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Cover

Detail of the underside of the hind-wing of a Western Marbled White *Melanargia occitanica* (photograph: A. Miquel).

Marbled White *Melanargia galathea* on a Compositae (photograph: J.R. Salas).

Editorial

The BMS network takes root in Europe

The year 2005 saw the end of one era for the CBMS and the start of another. From 2006 onwards, the organisation and infrastructure of the project will be improved thanks to an agreement reached between the Catalan Department of the Environment and Housing and the Granollers Museum. The most obvious change will be the work of Jordi Jubany and Quim Muñoz, who will be in charge of the technical coordination of the CBMS project and will endeavour to make the CBMS work far more efficiently. Their new tasks include periodic visits to CBMS sites to help with doubts concerning methodology and identification. As well, the internal workings of the database will become much easier.

A second novelty for 2006 is the start of the BMSAnd project, the new Andorran butterfly monitoring scheme being coordinated by the Andorran Biodiversity Centre. The project uses the CBMS methodology and counts have begun in 2006 in a few stations, but it is hoped to incorporate new stations in the not too distant future in order to cover all of the country's different habitats. The BMSAnd will provide new information on Pyrenean butterflies and will document for the first time their yearly cycles. From the start the CBMS and BMSAnd have established close links that will permit both projects to benefit mutually from the other's findings. We wish our Andorran colleagues all the success in the world in their BMS project.

In 2005 new BMS networks were set up in Germany, France, Hungary, Switzerland and the Ukraine, coinciding with the interest shown by the European Union in developing indicators of changes in biodiversity. This will help identify which ecosystems are suffering greatest biodiversity loss and what corrective measures need to be applied. Thus, the BMS networks have become fully recognised as an essential tool in conservation and in the near future butterflies will join birds as one of the best bioindicator groups for terrestrial ecosystems.

The CBMS network

Current situation of the Butterfly Monitoring Scheme in Catalonia and the Balearic Islands

In all, 54 stations participated in the 12th season of the CBMS. This figure includes reactivated itineraries at Coll d'Estenalles and the UAB and a new station at Estrets d'Arnes (Ports de Tortosa-Beseït), although, on the downside, the loss of the Mas de Melons itinerary is to be regretted. A total of 99,107 butterflies belonging to 140 species were recorded.

During the 2005 season a total of 54 butterfly walks provided data, of which 50 managed to record a complete annual series of weekly counts (fig. 1). For 45 stations direct comparisons can be made with figures from 2004. Furthermore, a number of other itineraries will be incorporated forthwith into the CBMS network: Margalef (400 m, Priorat), Morera de Montsant (750 m, Priorat), Vilert (100 m, Pla de l'Estany), Barranc d'Useu, environs of Gerri de la Sal (800 m, Pallars Sobirà) and Plaça dels Arbres, next to the well-known Estany de Sant Maurici in the Aigüestortes National Park (1,800 m, Pallars Sobirà). As well, regular censuses have been carried out in Andorra at Enclar (900 m) and Sorteny (1,800 m) as part of a project for an Andorran BMS network. The available annual data series are shown in figure 2. Over 40 stations now exist with data sets for five or more years and 11 itineraries have now celebrated their tenth anniversaries.

New transects

Vall d'Horta (Vallès Occidental, 550 m). This transect runs through a mosaic of Aleppo pine woodland and fields that was badly affected by the forest fire in the Sant Llorenç del Munt Natural Park in August 2004. It consists of 10 sections around Can Brossa in La Vall d'Horta, a small valley near the town of Sant Llorenç Savall. Despite having been recently devastated by fire, the itinerary has maintained its highly diverse butterfly populations and species such as Provence Hairstreak *Tomares ballus*, Marbled Fritillary *Brenthis daphne*, Lesser Spotted Fritillary *Melitaea trivia*, Western Marbled White *Melanargia occitanica* and Southern Marbled Skipper *Carcharodus boeticus* all appear. This transect is financed by the Sant Llorenç del Munt Natural Park

Alinyà (Alt Urgell, 1,100 m). Located near the village of Alinyà, this itinerary follows a path and a track through a cultivated area (allotments and hay meadows), an abandoned terrace being encroached upon by the surrounding woodland, a more humid patch of woodland and, finally, a sub-Mediterranean wood consisting of a mixture of Lusitanian and downy oaks and dry garrigue. The transect runs through land belonging to the Fundació Territori i Paisatge and forms part of a monitoring system carried out by this foundation in its properties. This area is of great interest for butterflies and with almost 90 species counted so far is one of the richest transects in Catalonia.

Estrets d'Arnes (Terra Alta, 600 m). This itinerary also runs through land belonging to the Fundació Territori i Paisatge and passes through a spectacular river gorge dominated by sheer limestone and conglomerate cliffs. The vegetation largely consists of arid scrub and Aleppo pine; one of the most notable feature of the butterfly communities here is the rich selection of 'browns' such as Western Marbled White *Melanargia occitanica*, four species of the genus *Hipparchia* and The Hermit *Chazara briseis*.

Cal Carro (Vallès Oriental, 280 m). This itinerary passes through a landscape of fields and forest, so typical of the Vallès plain as it merges into the foothills of the Montseny Massif. This mosaic is blessed by species from more upland areas (White Admiral *Limenitis camilla*, Camberwell Beauty *Nymphalis antiopa* and Small Skipper *Thymelicus sylvestris*) and others more typical of lowland agricultural areas (Small White *Pieris rapae*, Clouded Yellow *Colias crocea*, Long-tailed Blue *Lampides boeticus* and Lang's Short-tailed Blue *Leptotes pirithous*).

It is worth highlighting the reactivation of the itineraries at **Coll d'Estenalles** after two years of inactivity and at the **UAB** campus. This latter station had only managed to generate incomplete results (2003) and so 2005 was the first time this itinerary had produced fully usable data. Despite being an area with relatively little biodiversity, the surroundings of the Barcelona Autonomous University are one of the few well preserved parts of what is otherwise an area under great pressure from urban sprawl.

The itineraries at Turó de l'Home, Vallgrassa, Martorell, Mas de Melons and Sant Boi were not active in 2005, although the only really important loss is that of the itinerary at Mas de Melons. The remaining stations will be reactivated in 2006 or, as is the case at Sant Boi, will be substituted by another itinerary in a nearby area.

Habitats represented

The different habitats and plant communities covered by the CBMS in 2005 are shown in table 1. As has been the case since the beginning of the project, there is an overwhelming dominance of lowland stations representing different types of holm oak forest. This explains the abundance of data for species of butterfly such as False Ilex Hairstreak *Satyrium esculi*, Nettle-tree Butterfly *Libythea celtis*, Two-tailed Pasha *Charaxes jasius*, Meadow Brown *Maniola jurtina* and Spanish Gatekeeper *Pyronia bathseba* that are common in these environments.

Moreover, in 2005 there were also 10 stations completely located in scrublands in the southern and/or most continental parts of Catalonia. Although conditions vary from one site to another, in these stations butterflies such as Spanish Festoon *Zerynthia rumina*, Bath White *Pontia daplidice*, Adonis Blue *Polyommatus bellargus* and Striped Grayling *Hipparchia fidia* are common.

The coastline is covered by a total of seven stations, including those on Menorca and Ibiza. Despite being generally fairly species poor, these itineraries provide interesting data on migrant species such as Painted Lady *Cynthia cardui* and even Plain Tiger *Danaus chrysippus*.

Central European environments are very important in Catalonia, but they are represented in the CBMS by only six stations. Despite this deficiency, those itineraries in areas of dry pine and oak forests provide abundant information on species such as Chalkhill Blue *Polyommatus coridon*, Violet Fritillary *Boloria dia* and Pearly Heath *Coenonympha arcania*, whilst itineraries in more humid zones (for example, areas of beech) are important for their populations of Map Butterfly *Araschnia levana*, Ringlet *Aphantopus hyperantus* and Provençal Short-tailed Blue *Cupido alcetas*, all species that are otherwise rare in the CBMS network.

The great weakness of the CBMS network is the lack of transects in alpine or subalpine habitats and in 2005 only the stations at Fontllebrera (Cadí mountains) and Campllong (El Berguedà) have provided information from these environments. It is hoped, however, that this situation will improve substantially in coming years, especially if the Andorra BMS project comes into fruition, and that more and more upland species will be represented in the BMS counts.

Species represented

The list of species recorded in 2005 and in previous years can be consulted in table 2. In all, 140 species were detected in 2005, five more than in the previous year. It is worth noting the presence for the second consecutive year of Desert Orange-tip *Colotis evagore* from the station at L'Aiguabarreig. This record (along with that at Mequinensa at the end of summer[2]) gives more weight to the idea that this African species has been expanding northwards in recent years, a fact possibly related to climatic change[3]. Another welcome butterfly is the Mediterranean Skipper *Gegenes nostrodamus*, a migratory species of African origin, that reappeared in the CBMS counts in 2005 with a certain frequency in a number of sites in the area of El Vallès.

Overall, the distribution of the species represented in the CBMS network is the same as in previous years (fig. 3), in which a group of 20 or so species (16% of the total) is present in practically all itineraries and a somewhat larger group (29% of the total) of species is only found here and there. The most widely represented species in the CBMS are mostly generalist species such as Swallowtail *Papilio machaon*, Scarce Swallowtail *Iphiclides podalirius*, Large White *Pieris brassicae*, Small White *Pieris rapae*, Bath White *Pontia daplidice*, Clouded Yellow *Colias crocea*, Small Copper *Lycaena phlaeas*, Holly Blue *Celastrina argiolus*, Red Admiral *Vanessa atalanta*, Speckled Wood *Pararge aegeria* and Wall Brown *Lasiommata megera*, although there are also a number of more Mediterranean species (Cleopatra *Gonepteryx cleopatra*, Brown Argus *Aricia cramera*, Southern White Admiral *Limenitis reducta* and Great Banded Grayling *Brintesia circe*) that are also fairly ubiquitous. Amongst the rarest species there are many whose populations are very localised and that have strict habitat requirements throughout their range (for example, Provence Hairstreak *Tomares ballus*, Small Blue *Cupido minimus*, Chequered Blue *Scolitantides orion*, Duke-of-Burgundy's Fritillary *Hamearis lucina*, Twin-spot Fritillary *Brenthis hecate*, Spanish Fritillary *Euphydryas desfontainii*, etc.). Other species are relatively common in the central European-style habitats that are poorly covered by the CBMS network (for example, Small Tortoiseshell *Aglais urticae*, Map Butterfly *Araschnia levana* and Ringlet *Aphantopus hyperantus*).

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[3] Stefanescu, C., Roca, M. C. & Vidallet, D., 2005. "*Colotis evagore* (Klug, 1829), espècie nova per a Catalunya (Lepidoptera, Pieridae)". *Butll. Soc. Cat. Lep.*, 94: 111-114.

[4] Karsholt, O. & Razowski, J., 1996. *The Lepidoptera of Europe. A Distributional Checklist*. Apollo Books, Stenstrup.

Fig. 1. Geographical situation of all the stations that have participated in the CBMS network (1994-2005), with their offical number and name. Also shown are the generally accepted boundaries of the biogeographical regions of Catalonia[1].

Fig. 2. Distribution of the annual series available for all the different stations that have participated in the project (period 1988-2005).

Fig. 3. The number of CBMS stations in which the 119 species of butterfly detected in 2005 were recorded (excluding the skippers (Hesperiidae), because this family is not recorded in the same way in all transects).

Table 1. Habitats and plant communities represented in the CBMS in 2005, with the number of stations they appear in. Classification of the vegetation zones and plant communities as per reference 1.

Table 2. Butterfly species that were recorded in any of the CBMS stations during 1996-2005. Also indicated is the number of localities from which the species has been recorded during the CBMS monitoring (out of a total possible number of sites of 20 in 1996, 25 in 1997 and 1998, 30 in 1999 and 2000, 42 in 2001, 41 in 2002, 46 in 2003, 51 in 2004 and 52 in 2005). Only those stations where it has been possible to calculate an annual index have been taken into account. Taxonomy as per reference 4.

Photo 1. The village of Alinyà seen from Roca de Sant Ponç, with the imposing Roca de la Pena in the background. The CBMS itinerary passes through pastures, copses and scrub in this typically pre-Pyrenean area blessed with great butterfly species richness. Of the 90 counted to date, some of the most interesting are Chequered Blue *Scolitantides orion*, Catalan Furry Blue *Polyommatus fulgens*, Meleager's Blue *P. daphnis*, Lesser Spotted Fritillary *Melitaea trivia*, Spanish Fritillary *Euphydryas desfontainii* and Dusky Meadow Brown *Hyponephele lycaon* (Photograph: Fundació Territori i Paisatge).

Twelfth year of the CBMS
Summary of the 2005 season

The year 2005 was marked by one of the coldest winters on record and then by one of the century's most severe droughts. However, it was this drought, above all, that had the most significant influence on the butterfly fauna and 2005 proved to be the second worst ever season since the CBMS began. In 39 out of 45 stations for which comparable figures exist for 2004 and 2005, fewer butterflies were counted in 2005, with especially noticeable declines occurring in the numbers of False Ilex Hairstreak *Satyrium esculi*, Clouded Yellow *Colias crocea*, Common Blue *Polyommatus icarus*, Two-tailed Pasha *Charaxes jasius*, Gatekeeper spp. *Pyronia* spp., Wall Brown *Lasiommata megera* and many others. The exception to this rule was the monovoltine spring butterflies and those that hibernate as adults, both of which were counted in good numbers in 2005.

Weather and butterfly counts

The 2005 season was characterised by two extreme climatic factors: first, one of the coldest winters in recent years and, secondly, an intense period of drought that lasted from the previous autumn to the end of the summer. Winter began with normal temperatures in December, but January saw an entry of cold air from Siberia that sent thermometers plummeting throughout the country. The situation only worsened in February, as successive cold snaps led to the lowest monthly averages for 40 years being recorded in many parts of Catalonia. The situation continued into March and only by mid-month did temperatures begin to recover and return to normal.

The drought began to bite in autumn 2004, which, depending on the part of Catalonia, was classified as 'dry' (less than 70% of normal average rainfall) or 'very dry' (less than 30% of the average rainfall) by the Catalan Meteorological Service. Rainfall in December returned briefly to more normal levels, before January to July saw a period of alarming drought with low or very rainfall figures (between 20 to 70% of normal figures). Finally in August and, above all, in September, copious rains arrived to palliate a situation that was already being described as critical.

Low rainfall levels did mean, however, that CBMS participants had fewer problems in finding appropriate days to carry out their counts: only 2.7 counts were lost per station on average (fig. 1a), the lowest values since 2000. Overall, only 9.5% of possible counts were lost (fig. 1b), the most critical part of the season being the beginning of the season when the cold made many counts impossible and the end of summer as the abundant late summer rains struck.

Changes in abundance: general considerations

Taking Catalonia as a whole, 2005 saw an important drop in the numbers of butterflies counted. In 39 out of 45 stations for which figures exist for 2004 and 2005, butterfly numbers dropped and only increased in the remaining six stations. The average number of butterflies counted per itinerary in 2005 was 1,966.9 ± 1,418.9 (average ± standard deviation) as opposed to 2,976.3 ± 2,162.6 in 2004. A Paired Student Test shows that this fall was very significant ($t = 4.82$, $P < 0.001$). On the other hand, the number of species per itinerary remained constant over the two years in question: 39.7 ± 17.6 in 2005 vs. 39.6 ±16.4 in 2004 ($t = 0.11$, $P = 0.91$).

The evident fall in butterfly numbers is obvious from figure 2, which ranks the 12 years of the CBMS counts in terms of the abundance of the 54 commonest butterflies found in the CBMS network. Along with 2001, 2005 occupies a place as the second-worst ever, just ahead of 1998.

Three main factors can be identified as the causes of this negative overall trend. Firstly, the serious drought described above affected those species whose larvae were growing in spring and early summer. During this important growth period, the drought was at its worst and plants were not able to provide sufficient nutrition. Secondly, the extremely cold winter would have devastated some of the populations of butterflies that do not enter into diapause and that are not equipped to deal with prolonged periods of sub-zero temperatures. Lastly, the numbers of migrant butterflies such as the Painted Lady *Cynthia cardui* were also particularly low in 2005.

Changes in abundance: fluctuation in populations

The False Ilex Hairstreak *Satyrium esculi* was one of the species that most suffered the effects of the drought; this species, after having been the most abundant species in the CBMS network for four years in a row, dropped to 13th position in 2005 (table 1). The figures are eloquent enough: in 28 out of 33 populations annual counts fell and the combined annual index for the whole of Catalonia crashed to 10% of the figure for the previous year. This collapse is undoubtedly related to the lack of fresh holm-oak and holly-oak shoots after the dry winter and spring, which leads to a drastic fall in the quality of the trophic resources available for larvae[2]. Likewise, Purple Hairstreak *Neozephyrus quercus*, a species with similar biological traits, suffered a comparable fall in numbers and in 2005 was recorded in its lowest numbers since the CBMS project began (table 2).

Another common lycaenid butterfly that suffered in 2005 was the Common Blue *Polyommatus icarus*, which –comparing 2005 with 2004- declined in 32 out of 41 stations. As in the case of the Purple Hairstreak, this generalised decrease led to the lowest ever counts for the species since the CBMS network was set up (table 2).

Very possibly the widespread decline in numbers of Satyrinae throughout Catalonia can also be attributed to the drought. In all, four species of Satyrinae in table 2 dropped to their lowest ever CBMS annual totals in 2005, in marked contrast to their relative abundance in 2004. In this group of butterflies synchronised changes in population numbers in both tendency and magnitude are commonly observed and are closely related with the influence of climate on the quality of larval food supply. Dry springs and summers normally lead to evident falls in numbers, as occurred in 2005 and 2001, the latter another year with a marked summer drought; on the other hand, wet springs and early summers are associated with significant increases in populations (table 2).

As mentioned above, a large number of species suffered from the extremely low temperatures during the winter. The most sensitive species are those for which the Mediterranean is at the northern-most limit of their ranges (or wintering areas in the case of migratory species). The most obvious case is that of the Two-tailed Pasha *Charaxes jasius*, of which 15 out of 19 studied populations fell in numbers in 2005 and its overall level of abundance throughout Catalonia fell to almost half of the numbers in 2004 (table 2). This reaction to the severe winter weather was perfectly predictable given the results of a previous study that analysed the effects of low temperatures on the survival of wintering larvae[3]. Two other species -Clouded Yellow *Colias crocea* and Red Admiral *Vanessa atalanta*- also reached all-time low levels in 2005 and may have suffered in a similar fashion to the Two-tailed Pasha (table 2). The larvae of both species continue growing during the winter and are thus very susceptible to periods of cold.

Table 2 also highlights the low numbers of the main migratory species, a fact that probably reflects poor population figures in their areas of origin. The paradigm of this is the Painted Lady *Cynthia cardui*, which in 2005 dropped to 2% of the numbers recorded in 2004 and was rare at most CBMS stations. As well, other migratory species such as Small White *Pieris rapae*, Bath White *Pontia daplidice*, Long-tailed Blue *Lampides boeticus*, Lang's Short-tailed Blue *Leptotes pirithous*, Swallowtail *Papilio machaon* and Clouded Yellow *Colias crocea* were also scarce in 2005, although in these species the effects of the drought could have negatively affected overall numbers.

An exception to this overall tendency was the abundance of the majority of the monovoltine spring species. Aside from the species in table 2 (Orange-tip *Anthocharis cardamines*, Moroccan Orange-tip *A. euphenoides*, Green Hairstreak *Callophrys rubi* and Panoptes Blue *Pseudophilotes panoptes*), other rarer species (Spanish Festoon *Zerynthia rumina*, Chapman's Green hairstreak *Callophrys avis*, Small Blue *Cupido minimus*, Chequered Blue *Scolitantides orion* and Duke-of-Burgundy Fritillary *Hamearis lucina*) were also much commoner in 2005. Likewise, some of the species that hibernate as adults were also extraordinarily abundant in spring (for example, Nettle-tree Butterfly *Libythea celtis*, Camberwell Beauty *Nymphalis antiopa* and Large Tortoiseshell *N. polychloros*). This coincidence in tendencies in species with similar biologies is yet another indication that climatic factors lie behind fluctuations in populations; thus, the combination of a cold and dry winter and a cold start to winter could have been beneficial for these species, although this affirmation will have to be analysed with new data in the future.

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[2] Stefanescu, C., 2003. "Resum de la temporada 2002". *Cynthia*, 2: 7-9.

[3] Stefanescu, C. & Planas, J., 2002. "Com afecta el rigor de l'hivern les poblacions catalanes de *Charaxes jasius*". *Butlletí de la Societat Catalana de Lepidopterologia*, 91: 31-48.

Fig. 1. (a) Coverage of the counts at the different CBMS stations and (b) distribution of the lost counts during the official 30 weeks of the 2005 season (March 1 - September 26).

Fig. 2. Ranking of the CBMS seasons in terms of the general abundance of the 54 commonest butterflies in the CBMS network. The best year to date was 2002 and the worst 1998. Calculations carried out according to the methodology used in reference 1.

Table 1. Sum of the annual indexes and rankings of abundance for the 20 commonest species from the 2005 CBMS counts compared to the corresponding figures for the 2004 season.

Table 2. Evolution of the overall annual indexes for the commonest 59 species of butterfly in the CBMS (1996-2005) based on an arbitrary value of 100 for the year 1994. Also indicated are the number of species that increased or decreased every season, as well as the proportions that are significantly different from equality (NS: not significant; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$).

Drawing 1. In 2005 the Clouded Yellow *Colias crocea*, the most widely recorded species in the CBMS, experienced its greatest ever drop in numbers since the CBMS project began. Compared to the previous year, its numbers fell in 42 stations and only increased in two. This migratory species lives mainly in Mediterranean areas and in Catalonia it reaches the northern-most limit of its wintering population. During the winter its larvae do not enter into diapause and continue to feed if temperatures are sufficiently benign. However, in hard winters larvae die. This is possibly the cause of the low numbers recorded in 2005, although a fewer than normal numbers of migrants may also have contributed to this decline (drawing: M. Arrizabalaga).

Drawing 2. Over the last six years numbers of Large Tortoiseshells *Nymphalis polychloros* have increased greatly in Catalonia. This spectacular Nymphalidae is a woodland species and above all appears in the CBMS counts in March and April, when the adults wake up from their overwintering sites and then mate. Eggs are laid during spring on a wide range of deciduous trees, including wild cherry *Prunus avium*, small-leaved elm *Ulmus minor*, Southern nettle-tree *Celtis australis*, black poplar *Populus nigra* and common sallow *Salix atrocinerea*. In Mediterranean areas, the new generation that emerges in May-June often goes unnoticed as it quickly finds a place to aestivate and then hibernate (often in buildings) until the following season (drawing: M. Arrizabalaga)

Habitat management and conservation

The *closes* of L'Alt Empordà: an important habitat for butterflies under threat

Data from the BMS always ranked hay meadows flooded in winter (the so-called *closes*) as the most valuable habitat in terms of conservation evaluation in the Aiguamolls de l'Empordà Natural Park. This conclusion coincides with that of previous investigations indicating that the most diverse and rare plant communities in the whole Natural Park are present in the *closes*, and highlights the importance of traditionally managed hay meadows for wildlife. However, these hay meadows are in alarming decline and have become one of the most threatened habitats in this area and the whole Mediterranean region.

The Aiguamolls de l'Empordà Natural Park (PNAE) is one of the best-loved of all protected areas in Catalonia and is well known above all for its birdlife[1]. Nevertheless, this protected area is home to other very valuable groups of animals and plants[2,3]. Recently, the conservation interest of the different habitats in the Natural Park have been analysed from a standpoint of their plant communities and the *closes* -hay-meadows enclosed by tree-lined drainage ditches that are flooded in winter and cut between one and three times a year (depending on the productivity of the season)- are now beginning to be recognised as the most interesting habitat for plants in the Park[4]. These damp meadows are characterised by a plant community -*Arrhenatherum elatioris* Br.-Bl., 1915- that is the most species-rich and diverse in the Park and also home to some of the Park's rarest plants (fig. 1). Nevertheless, the *closes* are disappearing fast, as figures show: the 136.04 ha of *closes* in the PNAE in 1956 has dropped to a mere 26.75 ha (2002) today. The cause of this regression is the ploughing up of the *closes* to plant, above all, maize, sunflowers

and rice and the implementation of intensive stock-rearing dependent on commercially purchased feed rather than locally produced hay.

Given that data is lacking it is unfortunately impossible to generalise on the relevance of the *closes* for wildlife in the PNAE (even in the case of birds). This is a serious handicap at a time when pressure needs to be put on the Catalan Government to invest more time and money in the conservation of this valuable habitat. Thus, it was decided to analyse more fully all the data provided by the CBMS transects in the PNAE as a means of contributing to the study of the *closes.*

Thus, as already had been done for the Park's flora, an in-depth analysis was carried out of all the butterfly habitats in the PNAE[5] in terms of the following three criteria: species richness, abundance and the presence of rare species. The study was based upon data from 46 sections of the Park's 6 BMS transects (El Cortalet, La Rubina, Vilaüt, Closes de l'Ullal, Closes del Tec and Mig de Dos Rius). First of all, the habitat of each section was characterised semi-quantitatively in terms of the percentage of meadow, the absence-presence of grazing in the meadow (if any), the percentage of woodland, the percentage of thickets and, finally, the presence-absence of intensive cultivation next to the BMS section. This information demonstrated that as these variables change, parallel changes occur in the respective butterfly communities as a result of the presence or absence of food resources for larvae, and the existence or otherwise of other types of essential resources (nectar sources for adults, hibernation sites, etc.).

In phase two each species of butterfly was associated with a number of basic habitat characteristics. All the species were placed in order along a gradient running from woodland at one extreme to the different types of meadows at the other. Speckled Wood *Pararge aegeria*, Green-veined White *Pieris napi*, Holly Blue *Celastrina argiolus* and Comma Butterfly *Polygonia c-album* were identified as the most woodland of the butterflies, being tolerant of thickets and other enclosed and shady environments. On the other hand, Clouded Yellow *Colias crocea*, Common Blue *Polyommatus icarus*, Small Heath *Coenonympha pamphilus* and Silver-studded Blue *Plebejus argus* (fig. 2) are clearly associated with open areas. In fact, many species are at their commonest in mixed habitats (for example, meadows with a certain presence of thickets and copses), a finding that undoubtedly reflects the value of these places in providing, for example, shelter from the wind and/or less disturbed oviposition sites.

Finally, a cluster analysis was carried out in order to identify five discrete habitats, each associated with a characteristic but different group of butterfly species. The five habitats were (fig. 1): (A1) paths and field edges surrounded by woodland and thickets; (A2) open woodland with small patches of grassland and meadow/woodland ecotones; (B1) well-established *closes* (cut 1-3 times a year and not grazed); (B2) well-established alfalfa fields, cut 2-3 times a year, and (B3) pastures and meadows also used for grazing. Figure 1 compares the conservation value of all these habitats. The well-established *closes* were always the most valuable habitat, boasting a greater abundance of butterflies, more species and more rare species. At the other end of the scale were the woodland and thickets, which in the PNAE are the least interesting habitat for butterflies.

Our results coincide fully with those of Gesti *et al.* (2003) (reference 4), whose analysis was based on higher plants. The *closes* are the most valuable habitat for butterflies as they provide adults with abundant nectar and larvae with a series of key resources (for example, many plants of the Leguminoseae family). These optimal conditions disappear when a meadow is grazed and the abundance and diversity of butterflies is seriously reduced.

The special relevance of the *closes* for two large taxonomic groups (butterflies and higher plants) occupying different trophic levels, together with the alarming loss of *closes* begun in the second half of the twentieth century (and still continuing), mean that these delightful coastal hay-meadows can be objectively considered as the most threatened and one of the most valuable habitats in the PNAE. Their value is even greater in a wider context, as little other such habitat exists in the Mediterranean Basin. Paradoxically, the declaration of the PNAE has not halted the disappearance of the *closes* and has even coincided with an acceleration of this process: at least 60% of the *closes* have disappeared since the PNAE was legally protected in 1983 (reference 4). This is due to two main reasons: firstly, a large part of the PNAE is privately owned and thus difficult to manage and, secondly, the *closes* are no longer financially viable and farmers have either been abandoned or converted into cropland. Thus, it is time to rethink the Park's management policies regarding the *closes.* Despite being described as a habitat of maximum conservation concern by the Park's new management plan (still in the writing), it is still essential -if they are to be effectively conserved- for the *closes* to be included in the agro-environmental measures proposed by the Spanish and Catalan governments and by the EEC and which are to be approved in 2007.

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Photo 1. The Empordà *closes* such as in the Mornau area are of great aesthetic value and are blessed with a wonderful variety of biological richness. Nevertheless, the surface area covered by the *closes* has declined enormously over the last few years and they are currently the most threatened habitat in the Aiguamolls de l'Empordà Natural Park. (photograph: M. Miralles).

Photo 2. The Silver-studded Blue *Plebejus argus* is the most typical butterfly of the *closes* in L'Alt Empordà. Populations of this small lycaenid reach extraordinary levels in the best-preserved *closes*, but soon drop when the habitat deteriorates (for example, when the meadows are not cut or are fertilised) (Photograph: M. Miralles).

Fig. 3. Average ± standard deviation for the criteria used to evaluate the conservation interest of the different habitats in the PNAE. (a) Abundance of butterflies (log individuals/100 m); (b) species richness, excluding occasional species (log number of species); and (c) rarity (in terms of Catalonia), calculated as log 1/ni, where ni is the number of CBMS stations in Mediterranean habitats in which a species has been detected (out of a total of 54). The different letters indicate the significant differences between the groups ($P < 0.05$).

CBMS sites

El Pla de Campllong, gateway to the Pyrenees

The *comarca* of El Berguedà currently boasts four CBMS stations, Gironella, Berga (new this year), La Nou de Berguedà and El Pla de Campllong, the latter framed in a beautiful subalpine setting and enjoying a great diversity of montane and high mountain species of butterflies.

The transect

The Pla de Campllong itinerary lies in the municipality of Castellar del Riu and begins and ends next to the well-known pine tree 'Pi de les Tres Branques'. The transect is flat and circumnavigates a large plain lying at 1,280 m a.s.l. between El Serrat dels Lladres (continuation westwards of La Serra de Queralt) to the south and the southern-most ridges of Els Rasos de Peguera (Cim d'Estela) to the north. It is sheltered from the northerly winds but is frequently buffeted by strong easterly and westerly winds channelled through this natural gap in the mountains.

The central part of the plain is occupied by a large hay meadow that was once grazed by cows once it had been cut. However, for the last two years it has been ploughed up and oats have been planted. Two of the transect's sections (1 and 4) lie totally within the plain, of which the former is never cut for hay. The other sections run around the edges of the plain through subalpine pastures (*Mesobromion*), shrubby woodland-edge habitats (sloe, wild roses, wild pears, apples and plums), or through stands of Scots pine of varying density. Sections 7 and 9 correspond to drier pastures and are gradually being colonised by shrubs, bushes and young pines.

The butterfly fauna

During the five years that the CBMS has been carried out in Campllong a total of 9,000 butterflies belonging to 87 different species have been recorded: these figures indicate that, while the abundance of butterflies at this site may not be exceptional, the level of species-richness certainly is. The annual average is 1,800 butterflies and 65 species (with an annual density of 128 individuals/100 m). The climatic conditions of the site (average annual temperature of 8.5ºC and average annual rainfall of 1,016 mm) mean that butterfly activity does not get underway until mid-May and that maximum activity does not occur until the end of July and early August. In fact snow is still lying on much of the itinerary when counting starts and snow continues to fall even in March. Butterflies are thus rather scarce during the first months, the first species recorded being hibernators such as Brimstone *Gonepteryx rhamni*, Small Tortoiseshell *Aglais urticae* and Red Admiral *Vanessa atalanta*, or polyvoltine species such as Clouded Yellow *Colias crocea* and Berger's Clouded Yellow *C. alfacariensis*. Regular observations do not start until mid- to late May when the Pieridae begin to appear (Large White *Pieris brassicae*, Small White *P. rapae*, Orange-tip *Anthocharis cardamines*, Moroccan Orange-tip *A.*

euphenoides and Wood White *Leptidea sinapis/reali*), along with a few Lycaenidae (Common Blue *Polyommatus icarus* and the first generation of Adonis Blue *P. bellargus*) and Satyrinae (Small Heath *Coenonympha pamphilus*, with a first generation in May-June and a second in August/September). At the same time the first Painted Ladies *Cynthia cardui* appear *en route* from North Africa and in some years become very abundant (424 individuals counted in 2003). June sees the presence of various species of the genus *Melitaea* (Glanville Fritillary *M. cinxia*, Knapweed Fritillary *M. phoebe* and the confusing group comprising Heath *M. athalia*, Meadow *M. parthenoides* and Provencal fritillaries *M. deione*, the latter three species often very abundant), the beginning of the single annual generation of Black-veined White *Aporia crataegi* (a species that is usually most abundant at the beginning of July), many Silver-studded Blues *Plebejus argus* (mainly in the pastures with short grass and often congregating in large numbers at mad puddles), and the beginning of the flight periods of most of the site's Satyrinae. This latter group dominates numerically in July and August: first of all Pearly *Coenonympha arcania* and Chestnut *C. glycerion* Heaths (both with a clear preference for pastures and woodland clearings with tallish grass) and Ringlet *Aphantopus hyperantus* (much less frequent than the previous species and more tied to woodland), which are replaced eventually by large numbers of Meadow Brown *Maniola jurtina*, Iberian Marbled White *Melanargia lachesis*, Gatekeeper *Pyronia tithonus*, Piedmont Ringlet *Erebia meolans* and Autumn Ringlet *E. neoridas*. All these species of Satyinae thrive in the pastures and open areas of forest (remember that their larvae feed on grasses). Finally, we should also mention the skippers, of which two of the commonest are Small Skipper *Thymelicus sylvestris* and Silver-spotted Skipper *Hesperia comma*.

Without doubt the most representative butterfly, however, is the Chalkhill Blue *Polyommatus coridon*, a typically Central European species found on limestone pastures with its food-plant, horseshoe vetch (*Hippocrepis comosa*). This Lycaenidae first flies at the beginning of July and is still on the wing at the end of September. On Pla de Campllong it is seen most often in grassy areas bordering on woodland and woodland clearings (sections 2 and 5) and up to 66 males have been counted in a single day (the females are very similar to those of Adonis Blue *Polyommatus bellargus* and as such are not recorded at species level).

The great diversity of species found at Pla de Campllong is largely due to the mixture of Mediterranean species and species more linked to subalpine habitats. Of the latter (poorly represented in the CBMS counts) we should highlight the Lycaenidae Mazarine Blue *Polyommatus semiargus*, Damon Blue *P. damon* and Amanda Blue *P. amanda* (all found typically in pastures), Duke-of-Burgundy's Fritillary *Hamearis lucina* and Pearl-bordered Fritillary *Boloria euphrosyne* (the latter two species scarce but regularly recorded from the clearings in section 5), and the Satyrinae De Prunner's Ringlet *Erebia triaria* and Esper's Marbled White *Melanargia russiae*. The latter was fairly abundant in a certain part of section 2 during the first years of the counts, but its numbers have gradually declined and it failed to appear in either of the last two years of the transect.

Changes in land-use and diversity

A change has taken place in the land-use at Campllong since 2005. What were until then hay meadows, fertilized with dung in mid-March and cut at the end of July and the end of October, are now ploughed fields sown with oats. This change has led to a serious loss in the number of butterflies in the section in question (in section 4 the average annual number of individuals counted has dropped from 125 to 32) and a loss in diversity. During the first fours years of CBMS counts the average number of species recorded in this section was 31, while last year only 16 species were recorded, of which nine were of just a single individual. Despite the fact that these figures correspond to a single year, it is clear that the change from a hay meadow to a monoculture has had negative repercussions on the diversity of butterfly species. It will be important to continue analysing the figures from this section to see how the butterfly populations evolve if in future years cultivation is abandoned and the meadow reverts to a hay meadow.

Eloi Escútia

Transect route at Campllong. The Campllong transect is circular and has nine sections in all. The total distance is 1,402 m, with an average of 156 m per section (range: 44-249 m).

Photo 1. The Chalkhill Blue *Polyommatus coridon* is the most abundant butterfly at Pla de Campllong and is also one of the most characteristic species of subalpine and alpine pastures in the Pyrenees. Its larvae feed on horseshoe vetch *Hippocrepis comosa*, an important plant that is also the food-plant of Adonis Blue *Polyommatus bellargus* and Berger's Clouded Yellow *Colias alfacariensis*. As well, large groups of male Chalkhill Blues –and other species- gather on the mud at edges of puddles to 'drink' (photograph: J. Jubany).

Photo 2. Section four is restricted to El Pla de Campllong itself and until last year consisted of a typical mid-altitude limestone pasture found in many subalpine parts of the pre-Pyrenees. In 2005 it was converted into a field of oats and as a result the diversity of butterfly species that live there has dropped greatly. Fortunately, subalpine pastures are still to be found throughout most of the transect. (photo: Eloi Escútia).

Fig. 1. Average abundance (average of the annual indexes for the period 2001-2005) of the 15 commonest butterflies at the Pla de Campllong CBMS station.

Review

Lockwood, M., 2005

Els ropalòcers del Solsonès: una primera aproximació (The butterflies of El Solsonès: a first look)

Butlletí de la Societat Catalana de Lepidopterologia, 94 (2005)

Now that talk of how to manage for increased biodiversity is so much in vogue, it is all the more important to work on the faunistic catalogues that tell us exactly what species are present in our biodiversity. This article presents data collected by the author regarding the butterfly fauna of the *comarca* of El Solsonès from five years of field work and the analysis of two local entomological collections. In all, the number of species recorded for the *comarca* has risen from 50 to 147.

It is perhaps somewhat surprising that a well-known lepidopterological journal should still be publishing articles with the words "first look" in their titles. It is unfortunate that this is so and therefore we should be aware that, despite the existence of an accurate list of butterfly species for Catalonia, faunistic catalogues are very incomplete. In fact for very few *comarques* in Catalonia does such a volume of good-quality data exist as is presented in this article.

Thus, in this context the contribution made by the author is especially important because this lack of information was especially patent in the case of the *comarca* of El Solsonès. Its position lying between well-prospected areas such as El Cadí or El Montsec and its low density of population have led to this area being historically rather forgotten by the majority of naturalists, as the small number of species cited before this article makes clear.

The information in the article comes from the study of two entomological collections (Josep Parramon, with material from 1965-1985, and Josep Guilanyà, from 1973-1983), and from the numerous prospections carried out by M. Lockwood between 1997 and 2001. Data were collected on a basis of 5 x 5 km UTM squares, giving a total of 55 squares and, although the coverage was rather uneven, the author tried prospect as much as possible the areas not covered by the two collections. Even so, there are still 10 squares without data, all of which lie in the most peripheral parts of the *comarca*.

The data collected –over 6.000 registers of 147 species- reflects the richness of the butterfly populations of the El Solsonès, a fact only explicable by the important altitudinal gradient of the *comarca* (running from just 500 m a.s.l. in the south of the region to over 2.300 m a.s.l. in La Serra del Port del Comte) and the resulting variety of vegetation types. The uneven coverage makes it difficult to determine exactly which areas are the richest, although the maximum diversity corresponds to the most intensely prospected squares (for example, those situated in the municipalities of Navès and Lladurs) where the owners of the collections studied once collected. Even so, it does seem clear that the maximum species richness lies in the northern-most part of the *comarca* on the southern slopes of La Serra del Port del Comte and La Serra del Verd, both areas of mid-altitude mountains. The author also highlights La Serra de Busa, in which Eurosiberian (for example, Esper's Marbled White *Melanargia russiae*, Duke-of-Burgundy Fritillary *Hamearis lucina*, Ringlet *Aphantopus hyperantus*, Pearl-bordered Fritillary *Boloria euphrosyne* and Alcon Blue *Maculinea alcon*) and Mediterranean species (for example, Spanish Festoon *Zerynthia rumina*, Catalan Furry Blue *Polyommatus fulgens* and Southern White Admiral *Limenitis reducta*) can both be found. Indeed, it was on this mountain –to be precise on the small plateau on top- that the Spanish Argus *Aricia morronensis* was found for the first time in Catalonia[1].

The most widely spread species in the *comarca* are Berger's Clouded Yellow *Colias alfacariensis* and Clouded Yellow *C. crocea*, followed by Scarce Swallowtail *Iphiclides podalirius*, Moroccan Orange-tip *Anthocharis euphenoides*, Wood White *Leptidea sinapis*, Large White *Pieris brassicae*, Pearly Heath *Coenonympha arcania*, Iberian Marbled White *Melanargia lachesis*, Painted Lady *Cynthia cardui* and Common Blue *Polyommatus icarus*. On the other hand, species such as Alcon Blue *Maculinea alcon*, Lesser Spotted Fritillary *Melitaea trivia*, White-letter Hairstreak *Satyrium w-album*, Scarce Copper *Lycaena virgaureae*, Western Marbled White *Melanargia occitanica*, Spanish Marbled White *M. ines* and Twin-spot Fritillary *Brenthis hecate* are only known from a single square. The article also highlights the presence in the *comarca* of 19 species that are either threatened in Europe[2] or rare in Catalonia (for example, Apollo *Parnassius apollo*, Provence Hairstreak *Tomares ballus*, Large Blue *Maculinea arion*, Alcon Blue *M. alcon* and Spring Ringlet *Erebia epistygne*), whose distribution and status in the comarca are given in more detail in the article.

All these data demonstrate not only the important and interesting butterfly fauna to be found in the *comarca* of El Solsonès, but also the lack of knowledge that still remains. As the author does in his article, we would like to encourage people to go and investigate the butterflies of El Solsonès and Central Catalonia in general, areas for where there are still great gaps in our knowledge.

Jordi Jubany

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Photo 1. The Chequered Blue *Scolitantides orion* is considered to be a SPEC3 species in Europe. Although it is fairly well spread throughout Catalonia, it usually lives in well-defined populations, often consisting of small numbers of butterflies. This fact, linked to its strictly springtime flight period, means that it is a species that is often overlooked. Indeed, it had not been recorded in El Solsonès until the author began his study.

News
5th CBMS meeting

The CBMS network is still growing and with it the number of people involved in the weekly counts. In the space of just a few years we have moved from 10 itineraries and eight 'counters' to almost 60 itineraries and 80 'counters', and this growth has led to a need to organise events and meetings so that all the participants in the project can meet to exchange ideas and compare notes. The first such CBMS meeting was held in 1998 and most recently -and far more multitudinariously- the fifth such meeting was held on February 18 of this year.

This latest meeting, attended by almost 40 people in the Granollers Museum of Natural History, was inaugurated by the town's mayor, Josep Mayoral i Antigas, and the town's councillor for culture, Francesc Sala. As host, Toni Arrizabalaga welcomed all the participants and thanked them for their dedication to the project.

The first part of the morning was centred on the presentation of the new organigram of the CBMS and then to the current situation of the CBMS and the main results obtained in 2005. Subsequently, CBMS 'counters' from Andorra gave a brief explanation of their ambitious BMSAnd project (the name given to the Andorra BMS network) and the activities carried out thus far.

After a coffee break, a number of participants briefly described other butterfly-related projects: Mike Lockwood, a study of the butterflies of L'Alta Garrotxa linked to the management of meadows; Fernando Carceller, the Badalona butterfly garden; and Toni Arrizabalaga, who is working from the Granollers Museum to put common names to the butterflies of Catalonia.

The final hour before lunch was given over to an exhaustive revision of the CBMS methodology in an attempt to resolve any doubts. Finally, the identification of a number of difficult groups of species was discussed, along with some of their biological and ecological traits.

After lunch, Constantí Stefanescu gave a brief introduction to the world of parasitoids in butterflies, highlighting their importance as natural enemies of these and many other insects. Then Jordi Dantart described some of the different projects currently being carried out by the Catalan Lepidopterological Society (SCL) and encouraged all those present to become members. Eventually, it was time for the identification competition, which was won with the same number of points by colleagues from La Garrotxa, Jordi Artola and Mike Lockwood.

The meeting closed with the prize-awarding ceremony: to Jordi Artola, for the identification competition, to Quim Muñoz for his unstinting efforts in 2005, and to Agnés Batlle for her notable and unfailing contribution to the CBMS since 1994. As a memento of the meeting, all the participants were presented with an orange hat to protect them from the sun during the forthcoming counting season.

Jordi Jubany

The butterfly
The Spanish Festoon *Zerynthia rumina*, a burst of spring colour

Early spring sees the appearance in many arid parts of Catalonia of the smallest and most brightly coloured of all our Papilionidae, the Spanish Festoon *Zerynthia rumina*. This unmistakable butterfly is closely tied to the birthwort *Aristolochia pistolochia*, a calcicole plant that is the sole food plant of the species' larvae. Although historically the Spanish Festoon has often been thought of as a rare butterfly, it has been recorded from most Catalan *comarques* and even from some typically Pyrenean areas. Nevertheless, its population densities are generally quite low and its flight period is relatively short and in many sites this species has disappeared completely by mid-May.

Geographical distribution and situation in the CBMS

The Spanish Festoon *Z. rumina* is only found in north-west Africa, the Iberian Peninsula and south-east France[1]. In much of its range in France, it co-exists with the Southern Festoon *Z. polyxena*, a similar species that completely replaces the Spanish Festoon in south-east Europe[2].

The Spanish Festoon is widespread in the Iberian Peninsula and has been recorded from all mainland Spanish provinces except Asturias, Vizcaya and Guipúscoa[3]; it is absent only from the most northerly part of the Peninsula (that includes the highest mountains of the Pyrenees) and the Balearic Islands. In Catalonia it is one of the few species whose range has been accurately studied[4,5]. Despite living in localised and often small populations, it flies over much of the country and in 32 out of 41 *comarques* and with further searching it may even appear in other areas. Its distribution map suggests that it prefers low-lying areas of the coastal and pre-coastal mountains, but it also flies in much of the pre-Pyrenees and large areas of the Ebro Depression. In general this butterfly is closely tied to arid environments and avoids humid areas or high mountains.

Within the CBMS network the Spanish Festoon has appeared to date in 20 of the 76 Catalan stations (fig. 1). The greatest population densities occur in the Massif del Garraf and along the valley of the river Llobregat (for example, Sallent and Gironella). In the mountains of Montmell and Prades, as well as in various sites in the Ebro Depression, populations are of intermediate density, while in the rest of the stations it is a rare species or is totally absent.

Habitats and food-plants

The Spanish Festoon is typically found in arid environments and in generally open and sunny and preferably calcareous habitats from sea level to mid-altitude mountains up to 1,000 m (ref. 4).

Data from the CBMS allows us to establish precisely which plant communities the species prefers (table 1). Using only data from sections in which the Spanish Festoon has an annual density of over 0.1 individuals/100 m (thereby excluding observations of isolated or dispersing individuals) and taking into account only those plant communities with a section coverage of 30% or more, this butterfly is associated above all with dry false brome *Brachypodium phoenicoides* grassland (37% of sections) and calcareous *Brachypodium retusum* grassland (23% of the sections). The false brome grassland is the preferred habitat in sub-humid areas (for example, in the pre-Pyrenees and more inland mountain ranges), whilst *Brachypodium retusum* grassland is more often the chosen habitat in areas of semi-arid climate (Ebro Depression and some areas of the Garraf mountains). Less commonly, the Spanish Festoon is found in scrub dominated by rosemary *Rosmarinus officinalis*, thyme *Thymus* spp. and blue aphyllanthes *Aphyllantes monspeliensis*, in communities dominated by annual plants and *Ampelodesma mauritanica* or in other plant communities typical of low-lying calcareous areas.

This close association with specific habitats can be explained by the monophagous nature of the species and the all but total dependence of Catalan populations on the birthwort *Aristolochia pistolochia*, a calcicole plant that appears in scrub under 1,200 m a.s.l. (ref. 6). Exceptionally, populations of Spanish Festoon appear in siliceous areas where *A. pistolochia* is not present (for example, in a few areas in L'Alt Empordà); it is possible that here the food plant is another birthwort, *Aristolochia longa*, a calcifuge species that is the preferred food plant in some populations in the south of the Iberian Peninsula[7]. The bibliography also cites *A. rotunda* as a food plant in some European populations of the Spanish Festoon[1], although there is nothing to confirm this fact in Catalonia.

Phenology and biological cycle

The Spanish Festoon is a monovoltine butterfly that flies only in spring (fig. 2). Aside from areas of the pre-Pyrenees, where a few festoons are still on the wing in June, its flight period is restricted to the months of March, April and May. In the Ebro Depression and Garraf mountains the first butterflies are seen in the first weeks of March (and even at the end of February; fig. 2a and b), whereas in more northerly locations (for example, Bages and El Berguedà) it is rare to see the species before the beginning of April (fig. 2c). In these latter areas the flight period is more compact than in the east of Catalonia, where emergence dates are more irregular. This is due possibly to the fact that in more continental areas the climate at the end of winter is more variable and depending on the year the single annual generation of the festoon may be advanced or delayed. Even so, the averaged-out data for all the years of the CBMS programme indicate that the maximum abundance of the species coincides in the three geographical areas shown in figure 2 in the second half of April. As of yet, no evidence of a second summer-autumn generation has been found in Catalonia, as occurs in certain areas of the Iberian Peninsula[8] and Morocco[9] where *A. pistolochia* flowers for a lot longer.

During the flight period, females festoons generally lay their eggs on the backs of leaves or on the flowers of *A. pistolochia* and only sometimes on the topside of leaves or on flower stalks. The eggs,

laid in clusters one-by-one or occasionally in groups of two or three, are shiny white, just under 1 mm in diameter, almost round, smooth and without any type of relief. The caterpillars hatch in about two weeks and customarily hide inside the flowers by making a hole at the base of the inflated corolla tube[10]. The caterpillars are not very mobile and once they have grown they are easy to find on the stalks and leaves of the host plant. They are characteristically yellow or brown-red, with a series of short black lines and 4-6 spines on each segment. The larval stage lasts for around six weeks and finishes as the host plants begin to die. The butterfly winters as a chrysalis and –at least in captivity- it is not unusual for two winters to pass before the adult butterfly emerges[11]. We have no information as to whether this is habitual in natural populations.

Population tendencies

Due to pressure from collectors and the loss of habitat, three decades ago the Spanish Festoon was included in the first Red Data Book of Spanish Lepidopters[12]. Nevertheless, more recent analyses show that the species' populations are in fact stable[13] and in Catalonia, without ever being anywhere abundant, it is widespread and found in a great number of sites and cannot be thought of as under threat. Nevertheless, some populations occupy very small, well-defined sites and so may be threatened more than other species by the alteration and destruction of habitat or even by collection. It seems that La Serra de Collserola is possibly the only site in Catalonia from which this species is documented as having disappeared[4]. Albeit only on a short timescale, it is worth pointing out that no CBMS station has shown either positive or negative tendencies in its populations of Spanish Festoon. At local scale, oscillations may well be determined by the impact of a specific parasitoid, the icneumonid wasp, *Agrypon polyxenae*, which attacks the larvae and then emerges from the chrysalis[14]. Nevertheless, this affirmation needs to be tested as no data regarding parasitism in Catalonia exists.

Constantí Stefanescu

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Fig. 1. Relative abundance of the Spanish Festoon *Zerynthia rumina* (expressed as the value of the annual index /100 m) in the different stations of the CBMS network (1994-2005).

Fig. 2. Phenology the Spanish Festoon *Zerynthia rumina* in (a) the Ebro Depression (data from five stations: Timoneda d'Alfés, Mas de Melons, Granja d'Escarp, Aiguabarreig and Sebes), (b) Garraf (data from two stations: Vallgrassa and Olesa de Bonesvalls), and (c) Llobregat valley (data from two stations: Sallent and Gironella).

Taula 1. Dominant plant communities in the sections of the different CBMS itineraries in which the Spanish Festoon *Zerynthia rumina* attains population densities of over 0.1 exemplars/100 m.

Photos. (a) Eggs nearly to hatch; (b) last instar larva; (c) pupa; and (d) adult of *Zerynthia rumina* (photographs: J. R. Salas).

Identification

How to separate the Catalan species of the genus Carcharodus

Amongst the skippers, the genus *Carcharodus* is one of the easiest to separate. The commonest species, the Mallow Skipper *C. alceae*, is found throughout Catalonia and is the only one that also flies in the Balearic Islands. However, this species can co-exist with Tufted Marbled Skipper *C. flocciferus*, Southern Marbled Skipper *C. boeticus* and Marbled Skipper *C. lavatherae*, all much rarer and more localised species.

Of the four species, the Mallow Skipper *C. alceae* is the most generalist and in Catalonia is fairly ubiquitous, appearing in 77% of CBMS stations. It prefers somewhat degraded habitats (waysides and even urban areas such as Barcelona[1]) with an abundance of mallows. The Tufted Marbled Skipper *C. flocciferus* (8% of itineraries) lives in mountainous areas, above all in the north of the country. The Southern Marbled Skipper *C. boeticus* (12% of itineraries) and Marbled Skipper *C. lavatherae* (21% of itineraries) frequent drier habitats: the former is common in central and southern Catalonia and is also found in the north along the coast (for example, in Els Aiguamolls de l'Empordà). The Marbled Skipper *C. lavatherae* is found from the coast to the Pyrenees, usually in very localised populations. The Mallow Skipper feeds on mallows such as common mallow *Malva sylvestris* and more rarely on dwarf mallow *Malva neglecta*, musk mallow *M. moschata*, marsh mallow *Althaea officinalis*, abutilon *Abutilon teophrasti* and lavateras *Lavatera* sp.[1]. The other three species use Labiates: the Tufted Marbled Skipper seems to prefer betony *Stachys officinalis*[2], although in El Montseny it possibly also uses yellow woundwort *S. recta* and black horehound *Ballota nigra*[2]; the Southern Tufted Skipper feeds on white horehound *Marrubium vulgare* and black horehound[1]; finally, *C. lavatherae* feeds on yellow woundwort, *Sideritis hirsuta* and *S. scordioides*[3], although there are no definite records as yet from Catalonia.

The larvae build shelters by sewing together one or more leaves with silken threads, which are then also used by the larvae to hibernate and by the chrysalis. Mallow and Southern Marbled Skippers are polyvoltine and fly in three or more successive generations from March-April to September-October. On the other hand, the Tufted Marbled Skipper is bivoltine (May-June and July-August) and the Marbled Skipper is monovoltine, flying at the beginning of summer.

Jordi Dantart

[1] J. Dantart & C. Stefanescu, unpublished data.

[2] Albrecht, M., Goldschalt, M. & Treiber, R., 1999. "Der Heilziest-Dickkopffalter *Carcharodus floccifera* (Zeller, 1847) (Lepidoptera, Hesperiidae). Morphologie, Verbreitung, Ökologie, Biologie, Verhalten, Lebenszyklus, Gefährdung und Schutz einer interessanten Tagfalterart". *Nachr. ent. Ver. Apollo, Frankfurt am Main, Suppl.*, 18: 1-256.

[3] Lafranchis, T., 2000. *Les papillons de jour de France, Belgique et Luxembourg et leurs chenilles*. Collection Parthénope, éditions Biotope, Mèze.

Drawings

MALLOW SKIPPER
Upperside (general): chocolate-brown marbling with grey shadows and black markings; white markings below apex and in discal area of fore-wing, but absent or faint on hind-wings.
Underside (general): brown with small discal and submarginal markings.
Marked with arrow:
Upperside (general): white discal mark often comma-shaped.
Underside (male): no hair tuft at the base of the fore-wing.

TUFTED MARBLED SKIPPER
Upperside (general): grey marbling with black and brown markings; white markings under apex and in discal area are larger on fore-wings; white markings in basal, discal postdiscal areas are obvious on hind-wings.
Underside (general): grey-green with white markings.
Marked with arrow:
Upperside (general): large white discal mark.
Underside (male): hair tuft at the base of the fore-wing.
Underside (general): white submarginal markings extending along veins.

SOUTHERN MARBLED SKIPPER
Upperside (general): fore-wings with rounded margin, grey or pale brown with marbling and dark markings.
Underside (general): hind-wings yellowy grey with a very obvious series of white marks and white veins.
Marked with arrow:
Upperside (general): hind-wings dark grey with obvious white basal, discal and postdiscal markings.
Underside (male): hair tuft at the base of the fore-wing.

MARBLED SKIPPER
Upperside (general): fore-wings yellowy-grey with marbling and darker markings; hind-wings much darker with obvious white basal, discal and postdiscal markings.
Underside (general): hind-wings yellowy-white with white markings that blend into ground colour.
Marked with arrow:
Upperside (general): fore-wings with large marks under apex and, above all, in discal area.
Underside (male): no hair tuft at the base of the fore-wing.

The colouration of the fore-wings in the four species varies: brown in the Mallow Skipper, dark grey in the Tufted Marbled Skipper, grey or pale brown in the Southern Marbled Skipper and yellowy-grey in the Marbled Skipper. In the latter species, the hind-wings are dark grey and contrast notably with the fore-wings. The Mallow Skipper can be separated from both Southern Marbled and Marbled Skippers by the brown as opposed to dark-grey colour of its undersides. The Tufted Marbled Skipper differs from the Mallow Skipper in the conspicuous white markings on the uppersides and the elongated white markings extending along the veins on the under hind-wing. Unlike the other two species, male Tufted Marbled and Southern Marbled Skippers both have androconial hair tufts at the base of the under fore-wing.

Identification

How to separate the Catalan species of the genus Coenonympha

Four species of the genus *Coenonympha* fly in Catalonia: the commonest is Small Heath *C. pamphilus*, which appears in various habitats in over half of the CBMS itineraries. Both Pearly *C. arcania* and Dusky Heath *C. dorus* are also fairly common: the former prefers more humid environments than the latter, although both do at times coincide and can be confused. The fourth species, Chestnut Heath *C. glycerion*, is much rarer and more localised and can be easily separated from the others by the marking on the underside of the hind-wing.

The biology of these butterflies is fairly similar. They overwinter as larvae, which feed on various species of grass[1]. Other than the Small Heath, all are monovoltine and fly from the end of spring to mid-summer. The Small Heath has appeared in 42 CBMS counts (53%) and is the only species of the genus that flies in the Balearic Islands[2], appearing -albeit in small numbers- in both of the itineraries on Menorca. It lives in slightly humid pastures from sea-level to alpine areas and flies in two or three successive annual generations from March-April until September-October. The Pearly Heath is the second commonest species of the genus in Catalonia and has been detected in 37 stations (46%). It is commonest in areas of more central European climate and appears –although rather less frequently- in Mediterranean areas with a touch of humidity. It is common in the mountains of southern Catalonia. The Dusky Heath has been recorded from 29 stations (36%) and shows a strong preference for more arid sites. Its greatest densities are found in some of the coastal mountains (for example, Collserola, Garraf and Montmell) and in interior regions such as Bages, although some also fly in the driest areas of the Pyrenees. Finally, the Chestnut Heath (represented in Catalonia by the subspecies *iphioides*) is the rarest of the four. It lives in isolated populations at mid-altitude in the Pyrenees and pre-Pyrenees and very locally in the Ports de Tortosa. So far it has only been detected in 5 stations (6%).

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[1] Tolman, T. & Lewington, R., 2002. *Guía de las mariposas de España y Europa*. 320 pàg. + 104 pl. Lynx Edicions, Bellaterra.

[2] Pons, G.X., 2000. *Les papallones diürnes de les Balears*. 87 pp. Edicions Documenta Balear, Palma.

Drawings

SMALL HEATH
Upperside (general): uniform golden brown with small, poorly marked eye-spot at apex of fore-wing.
Underside (general): golden brown fore-wing apart from greyish apex with well-marked eye-spot; hind-wing greyish, sometimes with the basal area darker and with (or sometimes without) poorly marked eye-spots.
Marked with arrow:
Underside: paler postdiscal band is in the central part of the wing.

PEARLY HEATH
Upperside (general): fore-wing mainly golden-coloured with a broad darkish marginal band, broader in male; hind-wing darker (sometimes with a paler basal area), with a narrow golden-coloured marginal band at the anal angle.
Underside (general): fore-wing golden-coloured with an eye-spot at the apex (often vestigial); hind-wing brown-grey, with a broad irregular white band.
Marked with arrow:
Underside: broad irregular white postdiscal band, outlined externally by a variable number of obvious but irregularly sized eye-spots (4-5, sometimes just 2-3), with one larger eye-spot displaced inwards at the beginning of the series.

DUSKY HEATH
Upperside (male): fore-wing dark brown; hind-wing with the basal half dark and the marginal half golden-coloured.
Upperside (female): fore-wing golden brown, with obvious dark marginal band; hind-wing similar to male.
Underside (general): grey-brown, with a broad white band occupying the postdiscal and submarginal areas.
Marked with arrow:
Upperside: black eye-spots normally visible on fore-wing.
Upperside: very broad white band in postdiscal and submarginal areas, outlined internally by first eye-spot of the series and externally by the second and third eye-spots, with a variable number of eye-spots (normally three) inside the white band.

CHESTNUT HEATH
Upperside (male): fore-wing dark brown, paler nearer the costa and the basal area; hind-wing uniformly dark, outlined in part by a narrow golden-coloured marginal band.
Upperside (female): fore-wing golden brown with a narrow darker premarginal band; hind-wing uniformly dark, outlined mostly by a narrow golden-coloured marginal band.
Underside (general): fore-wing uniformly golden-coloured other than in the rather greyer apex; apical eye-spot often small and hard-to-see; hind-wing grey with postdiscal eye-spots ringed in white and with a narrow golden-coloured marginal band.
Marked with arrow:
Underside: large eye-spots ringed in white arranged in a regular arc and with an internal white mark of varying size between the second and third eye-spot of the series.

In general, these species occupy different habitats, although in some dry mountain areas all four species species may co-exist. The Small Heath is easily separable by its lack of eye-spots on the underside. In the Chestnut Heath these eye-spots are regular both in size and in their arrangement in an arc; in both Pearly and Dusky Heath eye-spots vary in size and are arranged differently. The patterning on the upperside of Dusky Heath is another useful characteristic for separating this species. All four species present a certain sexual dimorphism, particularly obvious in Dusky Heath.

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