts). – Previous records: McLACHLAN, 1889: Tanger; – LE ROI, 1915: Tanger; – DUMONT, 1972: Mdiq (loc. 1).

The annual cycle of this species, known as hibernating in temperate Europe, certainly sets a problem in Morocco. At low altitude and under Atlantic climate, it seems to breed at the beginning of the winter, when the rains come back. For instance at loc. 38, reproduction was very active on 22-XII-1984 (see also JACQUEMIN, 1987b). The larval stages probably occur in winter. – At higher altitude or inland, where winters are harder, the reproductive period shifts to the spring (for instance on the 10-III-1985, loc. 25) with emergences noticed in June (loc. 25) and July (loc. 15). This kind of cycle is similar to that occurring in Europe.

The biotopes are various: running waters (3 loc.), marshes (2 loc.) and stagnant waters (1 loc.). Probably a very common species, but easily passing unnoticed.

PLATYCNEMIDIDAE

Platycnemis subdilatata (Selys, 1849)

Loc. 2, 6, 8, 12, 20, 21, 22, 24, 25, 26, 27, 33, 35, 36, 37 (26 contacts). – Previous record: DUMONT, 1972: Merja Zerga (loc. 39).

Endemic in the Maghreb, very common and widespread in the considered region (except above 400-500 m), this species typically frequents the running

waters.

Flying period. – From May (active reproduction on 25-V-1983, loc. 25) to the end of September (23-IX-1984, loc. 6). Emergences must begin as early as the end of April in the Atlantic regions (mid-April near Rabat). Immature individuals have been noticed until the second half of June, egglaying from the end of May to the beginning of August.

COENAGRIONIDAE

Cercion lindenii (Selys, 1840)

Loc. 6, 12, 17, 20, 21, 22, 23, 25, 26, 27, 30, 31, 33, 34, 36, 37 (32 contacts). – Previous records: McLACHLAN, 1889: Tanger; – DUMONT, 1972: Mdiq (loc. 1), O. Laou (loc. 6), Merja Zerga (loc. 39)

A very common species, living almost exclusively in a wide range of running waters. In its rare stagnant localities, one meets only reduced populations or isolated, perhaps erratic individuals. It disappears above 400 m (loc. 6).

Flying period. – Long: from March (10-III-1985, loc. 25) to the second half of October (20-X-1983, loc. 20, 22). Mating noticed from the end of May to the end of September. There might be 2 annual generations.

Coenagrion caerulescens (Fonscolombe, 1838)

Loc. 11, 12, 14, 19, 22, 23, 31, 34, 38 (10 contacts). – New for the Rif.

Rather common and widespread species, characteristic of running waters. It can also be met in marshes with an appreciable current (loc. 38). The altitude of the localities ranges from 0 to 1450 m (loc. 14).

Flying period. – From mid-April (at least in the Atlantic zone) to the end of September (26-IX-1983, loc. 31).

C. mercuriale (Charpentier, 1840)

Loc. 13, 19, 24, 38. – New for the Rif. Concerning the ssp. *hermeticum* Selys, 1872, see JACQUEMIN & BOUDOT, 1990.

This species must be common along the little streams with an abundant vegetation, but passes unnoticed (like in Europe, where it is somewhat unrecognized). The 4 localities are small clear rivulets, 2 of them draining fens; one is at 1300 m in altitude.

Flying period. – Early: from March (9-III-1984, loc. 24) at low altitude, until the second half of September (reproduction observed on 22-IX-1984, loc. 38).

C. puella kocheri Schmidt, 1960

Loc. 9, 19, 23 (3 contacts). – Previous records: SELYS, 1871: Tanger; – McLACHLAN, 1889: Tanger.

Two localities are running waters, the 3rd is a daya surrounded by springs and rivulets (loc. 9) at an altitude of 1200 m. This species is much less common than in Europe, but it is probably underestimated owing to its early and short flying period.

Flying period. – From mid April (14-IV-1985, loc. 19) to the second half of June (20-VI-1983, loc. 9).

C. scitulum (Rambur, 1842)

Loc. 5, 9, 13, 25, 31 (7 contacts). – New for the Rif.

Contrary to *C. caerulescens*, with which it is sometimes confused, this species is, in the Rif, typical of standing waters. The most remarkable populations inhabit dayas (loc. 9, 13) or marshes overgrown with vegetation (loc. 5, 31). The Ouezzane lake only harbours a very small population. Max. altitude: 1300 m (loc. 13).

Flying period. – Likely short and early, all the observations have been made in May and June.

Pyrrhosoma nymphula (Sulzer, 1776)

Loc. 9b, 11, 14 (3 contacts). – New for the Rif.

The African distribution of this Eurosiberian species, till now restricted to the Ifrane vicinity (Middle Atlas: cf. AGUESSE & PRUJA, 1958b; LIEFTINCK, 1966; DUMONT, 1972) is thus somewhat dispersed. In the 3 localities, reduced populations live on small rivulets, at an altitude between 1150 and 1450 m.

Flying period. – Observations in the second half of June and in July. Egglaying noticed on 21-VI-1983 (loc. 9) and on 4-VII-1984 (loc. 14).

Ischnura graellsii (Rambur, 1842)

Loc. 1, 2, 5, 6, 9a-b, 10, 11, 12, 13a, 13c, 14, 16, 17, 18, 19, 20, 21, 22, 24, 25, 31, 33, 34, 35, 36, 38, 39 (47 contacts). – Previous records: McLACHLAN, 1889: Tanger, "Esmir" (loc. 1); – DUMONT, 1972: Mdiq (loc. 1), O. Laou (loc. 6), Merja Zerga (loc. 39).

Undoubtedly the most common and widespread species, from sea level up to 1450 m (loc. 14). Most of the localities are running waters. (ca 70%) but the stagnant sites (relatively scarce in the Rif) seem to be systematically occupied too.

Flying period. – Throughout the year in the Atlantic coastal areas, reproduction noticed from March to October, emergences as late as on 22-XII-1984 (loc. 38). Inland, the flying period must cease briefly in winter.

I. pumilio (Charpentier, 1825)

Loc. 2, 5, 9b, 13c, 20, 25, 31, 38 (10 contacts). – New for the Rif.

Rather well widespread from sea-level up to more than 1000 m (1100 m at loc. 9b), the species preferentially colonizes standing waters (75% of the cases): dams, dayas, marshes but also some streams, in their calm sections. Probably more common than it appears, due to screening by strong populations of the preceding species. Nevertheless, the females of the orange form (which is likely to be very frequent) allow an easy identification.

Flying period. – Noticed from May (25-V-1983, loc. 13) to the end of September (26-IX--1983, loc. 31). But emergences in March near Rabat allow to place the beginning of the flying period in April (at least near the sea).

Ceriagrion tenellum (de Villers, 1789)

Loc. 5, 6, 9, 10, 11, 19, 24, 25, 31, 38 (17 contacts). – Previous records: McLACHLAN, 1889: Tanger; – LE ROI, 1915: Mdiq (loc. 1).

The presence of this species depends on specific features of the biotope: a

marshy area overgrown with a grassy, rather high vegetation. It may be associated with a true marsh (loc. 11, 24, 31, 38), a spring (loc. 19), the bank of a stream (loc. 5, 6, 9), the border of a pond (loc. 25) or a daya (loc. 10). In the large marshes, the populations are often considerable. But when the individuals are scarce, they become very difficult to detect, in spite of their colour. Maximum altitude: 1250 m (loc. 11).

Flying period. – From the beginning of April (numerous on 7-IV-1985, loc. 31) to the end of September (23-IX-1984, loc. 5).

Pseudagrion sublacteum (Karsch, 1893)

Only one locality, on the oued Sebou near Fes (loc. 35), reported and discussed by JACQUEMIN (1987a).

GOMPHIDAE

Gomphus simillimus maroccanus Lieftinck, 1966

Loc. 6, 27, 33, 38 (5 contacts). – New for the Rif.

In the Rif, it only frequents rather large streams, therefore it does not occur at high elevation. Probably common, but because of its early flying period seldom noticed.

Flying period. – From the beginning of April (egglaying noticed on 7-IV-1985, loc. 27) to the end of June (21-VI-1983, loc. 6: 22-VI-1984, loc. 33).

Onychogomphus costae Selys, 1885

Loc. 10, 12, 17, 27, 30, 31, 33, 35, 36 (9 contacts). – New for the Rif.

The localities are typically the low altitude oueds, in the southern foothills (Prerif and borders). This species also enters the Rifan zone by some deep warm valleys (oueds Awdour, Awlai, Sra, etc.). It is rather common, but its pattern and colouring make it easy to overlook.

Flying period. – From mid June (15-VI-1983, loc. 27) to August (3-VIII-1984, loc. 36). Mating noticed as early as 22-VI-1984, (loc. 33).

O. forcipatus unguiculatus (Vander Linden, 1823)

Loc. 2, 3, 4, 5, 6, 9, 12, 17, 18, 20, 26, 27, 29 (16 contacts). – Previous records: NAVAS, 1934: "dans le Nord du Maroc"; – DUMONT, 1972: O. Laou (loc. 6), Merja Zerga (loc. 39)

Widespread all over the Rif and common in the preferred biotopes: rapid streams, from the large oueds (Wargha, Awlai, Laou) to small brooks (loc. 9). It reaches 1100 m (loc. 9), but most of the localities are at a moderate elevation (only 2 out of 13 are above 1000 m).

Flying period. – From the end of May (24-V-1983, loc. 26, 27, 29) to August (8-VIII-1985, loc. 2, 6).

O. uncatus (Charpentier, 1840)

Loc. 2, 3, 5, 9, 13, 14, 15, 17 (10 contacts). – Previous records: McLACHLAN, 1889: Ceuta;

– NAVAS, 1934: "Nord du Maroc"; – AGUESSE & PRUJA, 1958a: Fes.

More linked than *forcipatus* to the small, swift and rather fresh rivulets, *uncatus* is localized in the axial and Rifan zones. Many localities are at high altitude (5, out of 8, above 1000 m), the highest is at 1900 m (loc. 15) at a water of less than 10°C (measurement made on 3-VIII-1984). The small brooks of the Mediterranean coast are also frequented by this species.

Flying period. – Later than in *O. forcipatus* (because of the water temperature?), from mid June (21-VI-1983, loc. 9) to August (8-VIII-1985, loc. 2). But AGUESSE & PRUJA give 27--V for their locality near Fes!

Paragomphus genei (Selys, 1841)

Loc. 4, 7, 20, 22, 27, 31. – New for the Rif.

This Ethiopian species is only known to inhabit the southern and western versants of the Rif (lack of data for the eastern part), and only at low altitude (up to 230 m, loc. 31). It appears rather common along streams of medium or great width, with sufficiently warm water. Well camouflaged in its preferred biotopes of sand-banks, gravel and dried grass.

Flying period. – Rather long: from mid-June (20-VI-1984, loc. 20) to the second half of October (21/22-X-1983, loc. 7, 20, 22).

AESHNIDAE

Boyeria irene (Fonscolombe, 1838)

Loc. 2, 3, 13, 15, 38 (9 contacts). – New for the Rif.

Boyeria inhabits small or very small rapidly flowing oueds with pebbles or rocks, sometimes very cool (loc. 15). The altitude ranges from 0 to 1900 m. Loc. 38, somewhat unlike the others, is a sandy brook with abundant vegetation. Crepuscular flight was noticed several times, in especially great numbers on 23--VI-1983 (loc. 2). In daytime, the imagos often rest on tree trunks.

In females, the "long cerci form" seems to prevail (JACQUEMIN, 1985).

Flying period. – From mid June (20-VI-1984, loc. 38), at least so at low altitude near the sea, to the second half of September (19-IX-1983, loc. 3).

Aeshna affinis Vander Linden, 1820

Loc. 5, 9, 10, 13 (5 contacts). – Previous record: DUMONT, 1972: Mdiq (loc. 1).

The localities are temporary (loc. 13), semi-temporary (loc. 5, 9) or permanent pools (loc. 10), situated between 700 and 1200 m, in the Rifan zone. The males untiringly patrol above the breeding sites, even when completely dried up: for instance on 5-VIII-1985, 5 to 10 males were on the wing over a dry forest daya (loc. 13). The 4 localities contrast with Dumont's one, in the littoral.

Flying period. – From mid June (21-VI-1983, loc. 5, 9) to the seçond half of September (19-IX-1983, loc. 5).

A. cyanea (Müller, 1764)

A doubtful report by NAVAS (1934), sub "*Aeshna cyanea* Latr." [sic!], from Ceuta. The presence of this species in northern Morocco is possible, since it has been reported from Algeria (SELYS, 1871; McLACHLAN, 1897; MARTIN, 1910; LACROIX, 1925) and from southern Spain (FERRERAS ROMERO & PUCHOL CABALLERO, 1984), but I failed to find it.

A. isosceles (Müller, 1767)

Loc. 11, 38 (2 contacts). – New for the Rif.

Two very dissimilar localities: a permanent pool at 1250 m (with numerous old individuals on 4-VII) and a coastal marsh (only 2 individuals), both sites rich in high grasses (*Phragmites, Typha, Cladium*, etc.).

Flying period. – Observations made in May (4-V-1985, loc. 38) and July (4-VII-1984, loc. 11); the flying period is therefore very early.

A. mixta Latreille, 1805

Loc. 25. – Previous record: DUMONT, 1972: Mdiq (loc. 1).

Observed in small numbers at loc. 25 from October to December 1983. Egglaying in dried reed stems on 22-X, before rising water levels in the winter. The flying period begins in August, or July in the coastal regions: thus Dumont probably observed immatures on 16-VIII-1971 "chassent en grand nombre au crépuscule le long de la lisière des bois". Uncommon species in the Rif.

Anax imperator Leach, 1815

Loc. 1, 3, 6, 9, 10, 11, 13, 16, 20, 22, 23, 25, 27, 28, 29, 31, 36, 38, 39 (36 contacts). – Previous records: McLACHLAN, 1889: "Esmir" (loc. 1); – NAVAS, 1934: "Benzus" (near Ceuta); – DUMONT, 1972: Mdiq (loc. 1).

Most common and widespread everywhere, from sea-level up to 1370 m (loc. 13). It inhabits both running and stagnant waters, even small oueds, as long as some waterholes remain during the summer. During hot weather it shows crepuscular behaviour (14-VI-1983, loc. 25).

Flying period. – Very long, from the first half of March (10-III-1985, loc. 25) to the end of October (22-X-1983, loc. 20, 22, 25).

A. parthenope Selys, 1839

Loc. 6, 20, 25, 31, 38 (10 contacts). – Previous record: LIEFTINCK, 1966: Restinga (near loc. 1).

Less common than *imperator*, it has never been found at an altitude exceeding 300 m (loc. 6) and frequents, therefore, the Prerif and the coastal zones. It is clearly linked to stagnant waters, especially marshes (loc. 1, 31, 38), although inhabiting also some oueds (loc. 6, 20). Crepuscular flight was noted in hot weather (loc. 25, with *A. imperator*).

Flying period. – Very long: from March (4-III-1984, loc. 25) to October (22-X-1983, loc. 20, 25).

Hemianax ephippiger (Burmeister, 1839)

Loc. 38 (1 contact). – Previous records: KOLBE, 1884: Tanger; – McLACHLAN, 1889: "Esmir" (loc. 1); – DUMONT, 1972: Mdiq (loc. 1).

One female freshly emerged on 19-VI-1984. Both McLachlan and Dumont have made their observations on 16-VII. For further data on this species, see JACQUEMIN & BOUDOT (1986) and JACQUEMIN (1987b).

CORDULEGASTRIDAE

Cordulegaster boltonii algirica Morton, 1915

Loc. 2, 5, 9, 11, 13, 15 (8 contacts). – Previous records: SELYS & HAGEN, 1850: Tanger; – McLACHLAN, 1889: Ceuta, "Benzus" (sub. *immaculifrons*); – NAVAS, 1934: "Nord du Maroc"; – DUMONT, 1972: O. Laou (loc. 6).

Typical inhabitant of rapid and clear rivulets, most often at altitude (loc. 5, 9, 11, 13, 15 ranging from 1000 to 1900 m). It occurs sometimes in the valleys (loc. 6, about 600 m) and also at the sea level on the steep Mediterranean coast (loc. 2, and also Tanger, Ceuta, Benzus). Absent from the Prerif and from the Atlantic coast.

Flying period. – From June (mating on the 21-VI-1983, loc. 9) to August, where it is still common (5/8-VIII-1985, loc. 2, 13, 15). Not seen in September.

CORDULIIDAE

Oxygastra curtisi (Dale, 1834)

Loc. 6. – Previous record: DUMONT, 1972: same locality.

This relic species seems very localized in Morocco. LIEFTINCK (1966) reported an immature female on 15-V-1961 near Rabat, DUMONT (1972) an old male on 18-VII-1971. My observations concern 1 female and several males on 5-VII-1984. They were keeping typically to the quieter parts of the river, where it is little deeper (1 m), with a slow current, and the banks are grassy and shaded by bushes and alders.

Flying period. – It seems to extend from mid May to the end of July, at least.

LIBELLULIDAE

Libellula quadrimaculata Linnaeus, 1758

Loc. 5, 9, 10, 11, 13 (5 contacts).

Contrary to what LIEFTINCK (1966) thought, when he reported this species from the Middle Atlas ("this is the first African record"), a previous observation had already been related by SCHMIDT (1957) from the Rif, "Buhasen". This locality probably is the Jbel Bou Hachim (or Bou Hassim), our loc. 5.

It inhabits some small pools, at the altitudes 700-1250 m, where it occurs in small populations. It seems regular in these preferred places.

Flying period. – From the end of May (25-V-1983, loc. 13) to July (5-VII-1984, loc. 10),

at least.

Orthetrum anceps (Schneider, 1845) [= *ramburi* Selys, 1848; cf. SCHNEIDER, 1985]

Loc. 2, 3, 5, 6, 9, 11, 13, 14, 15, 16, 20, 24, 31, 38 (26 contacts). – Previous records: McLACHLAN, 1889: "Esmir" (loc. 1); – LIEFTINCK, 1966: Tanger; – DUMONT, 1972: Mdiq (loc. 1), O. Laou (loc. 6), Merja Zerga (loc. 39).

This most common species colonizes every kind of running water: brooks and rapid rivers (provided there are some quiet zones), grassy rivulets, large oueds, marshes with slow current, springs with bogs, sloughs, or only sodden meadows. It seems to be unaffected by the altitude. On the northern slopes of the Jbel Tidighine (loc. 15), where it is regular on every forest oozing feeding a little grassy slough, it is met from the sea-level to above 2000 m. It presents the same ecology and the same behaviour as *O. coerulescens* in Europe.

Flying period. – From May (5-V-1984, loc. 24) to the end of September (28-IX-1983, loc. 6).

O. brunneum (Fonscolombe, 1837)

Loc. 20, 34 (2 contacts). – Previous record: DUMONT, 1972: Mdiq (loc. 1).

Two similar localities for this apparently uncommon species. Dumont's locality is quite different.

Flying period. – From May (well coloured individuals on 24-V-1983, loc. 20) to July (2--VII-1984, loc. 34; 17-VII-1971, loc. 1, DUMONT, 1972) at least.

O. cancellatum (Linnaeus, 1758)

Loc. 1, 9, 25 (5 contacts). – New for the Rif.

A stagnicolous species, it generally lives in the lakes (previous records in Morocco from the Middle Atlas lakes and loc. 25), but it occurs also in the lagunar complexes (loc. 1, and also near Rabat). The single male noticed in loc. 9, on a daya, was probably an erratic individual.

This species remains localized in the Rif, where it approaches its southern distribution limit.

Flying period. – Probably rather short: from May (immatures on 27-V-1984, loc. 25) to July (10-VII-1984, loc. 1).

O. chrysostigma (Burmeister, 1839)

Loc. 2, 3, 6, 13, 17, 18, 20, 22, 26, 27, 31, 32, 36, 38 (32 contacts). – Previous records: RIS, 1910: Tanger; – DUMONT, 1972: O. Laou (loc. 6), Merja Zerga (loc. 39).

This common and widespread species avoids high elevation: all localities are under 400 m, except loc. 13 (about 1000 m). Eleven out of 14 sites are on the southern versant, essentially in the Prerif. It slightly penetrates the massif through the large valleys (Wargha, Sra) and inhabits all kinds of streams, as well as marshes with a noticable current (loc. 31, 38).

Flying period. – Very long, from early May (numerous immatures and some coloured males

on 4-V-1985, loc. 38; active mating on 24-V-1983, loc. 20) to October and probably November. Emergences were still abundantly observed at the end of September (25/27-IX-1983, loc. 6, 20, 31).

O. nitidinerve (Selys, 1841)

Loc. 13, 16, 17, 20, 22, 23, 26, 28, 31, 34, 36, 38 (18 contacts). – Previous records: KOLBE, 1884: Tanger; – DUMONT, 1972: O. Laou (loc. 6).

Its distribution is analogous to that of *chrysostigma* (8 localities in common). *O. nitidinerve* also avoids high altitude (loc. 13 is the only one above 400 m), but seems to prefer slower streams: thus the rapid or cool brooks are inhabited only by *O. chrysostigma* (loc. 2, 3, 6), while muddy springs (loc. 16) or oueds reduced to stagnant water holes in summer (loc. 34) harbour only *O. nitidinerve*. To schematize, one can say that *chrysostigma* is linked to streams with a rather strong current and a pebble bed, whereas *nitidinerve* colonizes deeply embanked oueds with high earthy banks, covered with a richer vegetation.

Flying period. – From end May (24-V-1983, loc. 20) to early October (2-X-1983, loc. 22).

O. trinacria (Selys, 1841)

Loc. 25, 38 (7 contacts). – Previous record: McLACHLAN, 1889: "Esmir" (loc. 1).

Very localized Ethiopian species, but particularly abundant at loc. 25. Only a single individual at loc. 38 (erratic ?), but lagunar biotopes are regularly utilised by this species (loc. 1, DUMONT's 1972 locality at Oualidia; Sidi Bou Ghaba, near Rabat, JACQUEMIN, 1987b).

Flying period. – Spreading from May (a well coloured male on 28-V-1984, loc. 25) to the end of October (22-X-1983, loc. 25).

Brachythemis leucosticta (Burmeister, 1839)

Loc. 39 (1 contact). – Previous record: DUMONT, 1972: same locality.

An African species very localized in Morocco (coastal; often in brackish waters, in lagunar complexes).

Flying period. – Noticed in July by DUMONT (1972) and August by the author, but in a neighbouring site (Sidi Bou Ghaba; JACQUEMIN, 1987b) it is on the wing from mid April to the second half of October.

Crocothemis erythraea (Brullé, 1832)

Loc. 1, 3, 6, 9, 11, 19, 20, 22, 24, 25, 31, 32, 36, 38 (33 contacts). – Previous records: NAVAS, 1913: Tanger; – DUMONT, 1972: Mdiq (loc. 1), O. Laou (loc. 6), Merja Zerga (loc. 39), Qsar-el-Kebir, Larache (loc. 38).

An omnipresent species, but rarely very abundant. The strongest populations were met on stagnant waters (loc. 25) or in marshes (loc. 31). Small populations or isolated individuals (erratic ?) occur in all kinds of aquatic sites, even at considerable elevation (e.g. egglaying on 7-VIII-1985 at 1250 m, loc. 11).

Flying period. – Long: from April (7-IV-1985, loc. 31) to October (21/22-X-1983, loc. 20, 22, 25). One often notes two annual generations: for example immature individuals were numerous at loc. 31 on 26-IX-1983.

Diplacodes lefebvrei (Rambur, 1842)

Loc. 19, 38 (3 contacts). – Previous records: McLACHLAN, 1889: "Esmir" (loc. 1); – DUMONT, 1972: Merja Zerga (loc. 39).

An Afro-Asiatic widespread species, in Morocco restricted to the fens overgrown with vegetation (loc. 1, 38, 39, coastal marshes). At loc. 19, an immature was on the wing along a rivulet, near marshy springs.

Flying period. – Probably very long: from mid April (14-IV-1985, loc. 19) to the end of September (very numerous on 22-IX-1984, loc. 38).

Sympetrum meridionale (Selys, 1841)

Loc. 9, 11, 25, 31, 38 (8 contacts). – Previous record: DUMONT, 1972: Mdiq (loc. 1).

It seems to leave its breeding sites immediately after emergence, and returns very late, for a short breeding period (cf. AGUESSE, 1961). Thus, out of 8 contacts: 3 concern larvae or exuviae (sole indication of presence in loc. 35 and 31); – 3 concern fresh immatures; – 1 concerns mature individuals, near the breeding site; – 1 concerns aged individuals, far from the breeding site. So the abundance of this species is probably under-estimated.

Flying period. – Emergence dates ranging, according to the altitude (0-1250 m), from June (15-VI-1983, loc. 25) to July (4-VII-1984, loc. 11). Oviposition observed on 18-IX-1983 (loc. 9). The adults probably survive until October.

S. sanguineum (Müller, 1764)

Loc. 5, 9, 11, 13 (8 contacts). – New for Morocco.

Its discovery in the Rif is not really a surprise, since it is known in southern Spain (FERRERAS ROMERO & PUCHOL CABALLERO, 1984) and in Algeria (SELYS, 1871; McLACHLAN, 1897; MARTIN, 1910; LACROIX, 1925). Fair populations exist in several dayas in the Rifan zone (1100-1250 m approx.). Some dayas are permanent (loc. 11, 13), the others remaining only damp in summer. The neighbouring brooks are especially frequented at the end of summer, mostly so by the females.

Flying period. – From June (very numerous emergences on 21-VI-1983, loc. 9) to the end of September (27-IX-1983, loc. 13), but certainly also later. Oviposition observed in bottom of wet hollows on 18-IX-1983 (loc. 9) and 22-IX-1984 (loc. 5).

S. striolatum (Charpentier, 1840)

Loc. 5, 6, 9, 10, 11, 13, 24, 25, 31, 38 (27 contacts). – Previous record: DUMONT, 1972: Mdiq (loc. 1).

Common and widespread, particularly in stagnant or slightly running waters, regular in marshes (loc. 1, 24, 31, 38), it is scarcer along the oueds (loc. 6).

Flying period. – *S. striolatum* can be encountered throughout the year. But, for example reproductive individuals on 4-III-1985 (loc. 25) were all very old, with an abundant whitish pruinosity. Emergences have been observed in May at low altitude (4-V-1985, loc. 38; 27-V-1984, loc. 25) and till July in the mountains (4/5-VII-1984, loc. 10, 11). Presumably there is a single annual generation, but it is widely spread out: emergences probably start in early May on the Atlantic coast, are at a

maximum in May and June, then end at the beginning of July at high altitude. Adults must live very long, even surviving the winter at low altitude. Reproduction was noticed in September (23-IX-1984, loc. 5). December (22/23-XII-1984, loc. 25, 38) and March (10-III-1985, loc. 25).

S. (=Tarnetrum) fonscolombii (Selys, 1840)

Loc. 1, 2, 9, 10, 12, 13, 20, 25, 27, 29, 30, 31, 36, 37, 38, 39 (23 contacts). – Previous records: RIS, 1911: Tanger; – DUMONT, 1972: Mdiq (loc. 1), oued Laou (loc. 6), Merja Zerga (loc. 39), Qsar-el-Kebir, Larache (loc. 38).

Very common and widespread, except at high altitude (only 2 loc. above 1000 m), inhabits both running and standing waters in the coastal areas and in the valleys.

Flying period. – Very long: it commences in March (copulation on 7-III-1985, loc. 25) and continues till October (22-X-1983, loc. 25), November on the coast (breeding activities on 19-XI-1983, loc. 39). See JACQUEMIN (1987b) for information on the number of annual generations.

Trithemis annulata (Palisot de Beauvois, 1805)

Loc. 2, 3, 4, 6, 7, 8, 12, 17, 18, 20, 21, 22, 25, 26, 27, 33, 36, 38 (36 contacts). – New for the Rif.

Previously unrecorded from northern Morocco (JACQUEMIN, 1984), this is one of the most common dragonflies in the Rif, widespread everywhere up to 500 m (loc. 18). It occurs in the Prerif, and in the valleys and coastal regions, including the Mediterranean littoral (loc. 2), almost exclusively on running waters; loc. 25, with a strong population, is a noticeable exception. The present abundance of this species, which was never reported before from northern Morocco, suggests a spread to the North, that would be confirmed by its numerous recent records in the Iberian Peninsula.

Flying period. – From May (5-V-1984, loc. 27) to October (22-X-1983, loc. 6, 7, 25), and probably later. Emergences in September (17-IX-1983, loc. 25) and October (immatures on 22-X-1983, loc. 25). Some observations suggest 2 annual generations. At loc. 25, for example, massive emergences were evidenced at the beginning of June 1983, and oviposition as early as 15-VI-1983; the numerous emergences observed in September and October probably result from these egglayings.

T. kirbyi ardens Gerstäcker, 1891

Loc. 2, 7, 12, 27 (6 contacts). – New for the Rif.

Never seen before N of the Atlas, this species is not very rare in the Rif, although localized. It inhabits rather rapid oueds, with a bed of rocks, pebbles or coarse sand banks. Surprisingly, the most abundant population lives on the Mediterranean littoral (loc. 2). The other localities have yielded only a few individuals, or only a single one.

Flying period. – Extreme dates on 20-VI-1984 (loc. 27) and 22-X-1983 (loc. 7). An immature on 28-IX-1983 (loc. 12).

Zygonyx torrida (Kirby, 1889)

A single record by DUMONT, 1972: oued Laou (loc. 6), 18-VII-1971.

DISCUSSION

This study does not reveal any spectacular discoveries, and *Calopteryx virgo* ssp. and *Sympetrum sanguineum* are among the expected additions to the fauna of Morocco. On the other hand, 15 more species are added to the hitherto inadequately explored fauna of the Rif. It is also possible that in the future some other species, such as e.g. *Lestes sponsa, Brachytron pratense, Libellula depressa* and *L. fulva* (all known from Andalusia), or *Lestes macrostigma* and *Aeshna cyanea* (for which only doubtful records are available) will still be discovered in Morocco. The 1982-1985 period was rather dry and, above all, it was preceded by a severe drought in the early 1980s. In the region anyway poor in aquatic biotopes, this triggered an appreciable reduction of the number of odonate breeding sites, particularly so in stagnant waters. Consequently, the eastern part of the Rif, poorly explored and very arid, could also reveal in the future some southern or oriental species (cf. the presence of *Ischnura fountainei* and *I. saharensis* in the Za-Moulouya basin; JACQUEMIN, 1991).

Figure 2 gives a comparison between the odonate faunas of the Rif and Andalusia, arranged according to ST. QUENTIN (1960), with some slight modifications. There is, thus, some evidence that:

(1) The Rifan fauna is less rich.
(2) The Eurosiberian species are, as expected, more numerous in Andalusia.
(3) The African species are, also expectedly, more numerous in the Rif.

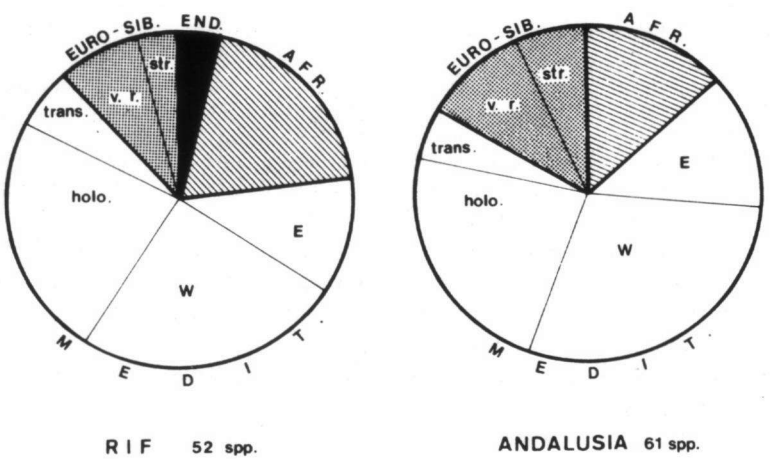

Fig. 2. Comparison between the Odonata faunas of the Rif and of Andalusia. – [Abreviations: AFR. = African spp.; – END. = endemic spp., – EURO-SIB. = Euro-Siberian spp. (str. = strict, – v.r. = vast repartition); – MEDIT. = Mediterranean spp. (trans. = transition group, – holo. = holomediterranean spp., – W. = Western spp., – E. = Eastern spp.)].

(4) The importance of the Mediterranean species is similar in both regions, but:
- they are proportionally more numerous in Andalusia;
- the West-mediterranean species are particularly well represented in Andalusia, Iberian Peninsula being their true dispersal centre;
- the East-mediterranean species are also more numerous in Andalusia, showing that the Iberian Peninsula is less isolated from the Eastern Mediterranean Basin than the Rif.

(5) There is a North African endemism in the Rif, which emphasizes its comparative biogeographic isolation.

Thus, the odonate fauna of the Rif allows confirmation of two well recognized features of this African region, viz. its relationship with the Mediterranean area, and its comparative biogeographic isolation. The "Africanism" of the Rif is all the less marked as 8 of the 10 African species of its fauna are also reported from Andalusia (the 2 remaining are *P. sublacteum* and *T. kirbyi*). Does this fact relate to a range extension to the North, helped by climatic changes? Simultaneously, certain Eurosiberian species could show a withdrawal northwards (*Aeshna cyanea*).

An interesting group of species includes *Gomphus graslinii*, *Macromia splendens* and *Oxygastra curtisi*. Several authors agree that these are preglacial relics, which have outlived the glaciations in the Iberian Peninsula and then expanded their range in southwestern Europe. Their distribution remains very restricted. The presence of *O. curtisi* in the Rif once again emphasizes its links with southwestern Europe.

As to the biology of the different species, two main modes of emergence strategy can be discerned, viz.

(1) The "temperate" type, where the insects present good emergence synchronization, and therefore a rather short flying period, although the good season is very long in Morocco. Sometimes there are two generations, but each evolves in synchronous manner; immatures are numerous at the beginning, but very rare at the end of the flying period.

(2) The "tropical" type, where the flying period is often extended for more than 6 months, i.e. as long as the climatic conditions allow it. No synchronization is clearly visible, the population permanently includes a certain percentage of teneral individuals.

The two modes co-occur in many biotopes, and represent a fascinating subject for the forthcoming studies.

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