

Notes on the distribution and conservation status of the Violet Copper *Lycaena helle* (Lepidoptera: Lycaenidae) in Bulgaria

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Abstract. This paper studies the rare and endangered butterfly *Lycaena helle* ([Denis & Schiffermüller], 1775) in Bulgaria, reporting two new records for the country, observations on habitat preferences and notes on other potential habitats. A detailed survey of the region shows that the very limited habitat base of the species has been deteriorating at an alarming rate for the last two decades. The causes of threat and proposed measures for conservation and population management are discussed.

Samenvatting. Gegevens over de verspreiding en beschermingsstatus van *Lycaena helle* (Lepidoptera: Lycaenidae) in Bulgarije

In dit artikel wordt de zeldzame en bedreigde dagvlinder *Lycaena helle* ([Denis & Schiffermüller], 1775) in Bulgarije besproken, met twee nieuwe vindplaatsen in dat land, waarnemingen van habitatvoorkeuren en notities over potentiële andere habitats. Een gedetailleerde studie van het gebied toont aan dat de reeds erg beperkte habitatbasis voor deze soort de laatste twee decennia in een alarmerend tempo sterk achteruit is gegaan. De oorzaken van de bedreiging en mogelijke beschermingsmaatregelen en populatiemanagement worden besproken.

Résumé. Notes sur la distribution et le degré de survivance de *Lycaena helle* (Lepidoptera: Lycaenidae) en Bulgarie
Dans cet article le cas de ce papillon rare et menacé *Lycaena helle* ([Denis & Schiffermüller], 1775) en Bulgarie est discuté. Deux nouvelles localités sont mentionnées dans ce pays, ainsi que les préférences de biotope et quelques notes sur des habitats potentiels sont fournies. Une étude détaillée de cette région montre que la situation des biotopes pour cette espèce est devenue pire durant les deux derniers décennies. Les causes de cette menace et de possibles mesures de protection et gestion sont discutées.

Key words: *Lycaena helle* – Bulgaria – Faunistics – Distribution – Conservation.

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Introduction

The Violet Copper *Lycaena helle* ([Denis & Schiffermüller], 1775) is a widespread Palaearctic species, whose range extends from northern Spain across the forest zone of Central and Northern Europe and Asia to China, North Korea and the Pacific coast of Russia (Gorbunov 2001, Settele *et al.* 2008). Despite occurring over such a vast territory, the Violet Copper is one of the most threatened butterfly species in Europe west of Russia. It has declined strongly (by 50 to 80 %) in Western and Central Europe during the last century and is currently considered extinct in Hungary, the Czech Republic, Italy, Latvia and Slovakia (Van Swaay *et al.* 2010b). In Eastern Europe, the decline is more recent and ongoing and the species is listed as Endangered (EN) in Europe (Van Swaay *et al.* 2010a). As a species of high conservation priority in Europe, *L. helle* is included in Annexes II and IV of the European Union Habitats Directive (Council of the European Communities 1992). The population reduction in Europe is a result mainly of habitat loss (IUCN criterion A2c) due to land drainage, afforestation and changes in traditional land use practices (Van Swaay *et al.* 2012).

Until very recently, there were no indications that *L. helle* might be present on the Balkan Peninsula. The nearest record to this area is old collection material from Romania, București: Chitila, 20.v.1889, coll. Salay (Popescu-Gorj 1964). While very close to the Balkan

Peninsula indeed, this population is now apparently extinct (Székely 2008, 2011). The nearest known extant populations are in Central Romania, north of the Carpathian chain (Székely 2008; Rákósy 2013). Therefore it came as a considerable surprise when *L. helle* was discovered in Eastern Serbia, in the Stara Planina mountain chain, as recently as 2011. This discovery was first published, almost as a footnote without further details, in a field guide to Serbian butterflies (Popović & Đurić 2011). More details were published online, identifying the locality as Mt. Ponor, near Dojkinci village (Popović 2011). Shortly afterwards, photographs of *L. helle* specimens (adults, eggs and first-instar larvae) from the Bulgarian part of Western Stara Planina together with exact geographic co-ordinates were published in the online database Observado.org by Dutch ornithologists (Anonymous 2012). The available details relating to the Serbian and Bulgarian records have just been published (Popović *et al.* 2014).

Considering the high interest presented by *L. helle* in zoogeographical as well as conservation aspect, the present paper makes an important and timely contribution by detailing the independent surveys carried out by the present authors in the Bulgarian territory of the Western Stara Planina range. This research has resulted in a significant accumulation of information on the distribution, habitat preferences, threats and future priorities for research and conservation of this remarkable species in Bulgaria and the Balkan Peninsula.

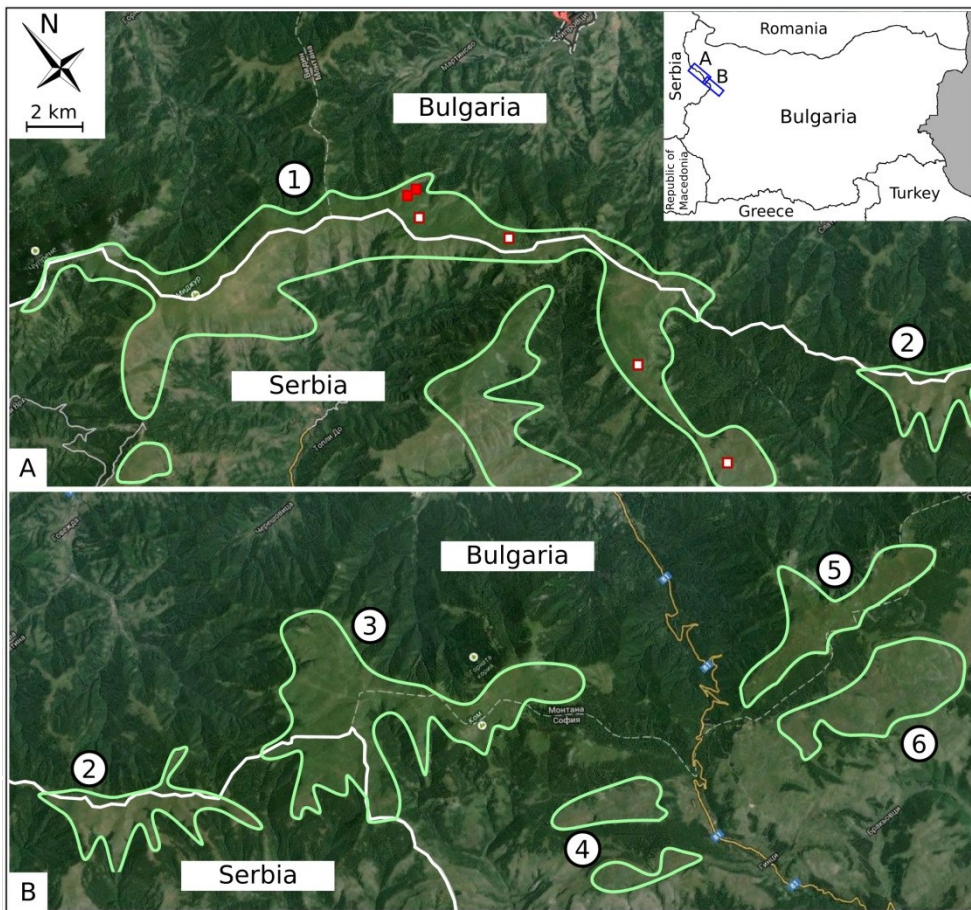


Figure 1. Map of W Stara Planina with the areas containing potential habitat for *Lycaena helle*:

1. Midzhur-Kopren;
2. Dalgi Del;
3. Kom;
4. Gintsi;
5. Todorini Kukli;
6. Magareshnitsi.

Records are shown with filled squares (new records) and empty squares (Popović *et al.* 2014). The inset shows the position of the two map panels A and B on the map of Bulgaria. The Bulgarian-Serbian border is shown with a continuous white line. Satellite images from Google Maps, (c) 2013 TerraMetrics.

Surveys for *L. helle* in the Bulgarian Western Stara Planina

The butterfly fauna of the Western Stara Planina region in Bulgaria and especially of the montane and subalpine zones is poorly studied. To the best of our knowledge, there have been only two dedicated studies of the region to date (Tuleschkow 1932, Beshkov 2000), both of them devoting only passing attention to the highest parts of the range. Recent studies, which have led to the discovery of some remarkable butterfly species in the Bulgarian part of western Stara Planina (Dincă *et al.* 2010), have focused exclusively on the lower, calcareous parts of the mountain south of the main ridge.

Our research on the butterfly fauna of the montane and subalpine zones of Western Stara Planina began in 2010, prior to the discovery of *L. helle* in Serbia, when we undertook an extensive search for the Nymphalid butterfly *Boloria eunomia* (Esper, 1799) in Western Stara Planina. In Bulgaria, *B. eunomia* is reliably known only from Central Stara Planina (Abadjiev 2001) and is one of the most poorly known butterfly species in the country. The recent discovery of this species at Babin Zub in Serbia (Jakšić *et al.* 2007), a mere 5 km from the Bulgarian border, was intriguing and suggested that this species could occur at the Bulgarian side of the border as well. It is important to note that both *B. eunomia* and *L. helle* are boreal relicts inhabiting wet mountain grassland

habitats near and above the tree line; in addition, they share the same larval food-plant, *Polygonum bistorta* (Polygonaceae) (Tolman 2008, Jakšić *et al.* 2007, Popović *et al.* 2014). Hence, our initial surveys for *B. eunomia* are relevant for *Lycaena helle* as well, although at the time we were unaware of the existence of a population of the latter species in the region.

As our research progressed in 2010–2012, we identified six different areas in Western Stara Planina that were likely to host suitable habitats for *L. helle* and *B. eunomia*. Those areas are shown in the map in Fig. 1. In the rest of this section, we describe the history of our surveys that culminated in our records of *L. helle* in June 2013. An overview of the characteristics of the six areas and a summary of our surveys is given at the end of this section.

Our visits in the area were on 9.vii.2010, 26.vi.2011 (N. Shtinkov), 9.vii.2011 (N. Shtinkov and Z. Kolev) and 18.vii.2011 (N. Shtinkov). We surveyed vast areas containing an abundance of *Polygonum bistorta* west of Petrohan pass in the vicinities of Kom peak (area 3 in Fig. 1), near and well above the tree line. We carried out a detailed survey of the areas with *P. bistorta* for the highly local and rare *B. eunomia*, examining the inflorescences of each clump of *P. bistorta* at close distance. We did not observe *L. helle* (or, for that matter, *B. eunomia*), although it is likely that the flight period of *L. helle* had ended by then.

After becoming aware of the discovery in 2011 of *L. helle* in Serbia and taking into account the known character of the Serbian localities, especially that on Ponor, we set out to identify and research potentially suitable areas in Bulgaria. We combined geological data (Gerasimov & Galabov 1966), satellite imagery and geotagged digital photographs in Google Earth® and identified as most closely corresponding, although somewhat distant, geographical features a series of depressions east of Petrohan pass. These lie at altitudes of about 1350–1450 m and run in a roughly west-to-east direction (area 6 in Fig. 1). These formations are situated at the boundary of siliceous rock to the north and calcareous rock to the south (Gerasimov & Galabov 1966) and are covered by a dense network of meandering streams and associated open boggy terrain, with the streams eventually disappearing in sinkholes in the calcareous layer. During our survey on 10.vi.2012 (Z. Kolev and N. Stinkov) we noted that the initial expectations regarding the orographic character and vegetation of the area were fully confirmed (see Fig. 2d). In particular, the abundance of *P. bistorta* over large areas was striking, as was that of the red-flowered *Geum coccineum*, a nectaring source of *L. helle* in Stara Planina as documented by Popović & Đurić (2011) and Popović *et al.* (2014). However, *L. helle* was not found during our extensive survey of an area of ca. 800 ha.

This forced us to reconsider our priorities for future research in 2013. An obvious strategy shift was to focus next on areas that were geographically closest to the known Serbian sites, i.e. the main ridge of western Stara Planina between the Midzhur and Kopren peaks, the highest in that part of the chain (area 1 in Fig. 1). Accordingly, we surveyed the area on 18.vi.2013. There

are few suitable points of access to the main ridge on the Bulgarian side, of which Chiprovtsi was chosen due to the presence of a charted road reaching from the town to within a few kilometers of the tree line. Reality, however, fell short of expectations, and the last leg of our trek was accomplished through rough terrain without any paths. However once we were clear of the tree line, already one of the first encountered clumps of *P. bistorta* yielded a single female specimen of *L. helle* flying weakly around the host-plants. Further specimens were not discovered on that site (43°22'37"N, 22°47'19"E, 1500 m: Fig. 2a). Systematic search led us to a small stream below the Golema Chuka peak, where three other specimens, all males, were discovered (43°22'38"N, 22°46'54"E, 1600 m; specimen photo Fig. 2b, locality shown in Fig. 2c). In most of the area we observed worrying degrees of vegetation succession clearly due to abandonment of the subalpine pastures, as large parts of the grasslands had been, or were being, replaced with species-poor *Juniperus*-dominated plant communities.

Following this discovery, on 22.vi.2013 we undertook a first survey of the subalpine zone east of Petrohan pass (area 6 in Fig. 1). This survey showed that the vegetation succession was much more advanced than in area 1, with virtually all former grasslands being overgrown with *Juniperus* spp. and a complete lack of any potential habitats for *L. helle*. Another visit on 22.vi.2013 (N. Shtinkov) to the Magareshnitsi depressions (area 6) also failed to discover the species there. Yet both surveys allowed us to gather information about the quality of potential habitats and to assess the conservation status of the species in Bulgaria. A summary of our surveys of the six areas shown in Fig. 1 is given below and the main data are summarized in Table 1:

Table 1. Data from our surveys (2010–2013) of the six areas marked in Fig. 1.

No. and name	Altitude range	Total area (km ²)/% in Bulgaria	% overgrown	Remarks
1. <i>Midzhur-Kopren</i> (Fig. 2c)	1600–2168 m	65 km ² /35%	30–80%	All existing records for <i>L. helle</i> are from this area.
2. <i>Dalgi Del</i>	1400–1700 m	10 km ² /80%	–	Not surveyed.
3. <i>Kom</i>	1600–2016 m	31 km ² /80%	10%	Larval host plant abundant above ca. 1700 m.
4. <i>Gintsi</i>	1350–1400 m	7 km ² /100%	–	Not surveyed. Geologically similar to area 6.
5. <i>Todorini Kukli</i>	1600–1785 m	11 km ² /100%	90–100%	Larval host-plant not found.
6. <i>Magareshnitsi</i> (Fig. 2d)	1350–1450 m	13 km ² /100%	0%	Intensively managed. Larval host-plant abundant.

1. **Midzhur-Kopren.** (Fig. 2c) This area includes the highest parts of the main ridge of Stara Planina between the peaks Midzhur (2168 m) and Kopren (2119 m) at altitudes mostly above 1600 m, but including several lower-altitude areas on the Serbian side of the border. The total area of open grasslands is about 65 km² of which about 23 km² (35%) are in Bulgaria. Surveyed on 18.vi.2013. All existing records for *L. helle* are from this

area. Our surveys of the Bulgarian part have shown that large areas are heavily overgrown with *Juniperus* spp., thus destroying large parts of the species habitat. Where open grasslands are present, the larval host plant is widespread.

2. **Dalgi Del.** Open grassland areas at altitudes 1400–1700 m along the main ridge SW of Dalgi Del village.

Total area of 10 km², most of it (80%) in Serbia. Not surveyed.

3. **Kom.** Includes the grassy slopes in the vicinities of the Kom peak (2016 m) at altitudes mostly above 1600 m. Total area 31 km² of which about 25 km² (80%) in Bulgaria. Surveyed on 9.vii.2010, 26.vi.2011, 9.vii.2011, 18.vii.2011. Our detailed surveys of the areas S and E of Kom peak have shown that the larval host plant is abundant above ca. 1700 m but have failed to discover *L. helle* in spite of seemingly favourable conditions. However, it is likely that the flight period of the species might have ended just prior to our surveys, and it is highly recommended that the area be revisited during the first half of June.

4. **Gintsi.** Includes two depressions W of Gintsi village at altitudes of 1350–1400 m; total area 7 km². Geologically similar to area 6. Not surveyed.

5. **Todorini Kukli.** Main ridge of Stara Planina W of Petrohan pass; altitudes 1600–1785 m (Todorini Kukli peak); area 11 km². Surveyed on 22.vi.2013. The area consists of abandoned mountain pastures, now completely overgrown with *Juniperus* sp. The larval food plant was not found and any suitable habitat that might have been present seems to have disappeared.

6. **Magarehnitsi.** (Fig. 2d) Includes several depressions south of the main ridge at altitudes of about 1400 m with total area of 13 km². Surveyed on 10.vi.2012 and 22.vi.2013. The specific relief and geological conditions favour accumulation of water in the depressions, creating moist meadows with an abundance of the larval host-plant and rich flower vegetation, particularly near the forest edges and in the vicinities of several small streams. The grasslands are intensively used for cattle grazing and actively maintained with regular pruning and cutting of bushes and tree saplings (pers. obs.). In spite of the abundance of the larval host plant and nectaring sources for the adults, the search for *L. helle* was unsuccessful.

Threats and conservation status

The Violet Copper (*Lycaena helle*) is a threatened butterfly of high conservation importance in Europe, included in Annexes II and IV of the European Union Habitats Directive (Council of the European Communities, 1992) and listed as Endangered (EN) in Europe (Van Swaay *et al.* 2010a). The population reduction is a result mainly of habitat loss (IUCN criterion A2c) due to land drainage, afforestation and changes in traditional land use practices (Van Swaay *et al.* 2012). The recent discovery of *L. helle* in Serbia and Bulgaria therefore calls for urgent assessment of its conservation status and development and implementation of necessary conservation measures.

The most significant threat to *L. helle* in Western Stara Planina appears to be habitat loss due to

overgrowing of mountain pastures above the tree line as a result of the natural vegetation succession after a strong decline in traditional grazing since the 1990s. Large-scale overgrowing with species-poor plant communities dominated by *Juniperus* sp. was observed in approximately 30–40% of the surveyed open areas superficially suitable for *L. helle* habitat. In some regions the overgrown areas can be 80% (Donchev 2008, pers. obs.). In addition, the potential areas that could provide suitable habitat are very fragmented and further fragmentation and loss of connectivity between habitat patches is observed due to overgrowing (pers. obs.). This trend could be especially important for an extremely sedentary species such as *L. helle* (Fischer *et al.* 1999). The potential area of occupancy (AOO) appears to be rather small because of the small size and low number of suitable habitat patches in most of the area. Even considering the entire area of all locations that we identified as superficially suitable for the species in Western Stara Planina, a generous tentative estimate based on direct observation and satellite images gives a total AOO in Bulgaria and Serbia of less than 140 km². The extent of occurrence (EOO) is also generously estimated to less than 850 km², including the disjunct areas around Kom and east of Petrohan Pass. Thus, it appears that the species satisfies IUCN criterion A2c for Vulnerable status (inferred population reduction due to habitat decline of more than 30% in the last 10 years) and B1+2ab(ii,iii) criteria for Endangered status nationally (IUCN 2012a). The Balkan population is separated by a considerable distance from the nearest known occurrences of *L. helle* and is therefore completely isolated. However, migration across the border can easily occur given the known altitude range of existing records (see also Popović *et al.* 2014). Nevertheless, since the above assessment is valid for the entire population on both sides of the border (see also Popović *et al.* 2014), we believe immigration does not significantly affect the extinction risk (IUCN 2012b).

In addition to overgrowing, potential threats that could lead to habitat destruction are posed by various development projects in the region. Examples are the (now abandoned) plans for construction of two wind farms above the tree line near Chiprovtsi and near the Dalgi Del village (Donchev 2008a, b) and a project for a winter resort considered by the Chiprovtsi municipal administration, including skiing courses that would pass right through the localities reported in the present work, below Golema Chuka peak (Anonymous 2009). Another threat could be posed by the increasing tourist influx due to ongoing construction of new recreational infrastructure that will facilitate access to this part of Stara Planina (Tsvetkov 2013) which has so far remained relatively pristine and far from popular tourist destinations. Nevertheless, all those threats are secondary and their effect, at least in the short term, is unlikely to be as significant as the ongoing habitat degradation due to abandonment of mountain pastures.

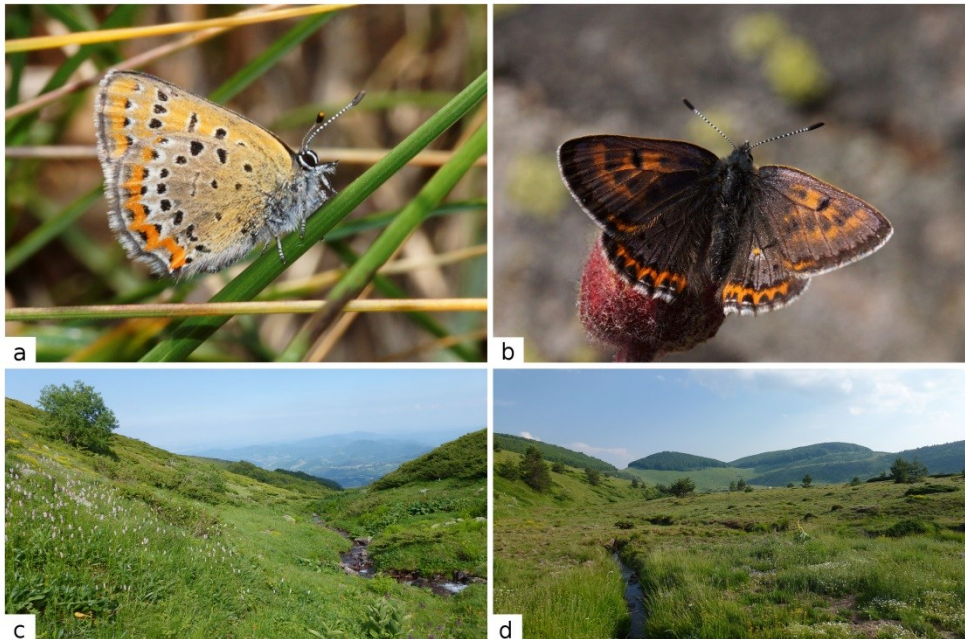


Figure 2. *Lycaena helle*:

a) female, 43°22'37"N, 22°47'19"E, 1500 m, 18.vi.2013.

b) male, 43°22'38"N, 22°46'54"E, 1600 m, 18.vi.2013.

c) habitat below Golema Chuka peak (area 1 in Fig. 1), 43°22'38"N, 22°46'54"E, 1600 m, 18.vi.2013.

d) potential habitat: Magareshnitsi (area 6 in Fig. 1), 1400 m, 22.vi.2013.

Based on the above discussion, we propose Endangered (EN) B1+2ab(ii,iii) red list status for *Lycaena helle* in Bulgaria. As the species is listed in Annexes II and IV of the Habitats Directive (Council of the European Communities, 1992), it is entitled to legislative protection in Bulgaria. Hence immediate measures should be taken for amending the relevant legislation. Specifically, *Lycaena helle* should be included in Annexes 2 and 3 of the Biological Diversity Act (Republic of Bulgaria, 2002), which implements the relevant European legislation in Bulgaria. The area in which *L. helle* occurs is part of the Natura 2000 protected zone BG0001040 Western Stara Planina and Predbalkan and the species should also be immediately included in the list of protected species in the protected zone. We also recommend listing *L. helle* in the Red Data Book of Bulgaria as Endangered. Although unlikely to have any effect by themselves (or to pose any obstacles to development projects endangering the species like the ones described above), these administrative measures would provide the necessary framework for funding conservation projects that could carry out the measures outlined below.

Habitat management seems to be essential for the survival of this species (Fischer 1999, Goffart *et al.* 2010, Van Swaay *et al.* 2012, Habel *et al.* 2012), which in Bulgaria means mainly curbing the overgrowing of existing habitat. Unfortunately the strong decline of traditional land use practices is a major trend which affects simultaneously large territories and cannot be easily reversed, especially in a region of the country which has marked the worst economic decline on a national scale for a quarter-century. The economic restructuring of the 1990's has been accompanied by a decline of the human population and livestock numbers that continues at an alarming rate to present days and has been further exacerbated by the global economic downturn of the last decade. For example, sheep herds in the Montana Province have declined by more than

35% between 2001 and 2011 (Montana Province 2005: 28, 2013: 27). Some temporary relief could be provided by economic incentives for traditional grazing through existing policies and programmes for maintaining wildlife habitats such as the European-funded Rural Development Programme (Bulgarian Ministry of Agriculture and Food 2012) but this is unlikely to reverse the long term economic and demographic trends.

In view of the above, it seems that the most feasible and effective short-term strategy would be to selectively maintain small patches of suitable habitats by clearing bushes around streams and valleys above the tree line in area 1 (Fig. 1) which so far contains the only known populations of *L. helle* in Bulgaria. This focused effort could be undertaken by volunteers and should also be used to contribute new data to the knowledge of the distribution of *L. helle* in Stara Planina and to determine the population size and dynamics of this species, as well as other butterflies with similar ecological requirements and facing similar conservation challenges, e.g. *Boloria eunomia*. As both species can be extremely sensitive to habitat management (Goffart *et al.* 2010, Habel *et al.* 2012), a careful scientific evaluation of the impact of different management options on the populations should be undertaken in order to develop a long-term conservation strategy.

Conclusion

The very recent addition of the Violet Copper to the butterfly fauna of the Balkan Peninsula, Serbia and Bulgaria is a fascinating zoogeographical discovery. However, even more importantly it offers considerable challenges but also opportunities in terms of effecting necessary, timely, science-based and responsible conservation measures on par with Western-European standards. While the species is a brand new addition to the fauna of Bulgaria, the government is bound by

current EU legislation to immediately devise and implement such conservation measures as are deemed necessary. In the case of the Violet Copper, the culprit for the ongoing detrimental development is not the hand of man, but rather the lack thereof. The decline is underlined by recent socioeconomic trends that are unlikely to be reversed in the near future and have to be taken into account when developing a conservation strategy.

Preserving the only populations of the Violet Copper on the Balkan Peninsula is ultimately a joint responsibility of Serbia and Bulgaria, especially in view of the fact that currently the area of potential habitat for *L. helle* is larger in Serbia than in Bulgaria (present work; see also Popović *et al.* 2014). However, Bulgaria is a full member state of

the EU which means both a clearer regulatory framework as well as better practical prerequisites for implementing concerted conservation measures. There is a pressing need for such measures as present data indicate that the species' very limited habitat base has been deteriorating at an alarming pace for the last two decades. If these changes continue unchecked, the only known population of the Violet Copper in the Balkan peninsula may soon follow the fate of this species in most of Western and Central Europe and be driven to the brink of extinction.

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References

- Abadjiev S. P. 2001. *An Atlas of the Distribution of the Butterflies in Bulgaria (Lepidoptera: Hesperioidea & Papilionoidea)*. — Pensoft Publishers, Sofia, Moscow, 335 pp.
- Anonymous. 2009. *Chiprovtsi is looking for investors for a winter resort. Interview with Zaharin Zamfirov, mayor of Chiprovtsi*. — Investor.bg, July 27, 2009. <http://www.investor.bg/novini/122/a/chiprovcit-tyrsi-investitor-za-zimen-kurort,84343/> (accessed 29.vi.2013, in Bulgarian).
- Anonymous. 2012. Observation.org: Violet Copper – *Lycaena helle* ([Denis & Schiffermüller], 1775). — <http://observado.org/soort/photos/70081?from=2012-06-16&to=2012-06-16> (accessed 5.iii.2014).
- Beshkov S. 2000. Lepidoptera species (Macrolepidoptera) recorded and reported from the Western Stara Planina Mountain, NW Bulgaria. — *Entomologica romanica* 5: 11–43.
- Bulgarian Ministry of Agriculture and Food 2007. Republic of Bulgaria rural development programme 2007–2013. The European Agricultural Fund for Rural Development. http://prsr.government.bg/Admin/upload/Media_file_en_1318469686.rar (accessed 31.vii.2013).
- Council of the European Communities, 1992. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. — *Official Journal of the European Communities* 35: 7–50.
- Dincă V., Kolev Z. & Verovnik R. 2010. The distribution, ecology and conservation status of the Spinose Skipper *Muschampia cribrellum* (Eversmann, 1841) at the western limit of its range in Europe (Hesperiidae). — *Nota lepidopterologica* 33: 39–57.
- Donchev K. 2008a. Assessment of compatibility of investment proposal for building a wind generator farm “Georgi Damyanovo Wind” in the region of Dalgi Del village, Georgi Damyanovo municipality, Montana Province. Regional Inspection for Environment and Water, Montana. <http://www.riosv-montana.com/old/reports/report194.doc> 18 pp. (accessed 30.vi.2013, in Bulgarian).
- Donchev K. 2008b. Assessment of compatibility of investment proposal for building a wind generator farm “Chiprovtsi Wind” in the region of Chiprovtsi town, Chiprovtsi municipality, Montana Province. Regional Inspection for Environment and Water, Montana. <http://www.riosv-montana.com/old/reports/report195.doc>, 22 pp. (accessed 30.vi.2013, in Bulgarian).
- Gerasimov I. P. & Galabov Zh. S. (eds.) 1966. *Geography of Bulgaria. Vol. 2: Physical geography*. — Bulgarian Academy of Sciences, Sofia, 548 pp. (in Bulgarian).
- Goffart P., Schtickzelle N. & Turlure C. 2010. Conservation and management of the habitats of two relict butterflies in the Belgian Ardenne: *Proclissiana eunomia* and *Lycaena helle*. — in: Habel J. C. & Assmann T. (eds.) *Relict species. Phylogeography and Conservation Biology*. — Springer (Berlin Heidelberg), p. 357–369.
- Gorbunov P. 2001. The butterflies of Russia: classification, genitalia, keys for identification (Lepidoptera: Hesperioidea and Papilionoidea). — Thesis, Ekaterinburg, 320 pp.
- Habel J. C., Meyer M. & Schmitt T. (eds.) 2012. Jewels in the mist. A synopsis on the highly endangered butterfly species the Violet Copper, *Lycaena helle*. — Pensoft (Sofia-Moscow), 235 pp.
- IUCN 2012a. *IUCN Red List Categories and Criteria: Version 3.1. Second edition*. — Gland, Switzerland and Cambridge, UK: IUCN, iv + 32 pp.
- IUCN 2012b. *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0*. — Gland, Switzerland and Cambridge, UK: IUCN. iii + 41pp.
- Jakšić P., Van Swaay C. & Đurić M. 2007. *Boloria eunomia* (Esper, 1799): a new species for Serbia (Nymphalidae). — *Nota lepidopterologica* 30: 65–70.
- Montana Province 2005. *Montana Province development strategy 2005–2015*. — <http://oblastmontana.org/add/Montana-OSR.pdf> (accessed 31.vii.2013, in Bulgarian).
- Montana Province 2013. *Montana Province development strategy 2014–2020*. — <http://oblastmontana.org/add/Montana-OSR-2020.pdf> (accessed 31.vii.2013, in Bulgarian).
- Popescu-Gorj A. 1964. *Catalogue de la Collection de Lépidoptères “Prof. A. Ostrogovich” du Muséum d’Histoire Naturelle “Grigore Antipa”, Bucarest*. — Bucarest, 293 pp., 18 pl.

- Popović M. 2011. *Endangered Serbian Butterflies – Urgent Need for Research and Conservation*. — http://www.habiprot.org.rs/rsg2011/index_en.html (accessed 5.iii.2014).
- Popović M. & Đurić M. 2011. *Dnevni leptiri Srbije – priručnik*. — HabiProt, Beograd, 198 pp. (in Serbian).
- Popović M., Đurić M., Franeta F., Deijk J. & Vermeer R. 2014. First records of *Lycaena helle* ([Denis & Schiffermüller], 1775) for the Balkan peninsula (Lepidoptera: Lycaenidae). — *SHILAP Revista lepidopterología* **42** (165): 1–8.
- Rákossy L. 2013. *Fluturii diurni din România. Cunoaștere, protective, conservare*. — Editura MEGA, Cluj-Napoca, 352 pp.
- Republic of Bulgaria 2002. Biological Diversity Act. — *State Gazette* **77**, 2002.
- Settele J., Kudrna O., Harpke A., Kühn I., van Swaay C., Verovnik R., Warren M., Wiemers M., Hanspach J., Hickler T., Kühn E., van Halder I., Veling K., Vliegenthart A., Wynhoff I. & Schweiger O. 2008. *Climatic Risk Atlas of European Butterflies*. — Pensoft Publishers, Sofia – Moscow, 712 pp.
- Székely L. 2008. *Fluturii de zi din Romania [The butterflies of Romania]*. — Muzeul Judetean de Istorie Brasov, 305 pp.
- Székely L. 2011. The Lepidoptera of Bucharest and its surroundings (Romania). — *Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa»* **LIV** (2): 461–512.
- Tolman T. 2008. *Collins Butterfly Guide. The Most Complete Guide to the Butterflies of Britain and Europe (Illustrated by R. Lewington)*. — HarperCollins Publishers, London, 384 pp.
- Tsvetkov T. 2013. *Projects for eight million levs are being implemented by Chiprovtsi Municipality*. — Bulgarian News Agency, June 18, 2013. <http://bta.bg/bg/c/BO/id/622767> (accessed 30.vi.2013, in Bulgarian).
- Tuleschkow K. 1932. Erster Beitrag zur Schmetterlingsfauna des Westbalkans (Westliche Stara-Planina). — *Trudove na bulgarskoto prirodizpitatelno druzhestvo, Sofia* **15–16**: 307–312.
- Van Swaay C., Cuttelod A., Collins S., Maes D., López Munguira M., Šašić M., Settele J., Verovnik R., Verstrael T., Warren M., Wiemers M. & Wynhoff I. 2010a. *European Red List of Butterflies*. — Luxembourg: Publications Office of the European Union. x+47 pp.
- Van Swaay C., Wynhoff I., Verovnik R., Wiemers M., López Munguira M., Maes D., Sasic M., Verstrael T., Warren M. & Settele J. 2010b. *Lycaena helle*. — In: IUCN 2012. *IUCN Red List of Threatened Species. Version 2012.2*. — <http://www.iucnredlist.org>.
- Van Swaay C., Collins S., Dušej G., Maes D., Munguira M. L., Rakosy L., Ryrholm N., Šašić M., Settele J., Thomas J., Verovnik R., Verstrael T., Warren M., Wiemers M., Wynhoff I. 2012. Dos and Don'ts for butterflies of the Habitats Directive of the European Union. — *Nature Conservation* **1**: 73–153.

Boekbespreking

Aukema B., Chérot F., Viskens G. & Bruers J.: *Verspreidingsatlas van de Belgische Miridae (Insecta: Heteroptera)*. 21 × 30, 311 p., doorlopend geïllustreerd in kleur, Fauna van België, Koninklijk Belgisch Instituut voor Natuurwetenschappen, Vautierstraat 29, 1000 Brussel, bestellingen@natuurwetenschappen.be, paperback, 2014, 60,- EUR, exclusief verzendkosten (ISBN 9789073242326).



Wantsen zitten duidelijk in de lift! Nadat in het vorige deel in deze reeks de water- en oppervlaktewantsen van België aan bod kwamen, is het nu de beurt aan de Miridae. Deze wantsenfamilie is in België met haar 231 soorten het soortenrijkst. De meeste soorten zijn fytofaag en sommige zijn zelfs schadelijk in de landbouw. Andere soorten zijn carnivoor en deze worden dan weer gebruikt in de biologische bestrijding. Vele Miridae zijn erg klein en onopvallend, en misschien daardoor is hun studie slechts langzaam op gang gekomen.

In deze atlas ligt de aandacht op de verspreiding van de soorten in België. Die verspreiding wordt dan ook kort besproken en grafisch voorgesteld op drie kaartjes: Europa waar het voorkomen per land wordt aangeduid, en België met een kaart van de verspreiding vóór 1980 en eentje vanaf 1980. Daaruit is gemakkelijk af te lezen dat sommige soorten slechts laat ontdekt zijn, o.a. *Isometopus intrusus*, *Deraeocoris flavilinea*, terwijl andere minder talrijk voorkomen dan vroeger, o.a. *Capsodes gothicus*.

Over het algemeen ziet men dat er in de latere periode meer stippen op de kaartjes voorkomen. Dit heeft uiteraard niet met de uitstekende toestand van de Belgische natuur te maken, maar wel met het feit dat er nu meer aandacht aan deze diergroep wordt besteed.

Achteraan volgen enkele overzichtslijsten: literatuur, wetenschappelijke wantsennamen, plantennamen, systematische wantsenlijst, aantal uurhokken vóór en vanaf 1980, verspreiding per provincie, waarnemers, soorten uit het grenzend gebied maar nog niet in België waargenomen. Vooral deze laatste lijst is interessant voor de liefhebbers van het ontdekken van nieuwe soorten voor de Belgische fauna want er staan enkele soorten in die in al onze buurlanden voorkomen, o.a. *Agnocoris rubicundus*, maar nog niet in België!

Een mooi uitgegeven en rijk geïllustreerd boek. Hoewel de auteurs de vooruitgang en de voordelen van de digitale fotografie vermelden, blijft wie mooie plaatjes van adulte Miridae wil zien, op zijn honger zitten. De weinig afgebeelde soorten zijn voor het overgrote deel exemplaren uit Nederland. België moet het met één foto doen.

Willy De Prins