

Contribution to the knowledge of the spring butterfly fauna of the southern Anti-Atlas region, Morocco (Lepidoptera: Papilionoidea)

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Abstract

Data from eight butterfly surveys, mostly within the last 10 years, were combined to improve the knowledge of the distribution of butterflies in the Anti-Atlas region of Morocco. The records from 40 localities are presented and discussed. A total of 54 species were observed, closely matching the known butterfly fauna of the region. Interesting records for the following species are discussed in detail: *Papilio saharae*, *Zerynthia rumina*, *Euchloe falloui*, *Colotis chrysonome*, *Colotis liagore*, *Callophrys avis*, *Cigaritis allardi*, *Tarucus rosaceus*, *Azonus ubaldus*, *Plebejus allardi*, *Melitaea deserticola*, and *Spialia doris*. Of these *Colotis liagore* is recorded for the first time for Morocco, and two eremic species known only from a few localities are shown to be possible residents in the lower Draa Valley in the Assa region: *Colotis chrysonome* and *Azonus ubaldus*. Although we add valuable new information on the distribution of butterflies in Morocco more systematic research would probably yield many additional interesting records.

KEY WORDS: Lepidoptera, Papilionoidea, distribution, Morocco.

Contribución al conocimiento de la fauna de mariposas primaverales del sur de la región Anti-Atlas, Marruecos (Lepidoptera: Papilionoidea)

Resumen

Los datos de ocho muestreos de mariposas realizados durante los 10 últimos años se combinaron para aumentar el conocimiento de las mariposas de la región del Anti-Atlas de Marruecos. Se presentan y discuten los registros de 40 localidades. Se observaron un total de 54 especies, lo que se ajusta a la fauna de mariposas conocida de la zona. Las citas interesantes de las siguientes especies se discuten con detalle: *Papilio saharae*, *Zerynthia rumina*, *Euchloe falloui*, *Colotis chrysonome*, *Colotis liagore*, *Callophrys avis*, *Cigaritis allardi*, *Tarucus rosaceus*, *Azonus ubaldus*, *Plebejus allardi*, *Melitaea deserticola* y *Spialia doris*. Entre estas, *Colotis liagore* se cita por primera en Marruecos, y dos especies erémicas, conocidas sólo de unas pocas localidades, se muestran como posibles residentes del bajo Valle de Draa en la región de Assa: *Colotis chrysonome* y *Azonus ubaldus*. A pesar de que añadimos una valiosa nueva información sobre la distribución de las mariposas de Marruecos, constatamos que estudios más exhaustivos podrían proporcionar interesantes registros adicionales.

PALABRAS CLAVE: Lepidoptera, Papilionoidea, distribución, Marruecos.

Introduction

Owing to diverse topography, geology, different climatic zones and most importantly the presence of high mountains, Morocco has the most diverse butterfly fauna in the Maghreb region with a total of 136 species recorded (combined from TENNENT, 1996; TARRIER & DELACRE, 2008). The bulk of the diversity is limited to the high mountains, particularly in the Rif and Middle Atlas in the north,

which receive more precipitation and have many faunistic similarities with the nearby Iberian Peninsula. Further south, the fauna of the Anti Atlas is somewhat impoverished, but still includes several Mediterranean elements, especially at higher altitudes (TARRIER, 1996; TARRIER, 1997; TARRIER & DELACRE, 2008).

Based on exhaustive studies of Michel TARRIER one could conclude that the fauna of butterflies of Morocco, and the Anti Atlas in particular, is well studied apart from the skippers which were entirely neglected in his voluminous work. However, little precise faunistic information has been published on the butterflies of the Anti Atlas so far (DE PRINS *et al.*, 1984; BOZANO & GIACOMAZZO, 1988; MÉRIT, 2014) or only vague descriptions of the localities are provided (e.g. TARRIER, 1995, 2000, 2011). In order to fill this gap we give detailed information on the distribution of the butterflies, including skippers, in the Anti-Atlas region gathered during recent surveys. The more important finds, including one new record for the country, are discussed in detail.

Material and methods

In the last 10 years eight independent visits by the three authors were made to the southern Anti-Atlas and its surroundings in order to study the butterfly fauna. The region was first visited by MR as early as 2001. The selection of sites and areas with potentially important butterfly habitat for the more recent studies was made before the trips with the aid of Google Earth images. Adult butterflies were either netted using entomological nets and released after identification, or identified in nature without capture.

List of localities

The list of localities contains the relevant toponyms, altitude, coordinates, a short description of the habitat, and dates of the visits. The numbered localities are shown on the map (Fig. 3) and referred to in the results section for each species recorded.

1. Taroudant, Tioute, within the village oasis, 440 m, 30° 23' 39.21"N, 8° 41' 57.72"W, oasis with mosaic of small fields and bushy hedges, 3-IV-2013
2. Ouzzoun, Tiferki, along the road from Taliouline to Igherm, 1300 m, 30° 13' 30"N, 8° 16' 29"W, dry, bushy slopes, small gullies, 14-IV-2011
3. Igherm, high plateau on the road 7037 about 2 km east of Adar village, 1810 m, 30° 7' 41.82"N, 8° 21' 4.00"W, rocky pasture, 10-IV-2009, 14-IV-2011
4. Tata, Taangoumte, road verge in oasis at the SE edge of the village, 1200 m, 30° 1' 12.73"N, 8° 18' 22.52"W, rocky road side, sandy meadows, 18-III-2015
5. Igherm, small valley on the road 7037 about 4 km northeast of Igherm, 1840 m, 30° 6' 29.10"N, 8° 26' 6.84"W, woody gully with dry grasslands, 10-IV-2009
6. Igherm, along the road 7038 about 6 km west of the town, 1750 m, 30° 4' 35.76"N, 8° 31' 9.96"W, dry grasslands, abandoned arable land, orchards, 10-IV-2009
7. Tafraoute, Amzawr, in a small valley NE of the village, 1580 m, 29° 49' 53.48"N, 8° 44' 32.26"W, rocky meadows, flowery banks of a dry river, 14-IV-2011, 17-III-2015
8. Tafraoute, Imi n' Guerdane, side valley at the village, north of Ait-Abdallah, 1500 m, 29° 50' 11.94"N, 8° 45' 59.14"W, rocky slopes, small meadows, 10-IV-2009, 17-III-2015
9. Tafraoute, Azgour, dry riverbed and slopes W of the main road SW of the village, 1530 m, 29° 46' 13.07"N, 8° 47' 16.79"W, rocky meadows and slopes, dry riverbed, 15-III-2001, 16-III-2001, 1-IV-2013, 6-IV-2013, 17-III-2015, 25-III-2017
10. Tafraoute, Touli, small lateral valleys N of the main road above the village, 1620 m, 29° 45' 17.81"N, 8° 47' 17.05"W, rocky meadows and slopes, dry riverbed, 25-III-2017

11. Tafraoute, Titke, small valley N of the village, 1530 m, 29° 45' 2.07"N, 8° 48' 54.17"W, rocky slopes, dry gully, 1-IV-2013, 6-IV-2013
12. Tafraoute, Tizi' N Tarakatin, in the valley NW of the village, 1360 m, 29° 46' 56.95"N, 8° 51' 59.34"W, dry river bed, 14-IV-2011, 6-IV-2013, 25-III-2017
13. Tafraoute, SW side of the pass on the route 7056 before Tanalt, 1710 m, 29° 48' 12.65"N, 9° 5' 2.83"W, shrubby meadows with dwarf bushes, 8-IV-2009, 17-III-2015
14. Tafraoute, Ait Yiftan, in a small valley at the village, 1490 m, 29° 48' 54.35"N, 9° 2' 30.42"W, grassy meadows and orchards, 6-IV-2013
15. Tafraoute, north of Djebel Lekst on the road 7056 around the waterfall visible below the road, 1380 m, 29° 50' 6.58"N, 9° 1' 28.65"W, cultivated meadows, bushes, roadside, 8-IV-2009
16. Tafraoute, Ida Ougnidif, S facing slopes above the road SW of the town, 1380 m, 29° 50' 29.86"N, 9° 1' 30.20"W, bushy and rocky slopes, 6-IV-2013, 17-III-2015
17. Tafraoute, narrow valley few km before Ait-Iftene on the route 7056 from Ida-ou-Gnidif, 1290 m, 29° 50' 42.36"N, 9° 0' 40.26"W, abandoned meadows, rocky slopes, 8-IV-2009
18. Tafraoute, Tiguissas, along sideroad at the bridge N of the village, 1160 m, 29° 52' 28.17"N, 9° 0' 36.60"W, ruderal area, road verge, 17-III-2015
19. Tafraoute, Imhiln, slopes above main road NW of the village, 1300 m, 29° 55' 35.40"N, 9° 0' 32.52"W, dry grassy rocky slopes, 15-III-2001
20. Tafraoute, small hill almost encircled by the road on the route 105 some 30 km SE of Ait-Baha, 1200 m, 29° 58' 9.15"N, 9° 1' 10.82"W, dry grassland on sandy ground, 8-IV-2009
21. Ait Baha, Azour'n'Ali, at the turn for the village, 960 m, 30° 1' 36.61"N, 9° 2' 40.14"W, grassy meadows in dry hills, 1-IV-2013
22. Ait Baha, Tlata Uoanass, in the small side valley near the reservoir, 620 m, 30° 3' 45.41"N, 9° 6' 51.89"W, grasses in dry hills, 15-III-2001
23. Ait Baha, Targua N'Touchka, oasis and the E side valley, 450 m, 29° 52' 39.52"N, 9° 11' 26.08"W, arable land, bushes, gravels, 26-II-2012
24. Ait Baha, Ait Bibi, the pastures along the river NE of the village, 190 m, 29° 51' 47.03"N, 9° 17' 20.08"W, pastures, dry grasslands, arable land, 26-II-2012
25. Tafraoute, small valley 5 km south of Agard Oudad, at the beginning of the road to Ait-Mansour, 1190 m, 29° 39' 32.31"N, 8° 57' 26.01"W, dry river bed, rocky slopes, 9-IV-2009
26. Tafraoute, north side of the pass north of Tlatat Tasirt town, 1540 m, 29° 37' 56.88"N, 8° 56' 31.95"W, pastures, rocky slopes, 9-IV-2009, 23-III-2017
27. Tafraoute, Taghaout, in the gorge SE of the village, 1430 m, 29° 36' 21.19"N, 8° 50' 51.77"W, small gorge, rocky slopes and meadows, 16-III-2015, 23-III-2017
28. Tafraoute, first part of the gorge at the settlement Ait-Mansour, 1260 m, 29° 32' 54.58"N, 8° 52' 45.26"W, dry rocky slopes, meadows in the palmery, 9-IV-2009
29. Tafraoute, Ida Ouaassam, along small track on N facing slopes of the mountain N of the village, 1450 m, 29° 31' 49.00"N, 9° 6' 6.30"W, rocky and bushy slopes, 16-III-2015
30. Tafraoute, Col du Kerdous, on the ridge S of the hotel, 1250 m, 29° 32' 45.72"N, 9° 20' 21.04"W, rocky slopes with sparse vegetation, 16-III-2015
31. Tafraoute, Col du Kerdous, along the road down from the pass on N slopes, 1050 m, 29° 32' 50.51"N, 9° 21' 25.88"W, pine plantation, rocky slopes, terraces with cultivations, 16-III-2015
32. Tiznit, Sidi Ahmed Ou Moussa, dry river NE of the town, 450 m, 29° 32' 23.38"N, 9° 26' 49.09"W, olive trees plantation with artificial irrigation, 20-III-2016
33. Tiznit, Mirght, pastures north of the village, 830 m, 29° 24' 17.54"N, 9° 43' 18.81"W, small wadi with sparse almond trees, 20-III-2016
34. Tiznit, Mirght, slopes above the road to Guelmin SW of the village, 910 m, 29° 24.545'N, 9° 43.574'W, rocky and bushy slopes dominated by *Euphorbia*, 14-III-2015
35. Assa, Targoumait, along the road to Assa 15 km SE of the town, 500 m, 28° 46' 32.27"N, 9° 27' 29.84"W, rocky and sandy plane with solitary *Acacia* trees, 15-III-2015

36. Assa, edge of dry riverbed at SW edge of the town, 310 m, 28° 36' 8.02"N, 9° 26' 39.99"W, *Acacia* trees and bushes on dry rocky slope, 15-III-2015, 24-III-2017
37. Assa, in the oasis at the town centre, 300 m, 28° 36' 19.93"N, 9° 25' 40.04"W, abandoned meadows, dry riverbed, 15-III-2015
38. Assa, small wadi at the turn for Tuisgui Remz Jdid from the road to Zag, 290 m, 28° 26' 46.37"N, 9° 21' 56.33"W, dry riverbed with *Acacia* trees, 15-III-2015, 21-III-2016, 24-III-2017
39. Assa, Tistguezzemt, oasis at the dam in the village, 230 m, 28° 24' 53.86"N, 9° 13' 1.21"W, bushy road verges, rocky slopes, ruderal areas, 15-III-2015, 24-III-2017
40. Assa, large wadi south of Ouarkiz Mts. Along the road to Zag, 250 m, 28° 22' 45.31"N, 9° 23' 11.52"W, bushy and sandy area with *Acacia*, 15-III-2015

Results

Table 1.– The distribution of butterflies and skippers in the southern Anti-Atlas, Morocco. The numbering of localities corresponds to the list of localities in Materials and Methods section.

Species	Localities
PAPILIONIDAE	
<i>Papilio saharae</i> Oberthür, 1879	30
<i>Iphiclides feisthamelii</i> (Duponchel, 1832)	3, 5, 9, 10, 17, 19, 29
<i>Zerynthia rumina</i> (Linnaeus, 1758)	1
PIERIDAE	
<i>Pieris brassicae</i> (Linnaeus, 1758)	15, 25, 28, 37
<i>Pieris rapae</i> (Linnaeus, 1758)	1, 3, 4, 5, 6, 8, 9, 11, 12, 14, 15, 16, 17, 20, 21, 23, 24, 25, 26, 27, 28, 32, 35, 37
<i>Pontia daplidice</i> (Linnaeus, 1758)	1, 3, 4, 5, 6, 7, 8, 9, 11, 13, 15, 16, 17, 18, 20, 23, 25, 26, 27, 28, 29, 30, 31, 33, 35, 36, 38, 39, 40
<i>Anthocharis belia</i> (Linnaeus, 1767)	1, 9, 12, 14, 15, 16, 17, 21, 23, 24, 25, 26, 27, 28, 29, 31
<i>Euchloe belemia</i> (Esper, 1800)	3, 12, 22, 29, 31, 32, 39
<i>Euchloe charlonia</i> (Donzel, 1842)	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 19, 20, 22, 25, 26, 27, 29, 30, 31, 33, 34, 35, 36, 38, 39, 40
<i>Euchloe crameri</i> Butler, 1869	3, 4, 6, 9, 12, 14, 16, 17, 20, 25, 26, 27, 28, 29, 30, 35, 38, 39, 40
<i>Euchloe falloui</i> (Allard, 1867)	6, 7, 8, 9, 35, 39
<i>Gonepteryx cleopatra</i> (Linnaeus, 1767)	5, 12, 14, 15, 16, 17, 23, 24
<i>Colias croceus</i> (Geoffroy, 1785)	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 38
<i>Colotis chrysonome</i> (Klug, 1829)	38
<i>Colotis evagore</i> (Klug, 1829)	4, 8, 10, 11, 27, 28, 38, 39
<i>Colotis liagore</i> (Klug, 1829)	38
LYCAENIDAE	
<i>Callophrys avis</i> Chapman, 1909	12
<i>Callophrys rubi</i> (Linnaeus, 1758)	5, 9, 31
<i>Cigaritis allardi</i> Oberthür, 1909	16, 34
<i>Tomares ballus</i> (Fabricius, 1787)	3, 9, 11, 13, 16, 19, 21, 22, 26,
<i>Tomares mauretanicus</i> (Lucas, 1849)	8, 9, 12, 19, 21, 27, 34
<i>Lycaena phlaeas</i> (Linnaeus, 1761)	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 21, 23, 25, 27, 28, 29, 31, 32, 34, 39, 40

<i>Lycaena phoebus</i> (Blachier, 1905)	3, 5, 12, 14, 17, 18
<i>Lampides boeticus</i> (Linnaeus, 1767)	5, 16, 27, 31, 32, 36
<i>Leptotes pirthous</i> (Linnaeus, 1767)	1, 6, 12, 15, 16, 26
<i>Tarucus rosaceus</i> (Austaut, 1885)	7, 12, 32, 36, 38, 39, 40
<i>Tarucus theophrastus</i> (Fabricius, 1793)	2, 3, 7, 12
<i>Zizeeria knysna</i> (Trimen, 1862)	23, 24, 32
<i>Azonus jesus</i> (Stoll, 1782)	38
<i>Azonus ubaldus</i> (Guérin-Méneville, 1849)	36, 38
<i>Cupido lorquini</i> (Herrich-Schäffer, 1850)	13, 14, 15, 16
<i>Pseudophilotes abencerragus</i> (Pierret, 1837)	7, 8, 9, 10, 11, 16, 19, 23, 25, 27, 28, 29, 30, 34
<i>Glaucopsyche melanops</i> (Boisduval, 1828)	5, 6
<i>Aricia cramera</i> (Eschscholtz, 1821)	2, 5, 18, 25, 27
<i>Plebejus allardi</i> (Oberthür, 1874)	3, 6, 7, 8, 9
<i>Polyommatus celina</i> (Austaut, 1879)	5, 6, 8, 9, 12, 14, 15, 16, 17, 23, 25, 26, 33
<i>Polyommatus punctifera</i> (Oberthür, 1876)	3, 5, 6, 7, 9, 10, 14, 26
NYMPHALIDAE	
<i>Danaus chrysippus</i> (Linnaeus, 1758)	4, 35, 36, 37, 38, 39
<i>Vanessa atalanta</i> (Linnaeus, 1758)	15, 20, 23, 27, 30, 37
<i>Vanessa cardui</i> (Linnaeus, 1758)	1, 3, 4, 5, 6, 7, 8, 9, 13, 15, 16, 17, 19, 20, 22, 25, 26, 27, 28, 29, 30, 31, 34, 35, 37, 38, 39, 40
<i>Melitaea deserticola</i> Oberthür, 1876	4, 7, 9, 11, 27, 28
<i>Melitaea didyma</i> (Esper, 1778)	3, 8, 9, 17, 19, 27, 29, 30, 32
<i>Melitaea punica</i> Oberthür, 1876	2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 15, 17, 25, 26, 27, 30
<i>Pararge aegeria</i> (Linnaeus, 1758)	1, 23, 28
<i>Lasiommata megera</i> (Linnaeus, 1767)	1, 5, 7, 16, 20, 26, 29, 30, 31
<i>Melanargia ines</i> (Hoffmansegg, 1804)	8, 12, 20, 31
HESPERIIDAE	
<i>Carcharodus stauderi</i> Reverdin 1913	16
<i>Carcharodus tripolinus</i> (Verity, 1925)	3, 7, 9, 11, 12, 14, 15, 19, 25, 26, 27, 28, 33
<i>Gegenes pumilio</i> (Hoffmansegg, 1804)	36
<i>Pyrgus onopordi</i> (Rambur, 1839)	3
<i>Spialia ali</i> Oberthür, 1881	7, 9, 10, 11, 12, 15, 23, 25, 26, 30
<i>Spialia doris</i> (Walker 1870)	2, 3, 4, 9, 10, 11, 38, 40
<i>Thymelicus hamza</i> (Oberthür, 1876)	7, 12
<i>Thymelicus lineola</i> (Ochsenheimer, 1808)	16

Discussion

A total of 54 species were encountered during our surveys representing roughly 40% of the fauna of Morocco. The number of observed species exactly matches the number of species listed for Anti-Atlas (excluding Djebel Sioura) by TARRIER & DELACRE (2008), however the skippers are not included in their list. Given the fact that our visits were limited to March and April, thus excluding most of the late flying satyrids, the number of encountered species could be considered exceptionally high.

Among the most common and widespread species encountered during our surveys are habitat generalists like *Pieris rapae*, *Pontia daplidice*, *Euchloe charlonia*, *Euchloe crameri*, and *Lycaena phlaeas* which thrive in cultivated landscapes. *Vanessa cardui* was common and widespread only in years with abundant precipitation (like in 2009) when the region becomes an important source area for its migration to Europe (STEFANESCU *et al.*, 2011). On the other hand, several rare species were observed and these are briefly discussed below:

- *Papilio saharae* (Fig. 7).- This is a known eremic species limited to arid regions at the northern edge of the Sahara and western part of the Arabian Peninsula (PITTAWAY *et al.*, 1994). Two specimens were observed along a ridge south of the Col du Kerdous in mid March, so well outside the flight period of the more widespread sister species *P. machaon* (TARRIER & DELACRE, 2008). One of the specimens was already extremely worn indicating its possible emergence as early as February.
- *Zerynthia rumina*.- According to TARRIER & DELACRE (2008) the species is widespread in Djebel Lekst area near Tafraoute, but we were unable to find any despite targeted searching. Our only observation is from the Tiouite village oasis just south of the Souss Valley.
- *Euchloe falloui* (Fig. 4).- Another eremic species limited to desert regions of North Africa and Arabian Peninsula (TENNENT, 1996). Although considered rare in Morocco, the species was widespread and common in 2015 following the rainy winter in the Anti-Atlas, in some places outnumbering the similar and more widespread *E. belemia*. A similar phenomenon was also observed by Tennent in 1994 (TENNENT, 1996). Our records are from Assa region in the south and at much higher altitudes to the east of Tafraoute and Igherm.
- *Colotis chrysonome* (Fig. 6).- There is very limited information available on the distribution of this conspicuous pierid in Morocco where it is considered migratory (TENNENT, 1996). TARRIER's record from the north-eastern Anti-Atlas at Tazenakht falls into that category, as it is beyond the range of the species host plant *Maerua crassifolia* (Capparidaceae). According to RUNGS (1972) the species was found in lower Draa Valley near Auinet Torkoz north-west of Tan Tan. Based on available cartography this town is however much further upstream near Assa giving us a hint to visit this region in search for the species. We found both the host plant and adults in a small wadi south of Assa (Fig. 8) on the road to Zag. Four fresh males were observed in mid March 2015 and in March 2016 the species was again seen in some numbers at the same site. This indicates that the species is resident in this region or at least forms temporary colonies.
- *Colotis liagore*.- Published here for the first time for Morocco and only previously known from the southernmost part of Algeria in the Maghreb (TENNENT, 1996). It shares its host plant with the previous species, therefore its presence in the Assa region could be anticipated. The two specimens observed at the site south of Assa in 2016 were however still a big surprise. They were syntopic with *C. chrysonome*. Given the presence of its host plant, it is possible that it builds temporary colonies in this part of Morocco, however further surveys are needed to confirm its continuous presence so far north. It must be noted that in 2010 the species was photographed on the road between Dhakla and Aoussard much further south in the West Sahara territory (Raoul Beunen, pers. comm.), this being the first record of the species for the country.
- *Callophrys avis*.- This typical west Mediterranean species has so far not been mentioned from the southern Anti-Atlas (TARRIER & DELACRE, 2008). Here we publish records from the region for the first time: the earliest was by Stefano Bossi in 2005 (Bossi, pers. comm.) and we confirmed its presence at Tizi' N Tarakatin by finding two specimens in a dry wadi north-west of the village in March 2017.
- *Cigaritis allardi*.- This attractive lycaenid has very restricted colonies and is therefore easily overlooked and probably under-recorded. We found it at two sites on very different biotopes. The site near Djebel Lekst the habitat corresponds well with the description by TENNENT (1996) - steep rocky slopes covered by bushes, whereas the site at Miright represents a pasture heavily overgrown with cactus like *Euphorbia* sp. and thorny brooms (possibly *Genista* sp.), which could be the host plant of the species.
- *Tarucus rosaceus*.- In contrast to the scattered records for this species indicated in TARRIER & Delacre (2008) it proved to be much more common in the south. We found it both at higher altitudes near Tafraoute where it is sympatric with *T. theophrasuts* and near Assa where it is the only species of the genus present.
- *Azanus ubaldus*.- Despite its widespread occurrence in dry tropical regions of Africa and Asia including neighbouring regions (TENNENT, 1996) the species has only recently been confirmed

for Morocco (WEISS, 2000), quite unexpectedly for the northern Atlantic coastal region. The species was common on the outskirts of Assa at the edge of a dry wadi during visits in 2015, 2016, and 2017. A copula was observed also in a small wadi south of Assa en route to Zag in 2015. Given the abundance of the acacia trees the species is most probably a permanent resident in the region.

- *Plebejus allardi* (Fig. 5).- First reported for Anti-Atlas by BOZANO & GIACOMAZZO (1988) and then raised to a specific rank (*P. antiatlasicus*) by TARRIER (1995). Regardless of its status, the taxon has a very restricted range limited to the southern Anti-Atlas Mountains. We found the species at several sites east of Tafraoute and east of Igherm always in the presence of its larval host plant *Astragalus caprinus* L. which is usually detected before the butterfly. The reported flight period of the species is from April to May (TARRIER & DELACRE, 2008), however we found the species regularly in mid-March, in some cases even worn specimens.
- *Melitaea deserticola* (Fig. 1).- Due to its similarity to the more widespread *M. didyma* its distribution in Morocco is poorly understood. Although our findings are congruent regarding distribution patterns of both species, *M. deserticola* was not rare and was observed syntopic with *M. didyma* at two sites near Azgour and Taghaout, both east of Tafraoute.
- *Spialia doris* (Fig. 2).- This is another eremic species. It has a restricted and fragmented distribution in northern Africa, where it is known only from southwestern Morocco and Egypt. We found the species at several dispersed sites in the southern Anti-Atlas at elevations between 1200 and 1600 m. Interestingly we also found it further south at Assa along the road to Zag in much more arid semidesert environments. It is very likely that the species is also present in similar habitats in nearby Algeria from where it has not been recorded.

The butterfly data coverage for the southern Anti-Atlas, and in Morocco in general, is still insufficient and there are many regions with very limited or no butterfly records. A more systematic approach is needed with future surveys targeted at covering at least some of the unstudied areas. Although the grazing pressure is less intense in Anti-Atlas compared to the Middle and parts of the High Atlas (authors, pers. observ.), negative impacts of overgrazing are evident especially around villages and areas with easy access. As butterflies are very sensitive to such anthropogenic pressure (Numa et al. 2016) our data will be of great value for future comparisons.

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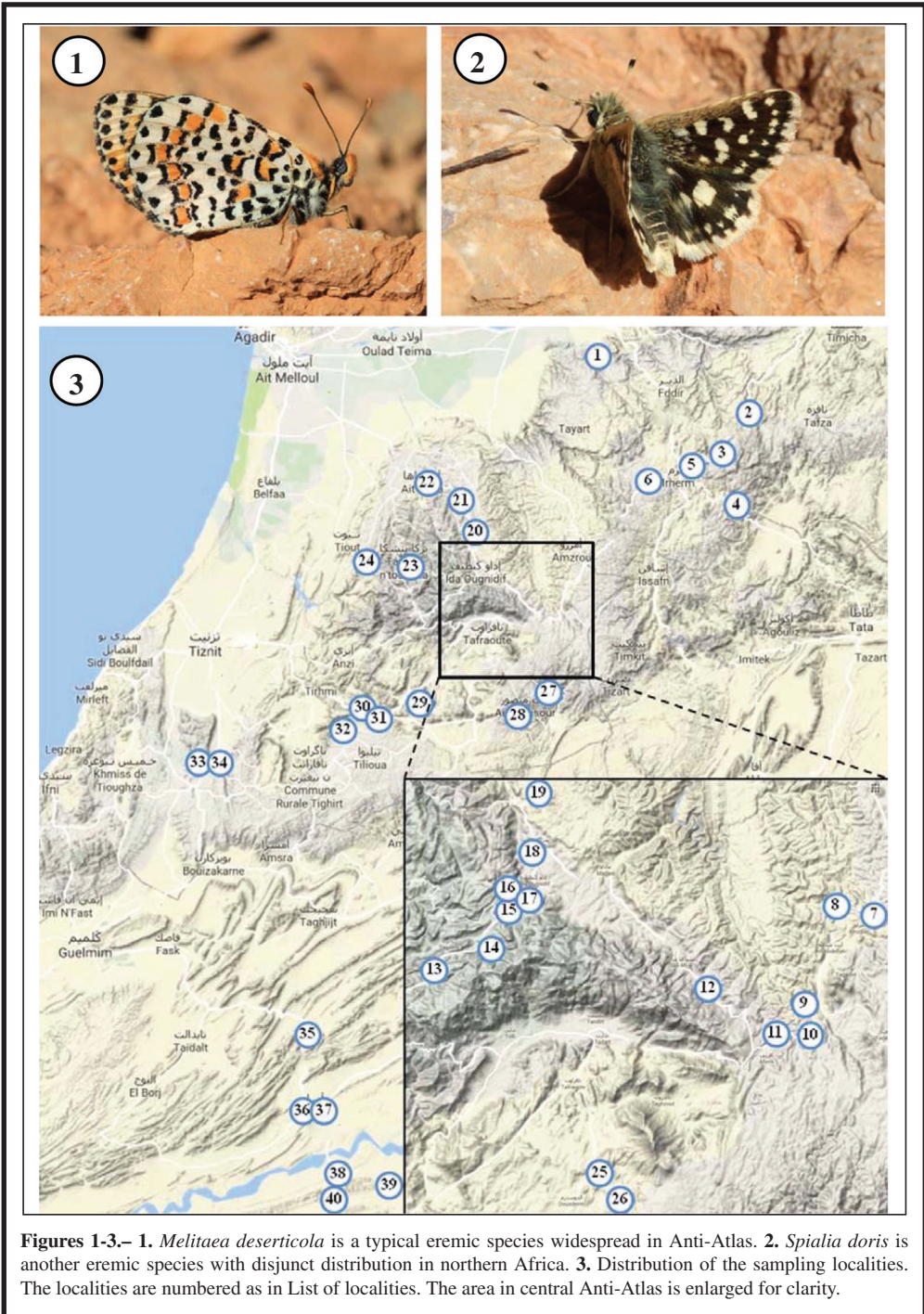
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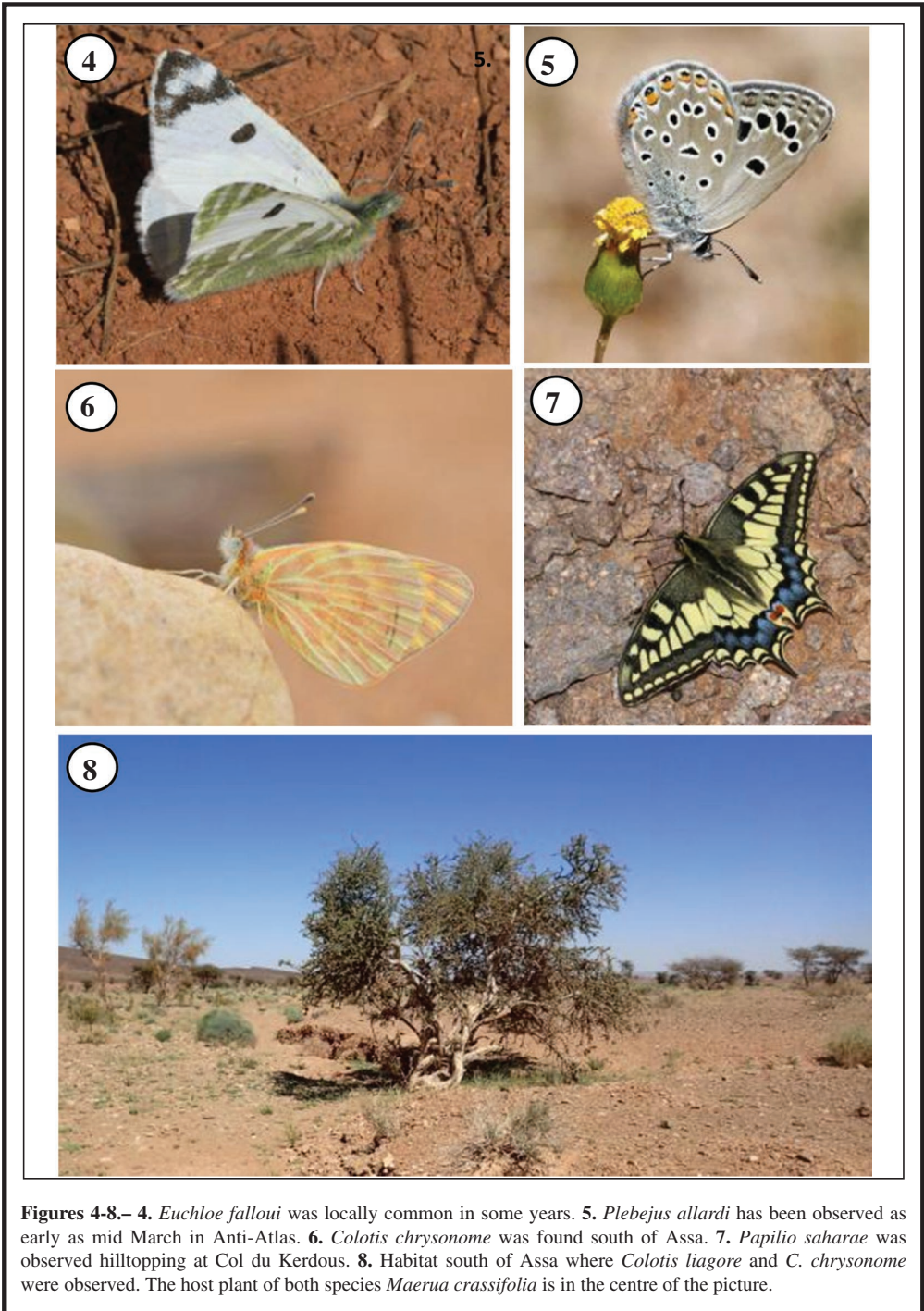
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Figures 1-3.– 1. *Melitaea deserticola* is a typical eremic species widespread in Anti-Atlas. 2. *Spialia doris* is another eremic species with disjunct distribution in northern Africa. 3. Distribution of the sampling localities. The localities are numbered as in List of localities. The area in central Anti-Atlas is enlarged for clarity.



Figures 4-8.– 4. *Euchloe falloui* was locally common in some years. 5. *Plebejus allardi* has been observed as early as mid March in Anti-Atlas. 6. *Colotis chrysonome* was found south of Assa. 7. *Papilio saharae* was observed hilltopping at Col du Kerdous. 8. Habitat south of Assa where *Colotis liagore* and *C. chrysonome* were observed. The host plant of both species *Maerua crassifolia* is in the centre of the picture.