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Contribution to the knowledge of the spring butterfly fauna of the Republic of Macedonia (Lepidoptera: Papilionoidea & Hesperioidea)

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Abstract. In spring 2010, we encountered 60 butterfly species during field surveys centred mainly in the under-surveyed southeastern part of the Republic of Macedonia. We visited 23 localities, where several interesting observations were made. Among these, new sites of some rare species such as *Pontia chloridice*, *Pieris krueperi*, *Plebejus sephirus*, *Scolitantides orion*, *Tarucus balkanicus*, *Melitaea ornata*, *Carcharodus orientalis*, and *Erynnis marloyi* should be mentioned. Such a high number of species observed indicates an overall high butterfly diversity of this region, particularly in the lower Vardar valley. Here, several specific habitats hosting rare and threatened species were discovered. The anthropogenic pressure on important butterfly habitat is still low in the surveyed area; however, the first signs of large scale abandonment are already visible.

Key words: fauna, habitat specialists, threatened species, Rhopalocera, distribution

Izvleček. PRISPEVEK K POZNAVANJU POMLADANSKE FAVNE DNEVNIH METULJEV REPUBLIKE MAKEDONIJE (LEPIDOPTERA: PAPILIONOIDEA & HESPERIOIDEA) – Spomladi 2010 smo med terenskimi raziskavami, usmerjenimi predvsem v manj raziskani jugovzhodni del Republike Makedonije, zabeležili 60 vrst dnevnih metuljev. Obiskali smo 23 lokacij in našli številne zanimive in redke vrste. Med njimi lahko posebej omenimo nova najdišča za *Pontia chloridice*, *Pieris krueperi*, *Plebejus sephirus*, *Scolitantides orion*, *Tarucus balkanicus*, *Melitaea ornata*, *Carcharodus orientalis* in *Erynnis marloyi*. Veliko število opaženih vrst v pomladanskem obdobju nakazuje visoko vrstno pestrost dnevnih metuljev tega območja, še posebej spodnjega dela doline reke Vardar. Tu smo odkrili nekaj specifičnih življenjskih okolij z redkimi in ogroženimi vrstami metuljev. Antropogeni vpliv na življenjski prostor, pomemben za metulje, je na tem območju še vedno omejen, po drugi strani pa se nekatera območja velikih travniških površin pospešeno zaraščajo.

Ključne besede: favna, habitatni specialisti, ogrožene vrste, Rhopalocera, razširjenost

Introduction

Butterflies are commonly one of the best studied groups of insects in countries where systematic faunistic surveys are sparse. The Republic of Macedonia is no exception with first large scale survey dating back to Rebel (1913) and Alberti (1922). A list of species with an overview of published records followed in 1964 (Thurner 1964) and in 1989, when a butterfly atlas was published by Schaider & Jakšić (1989). The grid size of the atlas is 10x10 km, which provides a good overview of butterfly distribution in the country. The negative side of the atlas is the non discriminatory use of all records, including questionable observations, making some maps misleading. Among the species not confirmed by recent surveys, the *Lycaena ottomana* (Lefèbvre, 1830), *Plebejus dardanus* (Freyer, 1844), *Erebia alberganus* (de Prunner, 1798), and *Pseudochazara graeca* (Staudinger, 1870) are the most prominent examples.

In the years that followed the atlas, several additional species were discovered (Krpač & Mihajlova 1997, Micevski et al. 2009, Thomas 1993, Verovnik & Micevski 2008, Verovnik et al. 2010), bringing the total of species known in Macedonia to 203. The list is still not complete and several additional species whose range is close to Macedonia are still expected to be found. This makes the Republic of Macedonia one of the butterfly richest countries in Europe, especially considering its small size. The main factor influencing the high diversity is the predominantly mountainous relief with several high mountain ranges and steep gorges providing microclimatic conditions for species whose range in Europe is very limited. Such regions, especially the Treska gorge, are also among the best surveyed in Macedonia, leaving relatively large areas of the country still unexplored or understudied.

The main aim of our study was to add faunistic records for spring butterflies in the sparsely surveyed south-eastern part of Macedonia. These records are particularly valuable, as spring occurring species are less studied than those flying in summer in high season for the majority of butterfly species. During our surveys we tried to cover a wide variety of habitats present in this region to provide for a complete overview of the butterfly fauna.

Material and methods

Our field survey was conducted between 24.4.2010 and 1.5.2010. In total, 23 localities were visited (Fig. 1). The selection of sites and regions with potential interesting habitat was made before the trip with the use of Google Earth images. Adult butterflies were netted using entomological nets and released after identification, or identified in nature.

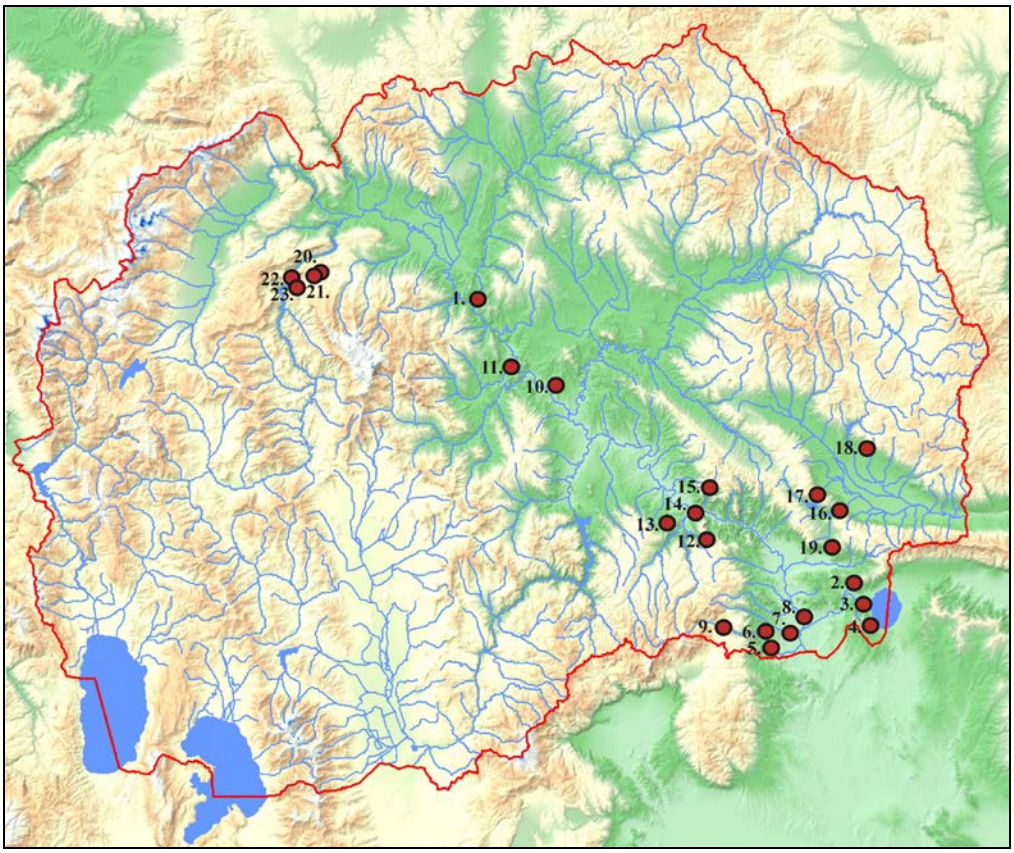

Figure 1. Distribution of visited sites during the survey of butterfly fauna in spring 2010. The numbering corresponds with the list of localities.
Slika 1. Razporeditev obiskanih lokalitet med raziskavo v Makedoniji pomladi 2010. Oštevilčenje ustreza seznamu lokalitet.

Results

List of localities

The list of localities contains the relevant toponyms, a short description of the habitat, altitude, coordinates and date of the visit. The localities are arranged in chronological order.

1. Veles, Pčinja Valley at St. Jovan monastery, path in woods and bushy slopes; 256 m; 41°49,482; 21°41,170; 24.4.2010.
2. Dojran, above Gopčeli village, small bushy gorge and pastures; 380 m; 41°15,394; 22°40,151; 25.4.2010.
3. Dojran, along the road NW of Nov Dojran, small abandoned quarry, wet meadow at a spring, rocky slopes; 165 m; 41°13,800; 22°41,685; 25.4.2010.
4. Dojran, slopes above Star Dojran, dry stony pastures, bushes, 208 m; 41°10,707; 22°42,597; 25.4.2010 and 30.4.2010.
5. Gevgelija, along Konska River at Moin village, bushy gravels, dry meadows; 120 m; 41°08,202; 22°27,110; 26.4.2010.
6. Gevgelija, E of Gorničet village, abandoned meadows, pastures with juniper bushes; 160 m; 41°08,975; 22°26,778; 26.4.2010.
7. Gevgelija, along Sermeninska River at Mrzenci village; gravels and dry bushy meadows; 75 m; 41°09,817; 22°29,652; 26.4.2010.
8. Gevgelija, along Vardar River NW of Gavato village, rocky and bushy slopes, pastures; 60 m; 41°11,893; 22°31,799; 26.4.2010.
9. Gevgelija, Gorničet, road verge E of the town, steep eroded slopes; 270 m; 41°09,973; 22°24,472; 27.4.2010.
10. Veles, Kočilari, side valleys of Vardar SE of the village, dry sandy grasslands; 160 m; 41°39,843; 21°52,551; 27.4.2010.
11. Veles, last part of Topolka Gorge, steep arid slopes with sparse grassy vegetation and bushes; 224 m; 41°41,915; 21°46,927; 27.4.2010.
12. Demir Kapija, above Dren village, meadows and abandoned pastures; 260 m; 41°21,774; 22°15,108; 28.4.2010.
13. Demir Kapija, gorge east of Besvica village, rocky and bushy slopes, dry grasslands; 260 m; 41°22,995; 22°11,413; 28.4.2010.
14. Demir Kapija, slopes N of the gorge on the S side of the river, rocky slope with sparse bushes; 180 m; 41°24,197; 22°15,491; 28.4.2010.
15. Demir Kapija, valley south of Čelavec village, pastures, woodland edges and bushes; 150 m; 41°25,107; 22°16,166; 28.4.2010.
16. Strumica, alluvium of Trkajna River south of the town; bushy gravels; 265 m; 41°24,689; 22°38,155; 29.4.2010.
17. Strumica, along the road above the valley E of Vodoča dam, woodland path, eroded slopes; 410 m; 41°25,504; 22°34,422; 29.4.2010.
18. Strumica, small valley bellow the road NW of Hamzali monastery, pastures, rocky dry meadows; 400 m; 41°30,691; 22°45,224; 29.4.2010.
19. Valandovo, dry riverbed E of the town, overgrown dry meadows on gravels; 170 m; 41°19,160; 22°36,340; 29.4.2010.
20. Mt. Suva Planina, plateau W of Nova Breznica, dry calcareous grasslands, wet meadows in the depressions;1036 m; 41°53,424; 21°14,256; 1.5.2010.

21. Mt. Suva Planina, ridge above Kozjak Lake W of Nova Breznica, screes bellow the ridge, dry calcareous grasslands, 1054 m; 41°53,320; 21°13,694; 1.5.2010.
22. Treska valley, at Kozjek Lake dam, rocky slopes; 470 m; 41°52,646; 21°11,470; 1.5.2010.
23. Treska valley, small side valley SE of the Kozjek Lake dam; steep rocky slopes and screes; 510 m; 41°52,524; 21°12,353; 1.5.2010.

List of species

Butterflies are listed in taxonomical order following the nomenclature of the Red List of European Butterflies (van Swaay et al. 2011). As butterflies were not collected and genitalia were not measured, we list *Leptidea sinapis* as *Leptidea sinapis/juvernica* species complex.

Table 1. The distribution of butterfly species observed during the spring field survey in Macedonia in 2010. The localities are numbered as in the List of localities chapter. D&S stands short for Denis & Schiffermüller.
Tabela 1. Razširjenost dnevnih metuljev, opaženih med pomladansko raziskavo v Makedoniji leta 2010. Lokalitete so oštevilčene kot v poglavju seznam lokalitet. D&S je okrajšava za Denis & Schiffermüller.

Species	Localities
Papilionidae	
Iphiclides podalirius (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 19, 20, 21
Papilio machaon Linnaeus, 1758	3, 4, 5, 7, 10, 11, 16, 20, 21, 22, 23
Zerynthia cerisy (Godart, 1824)	8, 13, 15, 17
Zerynthia polyxena ([D&S], 1775)	4, 6, 7, 8, 9, 13, 15, 18, 20
Pieridae	
Anthocharis cardamines (Linnaeus, 1758)	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 19, 20
Anthocharis gruneri (Herrich-Schäffer, 1851)	1, 11, 13, 21
Colias crocea (Geoffroy, 1785)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 19
Euchloe ausonia (Hübner, 1804)	2, 3, 4, 5, 7, 8, 12, 13, 15, 16, 19, 22
Euchloe penia (Freyer, 1852)	21, 22
Gonepteryx rhamni (Linnaeus, 1758)	2, 4, 9, 11, 12, 20, 23
Leptidea duponcheli (Staudinger, 1871)	10, 11, 13, 20, 21, 23
Leptidea sinapis/juvernica	1, 2, 4, 5, 6, 7, 8, 9, 12, 13, 15, 16, 17, 18, 19
Pieris balcana (Lorković, 1968)	4, 5, 15
Pieris brassicae (Linnaeus, 1758)	4, 7, 8, 11, 14
Pieris ergane (Geyer, 1828)	1, 11, 20, 21
Pieris krueperi (Staudinger, 1860)	8, 11
Pieris mannii (Mayer, 1851)	5, 9, 12, 14, 19
Pieris napi (Linnaeus, 1758)	3, 7, 8, 18
Pieris rapae (Linnaeus, 1758)	2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 16, 18, 19
Pontia chloridice (Hübner, 1813)	5, 7
Pontia edusa (Linnaeus, 1758)	4, 7, 10, 11, 15
Lycaenidae	
Aricia agestis ([D&S], 1775)	1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18, 19
Callophrys rubi (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 23
Celastrina argiolus (Linnaeus, 1758)	4, 5, 6, 7, 8
Cupido minimus (Fuessly, 1775)	11, 23
Cupido osiris (Meigen, 1829)	2, 4, 5, 13
Glaucopsyche alexis (Poda, 1761)	1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 15, 16, 17, 18, 22, 23
Lycaena phlaeas (Linnaeus, 1761)	1, 2, 4, 5, 7, 8, 9, 10, 11, 13, 16, 18
Lycaena tityrus (Poda, 1761)	2, 4, 6, 7, 8, 10, 11, 16, 18
Plebejus sephirus (Frivaldzky, 1835)	13
Polyommatus bellargus (Rottemburg, 1775)	11

Species	Localities
Lycaenidae (continued)	
Polyommatus icarus (Rottemburg, 1775)	2, 4, 5, 6, 7, 9, 10, 11, 12, 13, 15, 17, 18, 19, 22, 23
Polyommatus thersites (Cantener, 1835)	2, 4, 10, 11, 13, 17
Pseudophilotes bavius (Eversmann, 1832)	23
Pseudophilotes vicrama (Moore, 1865)	4, 5, 6, 7, 8, 9, 10, 11, 13, 16, 20
Scolitantides orion (Pallas, 1771)	16, 17
Tarucus balkanicus (Freyer, 1844)	10, 11, 13
Nymphalidae	
Aglais io (Linnaeus, 1758)	1, 8, 10, 12
Coenonympha pamphilus (Linnaeus, 1758)	3, 4, 6, 7, 8, 9, 10, 11, 16, 17, 19
Issoria lathonia (Linnaeus, 1758)	1, 2, 4, 6, 7, 8, 13, 15, 16, 18, 19, 20, 23
Lasiommata megera (Linnaeus, 1767)	2, 3, 4, 5, 6, 7, 11, 12, 13, 15, 16, 17, 18, 19
Libythea celtis (Laicharting, 1782)	2, 8, 11, 13, 15, 18
Limenitis reducta (Staudinger, 1901)	4, 6, 8, 13, 15
Melitaea cinxia (Linnaeus, 1758)	1, 4, 6, 9, 13, 17
Melitaea ornata Christoph, 1893	2, 4, 10, 11, 13, 14, 17, 18
Melitaea trivia ([D&S], 1775)	11
Nymphalis antiopa (Linnaeus, 1758)	1, 8, 10, 11, 14
Nymphalis polychloros (Linnaeus, 1758)	1, 13
Pararge aegeria (Linnaeus, 1758)	6, 8, 11, 13, 15
Polygonia c-album (Linnaeus, 1758)	8, 10, 13
Vanessa atalanta (Linnaeus, 1758)	4, 11, 13, 16, 17, 18
Vanessa cardui (Linnaeus, 1758)	2, 4, 5, 7, 8, 9, 10, 11, 13, 15
Hesperidae	
Carcharodus alceae (Esper, 1780)	2, 4, 8, 10, 11, 12, 20, 23
Carcharodus orientalis Reverdin, 1913	2, 4, 13, 19
Erynnis marloyi (Boisduval, 1834)	13, 23
Erynnis tages (Linnaeus, 1758)	2, 10, 11, 12, 13, 15, 17, 20
Pyrgus armoricanus (Oberthur, 1910)	2, 4, 11, 13, 15, 18, 19
Pyrgus malvae (Linnaeus, 1758)	6, 9, 12, 13, 15, 16, 17, 20
Pyrgus sidae (Esper, 1784)	17
Spialia orbifer (Hübner, 1823)	4, 7, 9, 10, 12, 13, 16, 19

Discussion

In many cases, the early spring butterfly fauna is less studied compared to the peak season in June or July, especially in the countries where faunistic data are published mainly by foreign authors. The Republic of Macedonia is no exception, therefore distribution of several species with flight period limited to the spring is not well known. In order to fill this gap, we surveyed large part of the country, but stayed mostly in the warmer lowland regions where diversity of butterflies was expected to be higher in early season. Thus we concentrated on the surveys of the Vardar Valley and wider surroundings of Lake Dojran. A total of 60 species observed is extremely high for the survey in the last week of April and it could be attributed to the early season due to favourable weather conditions in spring 2010.

The commonest species during the survey was *Callophrys rubi*, which was recorded at 21 sites. It is interesting to note that its recorded distribution in Macedonia is rather patchy (Schaider & Jakšić 1989). It was recorded from many new squares during our survey. As this is an exclusively early spring occurring species, our records indicate its much wider distribution in Macedonia. Among the species normally not flying in April, the following early records are interesting: *Plebejus sephirus*, *Polyommatus bellargus*, *Melitaea trivia* and *Pyrgus sidae*. We paid special attention to specific habitats during our surveys, where rare and local butterfly species were expected to be found. These are dealt with in detail bellow:

- *Pontia chloridice* – It is a habitat specialist utilizing sites with regular disturbance enabling its host plant *Cleome ornithopodioides* to grow (John et al. 2008). It was observed at two sites on gravels along streams near Gevgelija. These finds and its occurrence in Macedonia have been recently reviewed by Franeta et al. (2011).
- *Pieris krueperi* – Another habitat specialist limited to warm rocky gorges. We found it in the Topolka valley, from where it had already been reported by Thurner (1964), and at a new site north of Gevgelija on the rocky slopes above the Vardar River at Gavato village. This is the first record of the species from the lower part of the Vardar Valley in Macedonia.
- *Plebejus sephirus* – This is a predominantly mountainous species in the southern part of the Balkan Peninsula. The presence of a single male in the gorge east of Besvica village to the south from Demir Kapija was therefore a big surprise. The larvae of this species are feeding on *Astragalus* sp., possibly on *A. excapus* in Macedonia (Tolman & Lewington 2008). Non-flowering plants of an unidentified *Astragalus* were observed on dry sandy meadows at the site.
- *Scolitantides orion* – According to Schaider & Jakšić (1989), the species is rare in Macedonia and mainly limited to the western part of the country. It is again a habitat specialist utilizing screes and rocky areas, where its host plants *Sedum* sp. are growing. We found it on wide gravels SE of Strumica and on eroded slopes along the path at Vodoča dam. These are the first records from SE part of Macedonia.
- *Tarucus balkanicus* – The species has a very limited range in Macedonia with records scattered mainly in the southern half of the country (Schaider & Jakšić 1989). We found it in the Topolka Valley, where it had already been discovered by Thurner (1964), and at two new sites at nearby Kočilari in the Vardar Valley further south from the Topolka and in the gorge east of Besvica village near Demir Kapija.
- *Melitaea ornata* – This species was first mentioned for Macedonia by Verovnik et al. 2010 under the name *Melitaea telona*. Due to its morphological resemblance to a more widespread but not closely related *M. phoebe* (Leneveu et al. 2009), the status of *M. telona* was disputed until recently. Currently it has been confirmed that it is conspecific with and is a junior synonym of *M. ornata* from the European part of Russia south of the Urals (Tóth & Varga 2011, Tóth et al. 2012). Although the species can be identified safely only by adult larvae and their ecology (Russell et al. 2007), typically marked adults can also be provisionally assigned to one or another species. Additionally, the early occurrence in April is a good indication for *M. ornata*, as *M. phoebe* usually starts to fly from mid-May onwards (Tolman & Lewington 2008). We found putative *M. ornata* specimens with typical external characteristics at 8 new sites covering almost the entire surveyed area from the Strumica Valley in the east, to Lake Dojran and the middle part of the Vardar valley. The search for larval stages and host plants will be required to precisely delimit the distribution of *M. ornata* in Macedonia, and our records provide a good starting point for such surveys.

- *Carcharodus orientalis* – Due to its resemblance to *Carcharodus flocciferus* (Zeller, 1847), this is another poorly studied species in Macedonia. We found it at four sites, three in the wider surroundings of Lake Dojran and in Demir Kapija in the Vardar Valley. These records provide a further extension of the species' known range in Macedonia.
- *Erynnis marloyi* – This species reaches its northwestern limit in Macedonia and is therefore extremely rare and local, limited to the warmest regions, where it is usually confined to rocky gorges. This corresponds well with both sites, where it has been recorded during recent surveys. A single specimen was seen both in the gorge east of Besvica village near Demir Kapija and in the Treska Valley in a small gorge at Kozjek Lake dam.

Based on the recent European Red List of Butterflies (van Swaay et al. 2010), only two of the observed species *Zerynthia cerisy* and *Pseudophilotes vicrama* are listed as near threatened at the continental level. Both are widespread in Macedonia (Schaider & Jakšić 1989) and possibly locally not threatened. *Zerynthia cerisy* actually prefers a certain degree of habitat disturbance and it is commonly observed near or even within villages, where the host plant *Aristolochia clematitis* is growing (pers. observ.). Following the Red List of Butterflies for the Macedonian Republic (Krpač & Darcemont 2012), several additional threatened species found during our survey are listed: *Erynnis marloyi* (NT), *Zerynthia polyxena* (NT), *Euchloe penia* (VU), *Pieris krueperi* (NT), *Pontia chloridice* (VU), *Tarucus balkanicus* (NT), *Pseudophilotes bavius* (VU), and *Scolitantides orion* (NT). This assessment should, however, be considered tentative, as for many of the listed species the distribution and habitat requirements in Macedonia are not sufficiently known to allow designation of threat categories. *Pseudophilotes bavius*, for example, has been reliably recorded only from two sites in Macedonia (Thurner 1964) and not confirmed at Veles site in recent decades. The abundance of adults in the Treska-Matka Gorge has been steadily declining during last two decades due to overgrowing (pers. observ.) and it is not unlikely that the species is on the verge of extinction in Macedonia. Its presence at Kozjek Lake dam further upwards in the Treska Valley provides some hope it is still surviving in other localities along the river.

Once again, Macedonia has proved to be one of the most interesting counties for butterflies in Europe. Our survey provides a good overview of the spring butterfly fauna of the southeastern part of the country. However, only a more systematic approach targeting all under-surveyed regions would be required to fully understand the species distribution and endangerment. We hope this contribution will be seen as a step in this direction.

Figure 2. The Inky Skipper (*Erynnis marloyi*), a rare species in Macedonia, was found at two sites during the survey (photo: Rudi Verovnik).
Slika 2. Sivček vrste *Erynnis marloyi* je v Makedoniji redka vrsta. Našli smo ga na dveh novih lokacijah (foto: Rudi Verovnik).

Figure 3. The Krueper's Small White (*Pieris krueperi*) has been found for the first time in the lower part of the Vardar Valley (photo: Rudi Verovnik).
Slika 3. Krueperjev belin (*Pieris krueperi*) je bil prvič najden v spodnjem delu doline reke Vardar (foto: Rudi Verovnik).

Figure 4. The gorge east of the village Besvica was one of the most interesting localities with 37 species observed, including rare species like: *Plebejus sephirus*, *Tarucus balkanicus*, *Melitaea ornata*, *Carcharodus orientalis*, and *Erynnis marloyi* (photo: Barbara Zakšek).
Slika 4. Soteska vzhodno od vasi Besvica je bila ena izmed najbolj zanimivih obiskanih lokacij. Tu smo našli 37 vrst metuljev, med njimi tudi redke vrste: *Plebejus sephirus*, *Tarucus balkanicus*, *Melitaea ornata*, *Carcharodus orientalis* in *Erynnis marloyi* (foto: Barbara Zakšek).

Povzetek

Med 24. aprilom in 1. majem 2010 smo opravili raziskavo dnevnih metuljev pretežno v jugovzhodnem delu Makedonije. Obiskali smo 23 lokalitet in skupno zabeležili 60 vrst dnevnih metuljev. To je za tako zgodnji termin izjemno veliko število vrst, kar lahko pripišemo ugodnim vremenskim razmeram v tem delu Evrope leta 2010. Posebno pozornost smo namenili posebnim življenjskim prostorom, kjer smo pričakovali nekatere redke vrste dnevnih metuljev. Tako smo na prodiščih v okolici Gevgelije našli izjemno redkega predstavnika rodu selcev *Pontia chloridice*. Zanimive so tudi soteske, ki so v Makedoniji pogosto izrazito skalnate in tople. Tu smo med drugim našli nekatere redke in ogrožene vrste metuljev, kot so *Erynnis marloyi*, *Euchloe penia*, *Pieris krueperi*, *Tarucus balkanicus*, *Pseudophilotes bavius* in *Scolitantides orion*. Predvsem *Pseudophilotes bavius* je vrsta, ki ji zaradi zaraščanja grozi izumrtje v Makedoniji. Nova najdba te vrste pri akumulacijskem jezeru Kozjek v soteski Treske daje upanje, da se vrsta skriva še kje v nedostopnih delih te doline. Gledano v celoti je favna dnevnih metuljev Makedonije še vedno zelo površno raziskana. V prihodnje bi se bilo smiselno teh raziskav lotiti bolj sistematično in pregledati vsa slabo raziskana območja. Naš prispevek je korak v tej smeri in upamo, da jih bo sledilo še več.

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