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Prispevek k poznavanju razširjenosti hromega volnoritca *Eriogaster catax* (Linnaeus, 1758) (Lepidoptera: Lasiocampidae) v Sloveniji

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Izvleček. V prispevku predstavljamo 113 novih, naključno zbranih podatkov o razširjenosti hromega volnoritca *Eriogaster catax* (Linnaeus, 1758) v Sloveniji na 78 različnih lokacijah. Poznavanje razširjenosti vrste smo s 44 povečali na 56 UTM kvadratov. Največ podatkov je s Primorske. Nova nahajališča vrste so predvsem iz severovzhodne Slovenije: ob reki Ledavi, Muri in Dravi; v vzhodni Sloveniji na Kozjanskem in ob spodnjem toku reke Save. Vrsta je prvič najdena tudi v Beli krajini. Izboljšali smo poznavanje razširjenosti vrste na Notranjskem (Cerkniško jezero in Pivška jezera), na obronkih Nanosa in v dolini Dragonje. Za analizo fenologije in vertikalne razširjenosti vrste smo uporabili vse podatke. Gosenice smo opazovali od konca marca do sredine junija, odrasle osebke pa od sredine septembra do začetka novembra. Po doslej znanih podatkih se hromi volnoritec v Sloveniji pojavlja med 0 in 960 m nadmorske višine. Mediana višinske razporeditve podatkov je pri 258 m n. m., polovica vseh podatkov pa je razporejena v pasu od 166 do 420 m n. m. Ocenjujemo, da je poznavanje razširjenosti vrste v Sloveniji še zmeraj nezadovoljivo.

Ključne besede: hromi volnoritec, *Eriogaster catax*, razširjenost, Slovenija, Natura 2000, fenologija, Direktiva o habitatih

Abstract. Contribution to the knowledge of *Eriogaster catax* (Linnaeus, 1758) (Lepidoptera: Lasiocampidae) distribution in Slovenia – The paper reveals 113 new records of *Eriogaster catax* (Linnaeus, 1758) from 78 localities in Slovenia. Its known distribution was extended from 44 to 56 UTM grid squares. Most of the new records come from the Primorska region. The most valuable extension of the currently known distribution is in north-eastern Slovenia: at the Ledava, Mura and Drava Rivers; in eastern Slovenia: the Kozjansko region and along lower stretches of the Sava River. The species was recorded for the Bela krajina region for the first time. Additional records were collated also in the Notranjska region (Cerkniško Lake and Pivka lakes), at southern slopes of Mt. Nanos and in the Dragonja River valley. Using all the data, an analysis of phenology and vertical distribution of species was conducted. Observations of larval stages of *E. catax* were made from late March until mid-June, while adults were observed from mid-September until early November. Altitudinal distribution varies between 0 and 960 m a. s. l. The median of vertical distribution is at 258 m a. s. l. Half of the records were made between 166 and 420 m a. s. l. We conclude that the distribution of the species in Slovenia is still inadequately known.

Ključne besede: *Eriogaster catax*, distribution, Slovenia, Natura 2000, phenology, Habitat directive

Uvod

Hromi volnoritec *Eriogaster catax* (Linnaeus, 1758) je nočni metulj iz družine kokljic (Lasiocampidae). Gosenice vseh vrst tega rodu v začetnih razvojnih stadijih oblikujejo skupna gnezda. Samice hromega volnoritca jeseni ležejo jajčeca spiralno okoli vejic hranilne rastline gosenic ter jih prekrijejo z dlačicami s konca zadka, da so bolj prikrita in zavarovana pred nizkimi temperaturami (Pro Natura 2000). Vrsta prezimuje v stadiju jajčec, iz njih pa se v toplejših spomladanskih dneh, praviloma aprila pred olistanjem hranilnih rastlin, izležejo gosenice. Te v prvih razvojnih stopnjah živijo skupinsko na gnezdih, ki jih same spletejo iz svilnatih niti. Po treh levitvah gosenice gnezdo zapustijo in živijo samostojno. Po treh do štirih tednih se gosenice po peti levitvi zabubijo v svilenem kokonu v vrhnjem sloju tal. Iz večine bub se jeseni razvijejo metulji, del bub pa lahko prezimi do naslednje jeseni ali celo večkrat (Ebert et al. 1994, Pro Natura 2000, Dolek et al. 2008), kar so potrdila tudi naša opažanja (Gomboc, neobjavljeno). Metulji so aktivni od konca septembra do začetka novembra, njihova aktivnost pa se začne v poznih popoldanskih ali zgodnjih večernih urah, ko samci v hitrem vijugastem letu iščejo sledi feromonov samic, s katerimi se parijo. Samice so aktivne v večernih urah, ko odlagajo jajčeca. Tako samci kot samice neradi priletijo na luči za privabljanje nočnih metuljev. Na luči pogosteje priletijo samice, pa še to le v bližini pomladanskega opazovanja gosenic. Samci zaradi popoldanske aktivnosti neradi priletijo na luči, ker se z večerom njihova aktivnost že zaključi. Če želimo imeti več uspeha, naj bi glede na izkušnje metuljarjev luči za nočne popise metuljev postavili že ob sončnem zahodu, ko samci še letajo med grmišči (Carnelutti & Lasan, neobjavljeno). Metulji se ne hranijo, zato živijo zelo kratek čas, samci poginejo po parjenju, samice po odlaganju jajčec (Freina & Witt 1987, Pro Natura 2000).

Hromi volnoritec je vezan na obrobja termofilnih presvetljenih gozdov, zaraščajoče pašnike in travnike, grmišča in mejice v toplih in vlažnih legah, katerih glavna predstavnika sta črni trn (*Prunus spinosa*) in glog (*Crataegus* spp.). Vrsta je razširjena od severnega dela Iberskega polotoka prek zahodne, srednje in južne Evrope do Rusije. Na severu sega meja areala do severne Nemčije, na jugu pa prek Italije in Balkanskega polotoka do zahodne Azije (Ebert et al. 1994, Pro Natura 2000, Čelik et al. 2004).

Za Slovenijo hromega volnoritca prvi navaja že Mann (1854). Vrsta bi bila še nadalje zgolj ena izmed 3.400 vrst nočnih metuljev, ki živijo v Sloveniji (Gomboc & Lasan 2006), če ne bi bila uvrščena v Prilogo II in IV Direktive o habitatih, zaradi česar je deležna posebne pozornosti tudi v Sloveniji. V Kryštufek et al. (2001) so bili zbrani obstoječi literaturni podatki, podatki iz Prirodoslovnega muzeja Slovenije in nekateri neobjavljeni podatki in takrat je bila vrsta znana iz 20 UTM kvadratov. V delu Čelik et al. (2004) so avtorji podatke o hromem volnoritcu iz leta 2001 (Kryštufek et al. 2001) dopolnili z novimi terenskimi podatki ciljnega vzorčenja gnezd gosenic. Poročilo je bilo kasneje objavljeno v obliki monografije (Čelik et al. 2005). Leta 2005 je bil hromi volnoritec znan iz 44 UTM kvadratov (Čelik et al. 2004, 2005, dopolnjeno s Stauder 1923 in Mladinov 1976).

V Čelik et al. (2004) je bilo za opredelitev območij Natura 2000 za hromega volnoritca predlaganih devet območij, razglašeni pa le dve – Slovenska Istra (SI3000212) in Kras (SI3000276) (Ur. l. RS 2004a). Že v letu 2006 je bilo ugotovljeno, da Slovenija v celinski

biogeografski regiji ni izpolnila vseh zahtev po opredelitvi območij Natura 2000 za hromega volnoritca (Zagmajster & Skaberne 2006). Kasneje je sicer Republika Slovenija pričela z izvajanjem monitoringa (Verovnik et al. 2011), vendar ne z dodatnimi raziskavami razširjenosti vrste. Slednje je ugotovila tudi Evropska komisija, zato je bilo tudi na zadnjem biogeografskem seminarju v zaključkih sprejeto, da mora Slovenija preveriti stanje vrste v vzhodnem delu Slovenije (Petkovšek 2015). Po zadnjih spremembah območij Natura 2000 v letu 2013 je bil hromi volnoritec kot kvalifikacijska vrsta dodan za območje Natura 2000 Sečoveljske soline in estuarij Dragonje (SI3000240) (Ur. l. RS 2013).

Po letu 2005 je bilo o vrsti objavljenih malo podatkov (Lesar & Jež 2006, Jogan Polak 2007). V prispevku predstavljamo nove neobjavljene podatke o pojavljanju vrste v Sloveniji. Večina izmed njih je bila zbrana v zadnjih desetih letih.

Materiali in metode

Poleg hromega volnoritca iz rodu *Eriogaster* živita v Sloveniji še dve vrsti: spomladanski volnoritec (*E. lanestris*) in hrastov volnoritec (*E. rimicola*), ki so si po obliki jajčec zelo podobne, gosenice pa lahko ločimo po tretji levitvi (Ebert et al. 1994, Pro Natura 2000, Ruf et al. 2003).

V prispevku predstavljamo podatke, zbrane v okviru ciljnih raziskav avtorjev prispevka, ter številna naključna opazovanja oziroma ujetja vrste. Ker je bilo v Sloveniji v zadnjih letih opravljenih več favnističnih raziskav s poudarkom na zavarovanih območjih ali zgolj na zavarovanih vrstah, med katere sodi tudi hromi volnoritec (Ur. l. RS 2004b), v tem prispevku predstavljamo tudi te rezultate. Podatki se nanašajo na tri razvojne stadije vrste (jajčeca, gosenice in metulje), ki jih je mogoče popisati v okviru terenskih opazovanj; buba se zadržuje v tleh in jo popisovalci težko opazijo.

Po dosedanjih izkušnjah avtorjev se gnezda gosenic hromega volnoritca pri nas pojavljajo izključno na črnem trnu ali glogu, zato je bilo temu dejstvu prilagojeno tudi terensko delo. Prepoznavanje gosenic je sicer mogoče tudi po fotografijah, vendar je zanesljivo šele po drugi do tretji levitvi, ko se gosenice značilno odlakajo in obarvajo, kar smo upoštevali tudi pri samem terenskem delu. Pri popisovanju smo si v dvomljivih primerih pomagali tudi z gojenjem gosenic do odraslega osebka ali do faze zanesljive določitve.

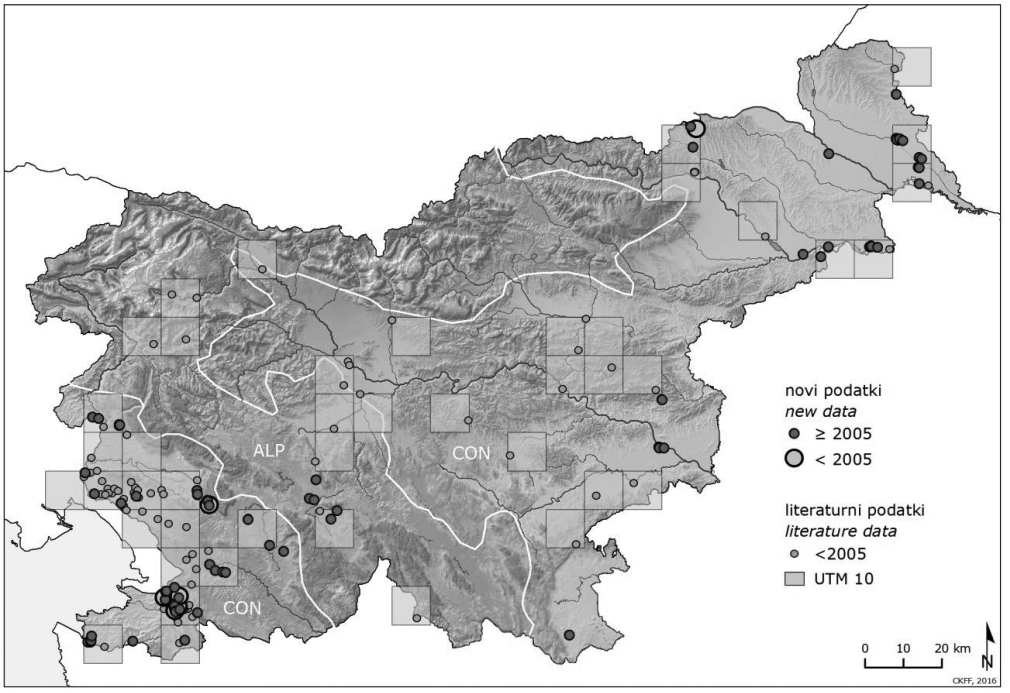
Najtežje izsledljiva in prepoznavna so jajčeca. V tem primeru smo v prispevku upoštevali le zanesljive podatke o najdbi jajčec. Podatki o najdbah odraslih metuljev so v glavnem zbrani v okviru popisov nočnih metuljev z UV svetlobnimi šotori. Odrasli osebki so enostavno prepoznavni in so nezamenljivi s sorodnimi vrstami.

Vsak podatek je predstavljen z opisom lokacije, koordinatami, datumom najdbe, najditeljem in po potrebi določevalcem ter razvojnim stadijem vrste v času opazovanja (Tab. 1). V primeru več podatkov na isti lokaciji so podatki razvrščeni po datumu.

Analize in prikaze smo naredili na novo zbranih podatkih, ki smo jih združili s predhodno zbranimi (Kryštufek et al. 2001, Čelik et al. 2004) in drugimi literaturnimi podatki (Stauder 1923, Mladinov 1976, Lesar & Jež 2006, Jogan Polak 2007). Za namene fenograma smo uporabili vse podatke, ki so nam bili na voljo z datumom najdbe (N = 152). Analizo višinske distribucije smo napravili na vseh podatkih, za katere smo imeli podano natančnost najdbe vsaj za naselje (N = 247).

Rezultati

V prispevku podajamo 113 novih podatkov za hromega volnoritca na 78 lokacijah, v skupno 27 UTM kvadratih za Slovenijo (Tab. 1). V 15 UTM kvadratih, kjer je bila vrsta že znana, smo potrdili njeno pojavljanje, za 12 kvadratov pa navajamo prve podatke za vrsto (Sl. 1).



Slika 1. Najdišča hromega volnoritca *Eriogaster catax* v Sloveniji glede na nove in literaturne podatke (ALP – alpinska, CON – celinska biogeografska regija).
Figure 1. New and published locations of *Eriogaster catax* in Slovenia (ALP – alpine, CON – continental biogeographical region).

Tabela 1. Novi podatki o najdbah hromega volnoritca (*Eriogaster catax*) v Sloveniji.
Table 1. New findings of *Eriogaster catax* in Slovenia.

Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Nasip ob reki Dragonji, 530 m Z od J vhoda v Sečoveljske soline, Parecag, Piran	13,607095	45,465578	UL93	3.4.2010	S. Gomboc	larva
				8.4.2010	S. Gomboc	larva
				4.2.2011	S. Gomboc	ovum
V nasip Sečoveljskih solin od V roba, 540 m J od letališkega stolpa do srednjega dela letališke steze, Sečovlje, Piran	13,615095	45,471506	UL93	8.4.2010	S. Gomboc	larva
JV nasip Sečoveljskih solin od V roba, 540 m J od letališkega stolpa do reke Dragonje, Sečovlje, Piran	13,615738	45,466691	UL93	3.4.2010	S. Gomboc	larva
				8.4.2010	S. Gomboc	larva
				17.4.2010	S. Gomboc	larva
				24.4.2010	S. Gomboc	larva
				11.10.2010	S. Gomboc	imago
				20.10.2010	S. Gomboc	imago
				24.10.2010	S. Gomboc	imago
				30.10.2010	S. Gomboc	imago
				5.11.2010	S. Gomboc	imago
				29.3.2014	S. Gomboc	larva
Grmičevje S od reke Dragonje ob J vhodu v Sečoveljske soline (Ornitološka postaja), Sečovlje, Piran	13,615815	45,465117	UL93	8.4.2016	S. Gomboc	larva
Grmičevje V ob V nasipu solin Fontanigge, 150 m Z od J konca letališke steze, Sečovlje, Piran	13,616876	45,468252	UL93	28.3.2014	B. Zakšek, M. Govedič	larva
Grmišča med solinami in nasipom na območju opuščenega rudnik, Sečovlje, Piran	13,619258	45,479637	UL93	24.4.2010	S. Gomboc	larva
Rob gozda na J strani makadamske ceste 770 m SVV od zaselka Klariči, Brestovica pri Komnu, Komen	13,619142	45,812227	UL97	25.3.2012	H. Deutsch	larva
Travnik ob cesti Z od Dolge njive, Gorjansko, Komen	13,710192	45,791525	UL97	4.6.2009	H. Deutsch	larva
				9.4.2010	H. Deutsch	larva
Poseka ob robu makadamske ceste 50 m V od ceste 460 m J od nekdanje karavle Lokvica, Lokvica, Kostanjevica na Krasu	13,586882	45,861096	UL97	23.4.2005	T. Čelik	larva
Pobočje 340 m S od cerkve v Podsabotinu, Podsabotin, Nova Gorica	13,608921	45,991933	UL99	25.10.2013	B. Zadravec	imago

Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Rob ceste pod 460 m Z od vrha hriba Sabotin, Podsabotin, Nova Gorica	13,628958	45,988199	UL99	17.10.2013	B. Zadravec	imago
Travnik ob gozdu 770 m J od osrednjega dela vasi Ravnica, 750 m Z od zaselka Pri Peči, Ravnica, Nova Gorica	13,698424	45,973508	UL99	20.4.2011	B. Zakšek	larva
Mejica ob poti 600 m JJV od osrednjega dela vasi Ravnica, 730 m ZSZ od zaselka Pri Peči, Ravnica, Nova Gorica	13,699442	45,975202	UL99	20.4.2011	B. Zakšek	larva
Travnik ob gozdu 770 m JJV od osrednjega dela vasi Ravnica, 560 m ZSZ od zaselka Pri Peči, Ravnica, Nova Gorica	13,701082	45,974087	UL99	20.4.2011	B. Zakšek	larva
Dolina reke Dragonje 600 m JV od zaselka Škrline, Labor, Koper	13,755913	45,469474	VL03	30.4.2016	M. Kastelic	larva
Grmičevje S od ceste 670 m SZZ od hriba Jažmerca, Komen, Komen	13,759513	45,808610	VL07	27.10.2006	B. Zadravec	imago
Kraški rob nad cesto 850 m JV od ceste v vasi Movraž, Movraž, Koper	13,929120	45,473128	VL13	28.10.2006	S. Gomboc, B. Porenta	imago
Grmičevje na travniku J ob cesti 550 m SZ od vasi Črnotiče, Črnotiče, Koper	13,890662	45,556481	VL14	8.4.2011	B. Zakšek	larva
Mejica ob poti 100 m V od železniške postaje Črnotiče	13,892869	45,552364	VL14	15.4.2011	B. Zakšek	larva
Rob gozda 100 m JZ od repetitorja 600 m SV od Lok, Črnotiče, Koper	13,895077	45,540336	VL14	17.10.2004	S. Gomboc	imago
				10.10.2008	S. Gomboc	imago
Travnik JV od vasi Črnotiče, Črnotiče, Koper	13,904953	45,549394	VL14	5.10.2004	S. Gomboc	imago
Kraški travnik 1 km JV od vasi Črnotiče, 200 m JZ od ceste, Črnotiče, Koper	13,909843	45,545562	VL14	21.9.2009	B. Zadravec	imago
Travnik na Plasi, ob gozdu 600 m ZSZ od vasi Loka, med železniško progo in cesto, Loka, Koper	13,896666	45,538993	VL14	14.4.2011	B. Zakšek	larva
Skalovje in stene na JV robu vasi Osp ob mostu ob potoku Osapska reka, Osp, Koper	13,858763	45,570690	VL14	10.10.1997	Ž. Predovnik	imago
Ob poti od Ospa k Mišji peči, Osp, Koper	13,861210	45,567493	VL14	28.10.2011	H. Deutsch (det. S. Gomboc)	imago

Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Travnik ob odcepu ceste od Grmade proti vrhu Slavnika, Podgorje, Koper	13,969611	45,538450	VL14	9.10.2009	T. Lesar, H. Habeler	imago
Rob gozda 50 m SZ od pokopališča JV od Socerba, Socerb, Koper	13,862290	45,586365	VL14	24.10.2008	R. Štanta	imago
Travniki in grmičevje 220 m J od Svete jame, Socerb, Koper	13,864825	45,587758	VL14	24.10.2008	B. Zadravec	imago
Kraška gmajna ob kolovozu 300 m JZ od vasi Beka, J od kala Na Mazariji, Beka, Kozina	13,891377	45,596324	VL14	25.4.2013	B. Zakšek, N. Kogovšek	larva
Travnik 220 m JJV od cerkve v Petrinjah, Petrinje, Kozina	13,906102	45,572692	VL14	25.10.2007	B. Zadravec	imago
Petrinje (Hrpelje-Kozina), Petrinje, Kozina	13,907060	45,574834	VL14	22.10.1997	R. Štanta	imago
Poplavljen gozd J od avtocestnega zbiralnika 150 m Z od ograjenega vojaškega strelišča - Mlake pri Vipavi, Podraga, Vipava	13,964256	45,814114	VL17	19.4.2011	D. Vinko (det. B. Zakšek)	larva
Zbiralnik odpadnih vod J od avtoceste J od Mlak pri Vipavi, Podraga, Vipava	13,964456	45,814412	VL17	19.4.2011	D. Vinko (det. B. Zakšek)	larva
Travnik na osrednjem delu Mlak – Mlake pri Vipavi, Vipava, Vipava	13,962374	45,823292	VL17	11.5.2008	B. Zakšek, N. Kogovšek, R. Luštrik	larva
Travniki na gmajni Podorešnica, 600 m J od vasi Barka, Barka, Divača	14,051227	45,634296	VL25	22.4.2009	S. Polak	larva
Travniki 100 m JV od vasi Barka, Barka, Divača	14,060963	45,633486	VL25	23.4.2015	N. Kogovšek	larva
Travnik S ob cesti Vareje-Naklo, J vznožje hriba Grič, Vareje, Divača	14,026034	45,637395	VL25	16.4.2015	B. Zakšek, N. Kogovšek	larva
Travniki in grmičevje V nad dolino potoka Sušica in Z od ceste Naklo-Podgrad, Zavrhek, Divača	14,007420	45,651317	VL25	20.4.2015	N. Kogovšek	larva
Travnik in grmičevje ob makadamski poti s ceste Nanos – Lozice, Lozice, Razdrto	14,003158	45,789409	VL27	22.5.1983	H. Deutsch	larva
				10.4.2016	S. Gomboc, B. Zakšek, N. Kogovšek, T. Koren	larva
Skalne stene v dvojnem ovinku ceste na Nanos, 1,2 km ZJZ od Šembijske bajte, Hrašče, Vipava	13,997363	45,800552	VL27	12.10.2007	T. Lesar, R. Štanta	imago
Rob ceste v dvojnem ovinku 1 km SZ od hriba Strmec, Hrašče, Vipava	13,999323	45,798842	VL27	12.10.2007	R. Štanta	imago

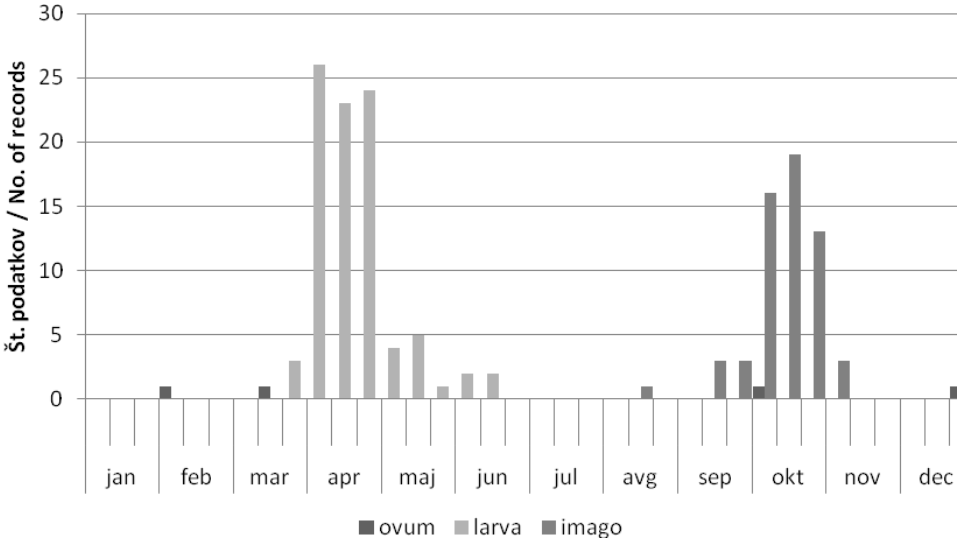
Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Mejice na Petelinjskem polju ob cesti Petelinje-Slovenska vas, Petelinje, Pivka	14,206402	45,697693	VL36	21.4.2011	B. Zakšek	larva
Rob gozda ob cesti Orehek-Hruševje, 250 m S od izvira potoka Karantan, Orehek, Postojna	14,134609	45,757620	VL36	21.4.2011	B. Zakšek	larva
Travnik na J robu Palškega jezera, 880 m JJZ od vrha hriba Jezerščak, Palčje, Pivka	14,254355	45,683772	VL45	27.4.2008	V. Zakšek, T. Kogovšek, B. Šarac (det. B. Zakšek)	larva
Mejice in poseke 400 m J od hriba Loški grič, Cerknica, Cerknica	14,338480	45,807787	VL47	8.10.2007	G. Torkar (det. S. Gomboc)	ovum
				leto 2008	Notranjski regijski park	ovum
Travnik in mejice 320 m SV od hriba Kamna Gorica, Cerknica, Cerknica	14,354540	45,804244	VL47	leto 2008	Notranjski regijski park	ovum
Zaraščajoč travnik in rob gozda ob cesti Martinjak – Grahovo 240 m V od ceste proti Slivnici, Grahovo, Cerknica	14,430912	45,779816	VL56	leto 2008	Notranjski regijski park	ovum
Mejica ob potoku Žerovniščica 670 JZ od hriba Kamna Gorica, Žerovnica, Cerknica	14,411303	45,760101	VL56	28.9.2009	S. Gomboc, V. Schein	imago
Grmičevje okoli cerkve Sveti Lenart, Dobec, Cerknica	14,359345	45,851888	VL57	21.12.2007	S. Gomboc	ovum
				25.4.2015	M. Govedič	larva
				leto 2008	Notranjski regijski park	ovum
Travnik ob gozdu Vrbice 500 m S od vasi Stara lipa, Stara Lipa, Črnomelj	15,205441	45,490264	WL13	12.5.2015	V. Zakšek, B. Zakšek	larva
Mejice in grmičevje S od makadamske ceste 960 m JZ od jezu ob NE Krško, Brege, Krško	15,507475	45,929119	WL38	11.4.2015	D. Klenovšek	larva
				25.4.2015	D. Klenovšek	larva
				7.4.2016	M. Govedič	larva
Travniki in mejice na desnem bregu Save nasproti NE Krško, 800 m SV od vasi, Brege, Krško	15,508951	45,927007	WL38	7.4.2016	M. Govedič	larva
				27.4.2016	M. Govedič	larva
Predel ob poti ob njivi na desnem bregu Save, 1400 m S od vasi Vihre, Vihre, Krško	15,523561	45,927184	WL48	11.4.2015	D. Klenovšek	larva

Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Cerkev Sveti Martin, Veliki Kamen, Veliki Kamen, Krško	15,519494	46,039726	WL49	11.10.2012	D. Klenovšek	imago
Rob gozda 270 m S od domačije Mlakar, Kozjak nad Pesnico, Kungota	15,629427	46,629400	WM46	6.5.2010	F. Rebeušek, B. Zakšek	larva
Grmičevje ob državni meji S pri vasi Podigrac, 340 m JV od hriba Plački vrh, Podigrac, Kungota	15,621561	46,678079	WM46	9.4.2011	B. Zakšek	larva
Travnik na J pobočju hriba Brloge, Cirknica, Šentilj v Slovenskih Goricah	15,640749	46,671360	WM46	2.10.2003	T. Lesar	imago
Gozd V lesu J od vasi Muretinci, Muretinci, Gorišnica	15,998835	46,376587	WM73	6.4.2014	L. Šparl (det. B. Zakšek)	larva
				6.4.2016	M. Govedič	larva
Južni nasip odvodnega kanala HE Formin med od mostom J od Cvetkovcev in JV od Mihovcev, Cvetkovci, Ormož	16,083790	46,393951	WM83	27.4.2013	M. Govedič	larva
				2.5.2015	M. Govedič	larva
Grmičevje ob poti pri hiši Goričak 28, V od Turškega potoka 550 m J od sotočja z Kojuhovskim potokom, Goričak, Zavrč	16,058365	46,370860	WM83	11.4.2011	B. Zakšek	larva
Travnik Z od gozdu ob gramoznici Prod, Hrastje-Mota, Radenci	16,090265	46,611551	WM86	19.4.2013	N. Kogovšek	larva
				4.4.2014	N. Kogovšek	larva
Grmišče Lovska remiza, SZ od železniške postaje Obrež, Obrež, Središče ob Dravi	16,222546	46,392129	WM93	9.5.2010	M. Govedič (det. F. Rebeušek)	larva
				11.4.2011	B. Zakšek	larva
				17.4.2011	M. Govedič	larva
				20.4.2013	M. Govedič	larva
				28.4.2013	M. Govedič	larva
				7.4.2014	M. Govedič	larva
				3.5.2015	M. Govedič	larva
				15.4.2016	M. Govedič	larva
Lovska remiza 490 m JJZ od gasilskega doma Z od ceste proti železniški postaji, Obrež, Središče ob Dravi	16,227868	46,394627	WM93	28.4.2013	M. Govedič	larva
				7.4.2014	M. Govedič	larva

Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Lovska remiza 600 m JJZ od gasilskega doma V od ceste proti železniški postaji, Obrež, Središče ob Dravi	16,229160	46,393066	WM93	9.4.2014	M. Govedič	larva
Grmišče na S strani železniške proge J od Ciglence, Obrež, Središče ob Dravi	16,249026	46,390115	WM93	30.4.2016	M. Govedič	larva
Loka J od mrtvice Kot do državne meje, Kot, Lendava	16,393645	46,538289	XM05	8.4.2014	B. Zakšek	larva
				25.4.2015	B. Zakšek	larva
Travnik in gozdni rob V od Male Polane, pri sotočju Črnega potoka in potoka Črnec, Mala Polana, Velika Polana	16,392708	46,575574	XM05	4.4.2014	B. Zakšek	larva
Zaraščajoč travnik v Panovju, Z ob sotočju potoka Črnec in Črnega potoka, Mala Polana, Velika Polana	16,395100	46,575257	XM05	4.4.2014	B. Zakšek	larva
Mejica ob poti med reko Ledavo in Radmožanskim kanalom, 250 m JJZ od mosta preko Radmožanskega kanala na cesti Renkovci – Dobrovnik, Dobrovnik, Dobrovnik	16,318769	46,644790	XM06	14.3.2014	B. Zakšek	ovum
Travnik ob mejici med reko Ledavo in Radmožanskim kanalom, 450 m J od mosta preko Radmožanskega kanala na cesti Renkovci – Dobrovnik, Dobrovnik, Dobrovnik	16,319337	46,642894	XM06	15.4.2011	F. Rebeušek	larva
				11.10.2011	F. Rebeušek, B. Zakšek	imago
				18.4.2013	B. Zakšek	larva
				27.4.2015	B. Zakšek	larva
Zaraščajoč travnik med reko Ledavo in Radmožanskim kanalom, 600 m J od mosta preko Radmožanskega kanala na cesti Renkovci – Dobrovnik, Dobrovnik, Dobrovnik	16,320864	46,641770	XM06	15.4.2011	F. Rebeušek	larva
				11.10.2011	F. Rebeušek, B. Zakšek	imago
Mejica ob kolovozu S od Radmožanskega kanala, 880 m JV od mosta na cesti Dobrovnik – Renkovci, Dobrovnik, Dobrovnik	16,330265	46,643739	XM06	15.4.2011	F. Rebeušek	larva
Mejica na J bregu Radmožanskega kanala Z ob cesti Dobrovnik – Turnišče, Dobrovnik, Dobrovnik	16,340899	46,639026	XM06	15.4.2011	F. Rebeušek	larva
Gozd in poseka ob Marijinem drevesu v Črnem Logu, J ob avtocesti 1 km JV od vasi Radmožanci, Radmožanci, Lendava	16,395131	46,598810	XM06	3.4.2014	S. Gomboc, B. Zakšek, N. Kogovšek	larva
				9.4.2014	B. Zakšek	larva

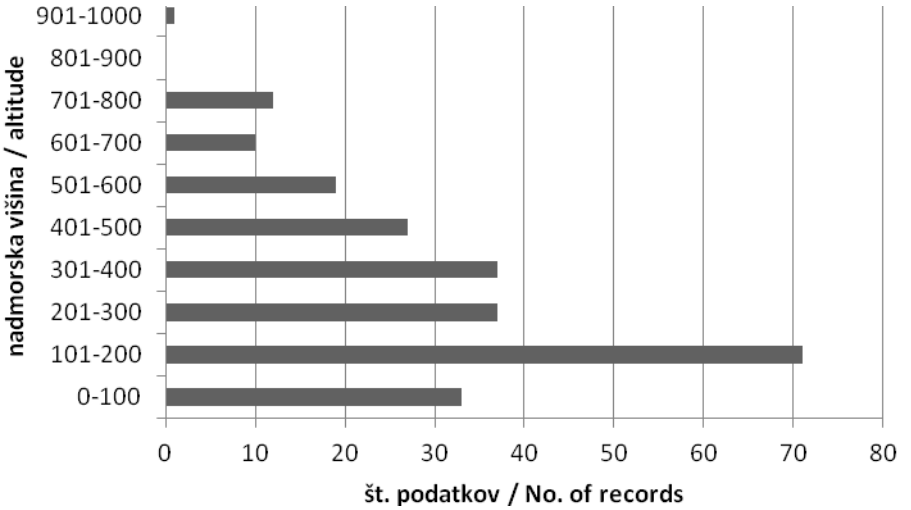
Lokacija / Location	Koordinate / Coordinates (WGS84)		UTM10 (10×10 km)	Datum / Date	Legit	Stadij/ Stage
	Long (°E)	Lat (°N)				
Grmičevje na poseki SZ ob cesti v Urbarialnem gozdu v Črnem logu, 200 m JZ od gramoznice JZ od vasi Banuta, Radmožanci, Lendava	16,403859	46,595626	XM06	9.4.2014	B. Zakšek	larva
Travnik 180 m JV od zaselka Topola, Prosenjakovci, Moravske Toplice	16,322113	46,747627	XM07	7.4.2014	K. Malačič	larva

Ugotavljamo, da se gosenice pojavljajo od konca marca do sredine junija (Sl. 2). Večina podatkov o odraslih osebkih je od druge polovice septembra do konca oktobra. Jajčeca so bila najdena zgolj osemkrat, vendar so nam natančni datumi na voljo samo za štiri najdbe. Vse te najdbe so iz zimskih mesecev razen ene, ki je iz začetka oktobra, ko se pojavljajo odrasli osebki.



Slika 2. Sezonski pregled najdb razvojnih stadijev hromega volnoritca *Eriogaster catax* po dekadah v Sloveniji.
Figure 2. Seasonal overview of observed life cycle stages of *Eriogaster catax* in Slovenia.

Po doslej znanih podatkih se hromi volnoritec pri nas pojavlja med 0 in 960 m nadmorske višine (Sl. 3). Na najnižji nadmorski višini so populacije tik ob morju v Sečoveljskih solinah, medtem ko je najvišje ležeča najdba na pobočju Slavnika. Mediana višinske razporeditve podatkov je 258 m n. m., polovica vseh podatkov (Q1–Q3) pa je razporejenih med 166 in 420 m n. m.



Slika 3. Pregled višinske razširjenosti hromega volnoritca (*Eriogaster catax*) v Sloveniji.
Figure 3. Altitudinal distribution of *Eriogaster catax* in Slovenia.

Diskusija

S prispevkom dopolnjujemo dosedanje poznavanje razširjenosti hromega volnoritca v Sloveniji. Poznavanje razširjenosti vrste smo izboljšali predvsem v severovzhodni Sloveniji (ob rekah Ledavi, Muri in Dravi) in v vzhodni Sloveniji (na Kozjanskem in ob spodnjem toku reke Save). Podajamo tudi prvi podatek o najdbi hromega volnoritca v jugovzhodni Sloveniji, v Beli krajini. Dodatne lokacije smo potrdili za območje Notranjske (Menišija, Cerkniško jezero in Pivška jezera), na obronkih Nanosa in v dolini Dragonje (Sl. 1). Največje zgostitve najdb smo zabeležili na Kraškem robu, v Sečoveljskih solinah in v severovzhodni Sloveniji. V osrednji in severni Sloveniji je novih najdb malo. V alpskem in predalpskem svetu severozahodne in osrednje Slovenije nam vrste ni uspelo potrditi, tako za to območje ostajajo le doslej objavljeni podatki, starejši od leta 1950 (Čelik et al. 2005). Vsekakor bi veljalo primerne habitate tu podrobno in ciljno pregledati, saj v tem območju po našem vedenju ni bilo raziskav hromega volnoritca. Razširjenost v Slovenski Istri in dolini Dragonje je neraziskana. Šele v tem prispevku predstavljena najdba vrste je prvi podatek po letu 2000 za območje Natura 2000 Istra, ki je bilo za hromega volnoritca opredeljeno že leta 2004.

Razširjenost vrste v Sloveniji se ujema tudi z razširjenostjo v sosednjih državah. Za Hrvaško je malo objavljenih podatkov. Koren (2012) hromega volnoritca navaja kot redko vrsto, v glavnem na osnovi starih zgodovinskih najdb, z le tremi podatki po letu 1990. Najdbe so ob meji s Slovenijo v Istri, ob Kolpi, v okolici Krapine, Zagreba (Koren 2012) in Kumrovca (Rebeušek, neobjavljeno). Razširjenost ob Kolpi in v Istri kaže na verjetno večje pojavljanje

vrste tudi na slovenski strani. Obratno pa lahko vrsto na Hrvaškem pričakujejo ob reki Savi, Dravi in Muri. V Italiji je vrsta ob slovenski meji razširjena od Gorice do Trsta (Bertaccini et al. 1995, Lapini et al. 2013). V Avstriji vrsta živi v osmih od desetih dežel, izjemi sta Salzburg in Vzhodna Tirolska (Huemer 2013). Vrsta se Sloveniji približa v okolici Celovca in na avstrijskem Štajerskem (Katzengraben pri Spielfeldu) ob reki Muri (Höttinger et al. 2005, Habeler 2014). Na Madžarskem pa so najbližje lokacije na meji s Slovenijo v narodnem parku Őrség in v okolici kraja Lenti (EIG 2010, Mille 2015).

Časovno pojavljanje različnih razvojnih stadijev v Sloveniji se ujema z rezultati drugih raziskav (Pro Natura 2000, Hottinger 2005, Ambrus et al. 2010). Nekoliko se razlikujejo le posamezni podatki o najdbi gosenic v mesecu juniju in najdba odraslega osebka sredi avgusta, ki so verjetno posledica medletnih vremenskih razlik in mikroklime posameznih območij.

Tako kot v Sloveniji je vrsta postala zanimiva za raziskave tudi v drugih državah EU. Najlažje je v naravi izslediti gosenice, zato je bila ta metoda uporabljena pri raziskovanju razširjenosti vrste pri nas (Gomboc & Torkar 2011, Verovnik et al. 2011, Zakšek et al. 2015) in tudi v drugih državah (Höttinger 2005, Ambrus et al. 2010). Objav o njeni ekologiji in razširjenosti je malo. Freina & Witt (1987) navajata pojavljanje vrste do 1500 m n. m. Nam najdišča vrste nad 1000 m v srednji Evropi niso znana. Podatki iz drugih držav o vertikalni razširjenosti vrste potrjujejo naše ugotovitve. V Romuniji so na višini 700 m našli visoke gostote gnezd (Sitar 2016), za Švico navajajo podatek o najdbi gosenice na 960 m (Lepiforum 2016) in za Italijo na 800 m (Lepiforum 2016).

Z vidika opredeljevanja območij Natura 2000 v Sloveniji imajo poseben pomen najdbe na območju Cerkniškega jezera, ki sodijo v alpinsko biogeografsko regijo. Na biogeografskem seminarju za to regijo Evropska komisija ni želela sprejeti argumentov nevladnih organizacij, da vrsta ni zadostno raziskana, in je vrsto izločila iz referenčnega seznama (Zagmajster 2005). Najnovejši podatki dokazujejo, da se vrsta v alpinski biogeografski regiji zagotovo pojavlja. Prav tako naši rezultati podpirajo mnenje Evropske komisije (Petkovšek 2015) o potrebi po dodatnih raziskavah hromega volnoritca v vzhodni Sloveniji z namenom opredelitve dodatnih območjih Natura 2000 za vrsto.

Razširjenost hromega volnoritca je v Sloveniji zaradi razmeroma prikritega načina življenja še vedno slabo poznana. To potrjuje tudi ta prispevek, kjer smo že samo z naključnimi podatki izboljšali poznavanje razširjenosti vrste v Sloveniji za 12 UTM kvadratov (28 %) glede na doslej znanih 44 kvadratov. Tudi v prihodnosti je zato pričakovati nove najdbe vrste v novih območjih. Dejanska razširjenost vrste v Sloveniji je tako še vedno neznanka in jo je treba raziskati. Vrsto pričakujemo predvsem v Halozah, v Beli krajini, v Slovenskih goricah in na Posavskem hribovju. To so tudi območja, kjer najdemo osončena suha travišča z grmišči in njihove zaraščajoče faze, navadno s črnim trnom in glogom, ki sta pri nas glavni hranilni rastlini gosenic hromega volnoritca.

Summary

Eriogaster catax is a species of moth listed on the Annexes II and IV of the Habitats Directive. Specimens and its habitat are legally protected by the national Decree on Protected Wild Animal Species (Ur. l. RS 2004a). In Slovenia, implementation of the Habitats Directive for the species is still in progress since Natura 2000 sites have not been fully designated as yet. Due to our poor knowledge of its ecology and distribution in Slovenia, every study of its recent distribution and population size could contribute to a better designation of appropriate Natura 2000 sites, since the species was categorized as »scientific reserve« for both biogeographical regions at the last biogeographical seminars (Petkovšek 2015).

The overview of its distribution in Slovenia was prepared by Čelik et al. (2004). In 2005, the species was known from 44 UTM grid squares (Čelik et al. 2004, 2005, complemented with Stauder 1923 and Mladinov 1976). In this paper, we present 113 new records from 78 localities for the species in Slovenia. Records in this contribution are a combination of systematic surveys for the species and chance encounters. These data extend the known distribution of the species to additional 12 UTM grid squares and confirm its presence for 15 UTM grid squares. It was not surprising that most of records come from the Primorska region. This could be mainly due to the presence of the most suitable habitats for the species, as well as popularity of the region among lepidopterologists. The known distribution is now extended to the areas along the Sava, Drava, Mura and Ledava Rivers. The record in Bela krajina is the first for the region. We widened the knowledge of the distribution also on Mt. Nanos, in the Dragonja River valley and in the Notranjska region (Cerkniško Lake and Pivka lakes). The findings in the Notranjska region are within the alpine biogeographical region in Slovenia. Our findings confirm the conclusion of the biogeographical seminars for *E. catax* as scientific reserve.

Larval stages of *Eriogaster catax* were observed from late March until mid-June and adults from mid-September until early November. Altitudinal distribution varies between 0 and 960 m a. s. l. (Me = 258, Q1–Q3: 166–420).

Our findings have improved the current knowledge on distribution of *Eriogaster catax* in Slovenia. We conclude that the distribution of the species in Slovenia is still inadequately known.

Zahvala

Zahvaljujemo se vsem, ki so prispevali podatke za ta prispevek ali drugače sodelovali pri terenskem delu: Tatjana Čelik, Miroslav Kastelic, Dušan Klenovšek, Tone Lesar, Kristjan Malačič, Slavko Polak, Bojan Porenta, Željko Predovnik, Luka Šparl, Valentin Schein, Gregor Torkar, Damjan Vinko in Valerija Zakšek. Notranjski regijski park nam je posredoval podatke lastnega monitoringa. Ali Šalamun iz Centra za kartografijo favne in flore (CKFF) je pomagal pri kartografiji in pripravi podatkov.

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Surveys of butterfly and skipper fauna in the southwestern part of the Republic of Macedonia (Lepidoptera: Papilionoidea & Hesperioidea)

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Abstract. Data from four surveys within the last six years were combined in order to improve the knowledge of the butterfly distribution in the Republic of Macedonia. These surveys covered a total of 40 localities, with special emphasis on less sampled areas of the south-western part of the country. The study yielded recording of 131 species, including several habitat specialist and potentially threatened butterflies. Interesting records for the following species are discussed in detail: *Muschampia tessellum*, *Anthocharis gruneri*, *Euchloe penia*, *Tarucus balkanicus*, *Cupido alcetas*, *Pseudophilotes bavius*, *Polyommatus aroaniensis*, *Polyommatus escheri*, *Araschnia levana* and *Melitaea ornata*. Ten species observed are considered threatened at the European level and 18 of them at the country level. This proves high conservation value of the studied region with many butterfly rich habitats still preserved. The lack of concerted effort for mapping of butterfly fauna in Macedonia is discussed and priorities for future surveys given.

Key words: distribution, habitat specialists, threatened species, Grypocera

Izvleček. Raziskave favne dnevnih metuljev v jugozahodnem delu Republike Makedonije (Lepidoptera: Papilionoidea & Hesperioidea) – Predstavljeni so podatki iz štirih raziskav v zadnjih šestih letih, s katerimi želimo prispevati k boljšemu poznavanju razširjenosti dnevnih metuljev v Republiki Makedoniji. Vzorčili smo na 40 lokacijah, s posebnim poudarkom na popisovanju v manj raziskanih predelih jugozahodnega dela države. Skupno smo zabeležili 131 vrst, med njimi več habitatnih specialistov in potencialno ogroženih metuljev. Podrobneje so predstavljene zanimive najdbe naslednjih vrst: *Muschampia tesellum*, *Anthocharis gruneri*, *Euchloe penia*, *Tarucus balkanicus*, *Cupido alcetas*, *Pseudophilotes bavius*, *Polyommatus aroaniensis*, *Polyommatus escheri*, *Araschnia levana* in *Melitaea ornata*. Deset opaženih vrst je navedenih kot ogrožene na evropski ravni, 18 vrst pa je vključenih v rdeči seznam na državni ravni. Prisotnost teh vrst dokazuje, da je na območju raziskave še vedno mogoče najti ohranjena življenjska okolja z visoko naravovarstveno vrednostjo in veliko vrstno pestrostjo metuljev. V zaključku razpravljamo o pomanjkanju usklajenih prizadevanj za kartiranje favne dnevnih metuljev v Makedoniji ter postavljamo prednostne naloge za prihodnje raziskave.

Ključne besede: razširjenost, habitatni specialisti, ogrožene vrste, Grypocera

Introduction

The Republic of Macedonia is situated in southeastern Europe, in the region where continental and Mediterranean climate influences intersect. The country possesses some of the most stunning mountain ranges of up to about 2700 meters, with typical mountain climate, and deep river gorges which provide great microclimatic variation and serve as refugia for a number of relict taxa. This wide range of climatic types resulted in extremely diverse invertebrate fauna in the country with a relatively small total area (Hristovski et al. 2015). With 205 butterfly species recorded up to date (Melovski & Bozhinovsk 2014), it is definitively one of the hotspots of butterfly diversity in Europe.

Comprehensive faunistic surveys from the previous century by Rebel (1913), Alberti (1922) and Thurner (1964) provided valuable outlines of the butterfly species distribution in the country. In 1989, a distribution atlas of the butterflies of Yugoslav Macedonia followed (Schaider & Jakšić 1989), but its reliability is questionable due to lack of record traceability and inclusion of doubtful and imprecise data. In the last two decades, the butterfly surveys intensified resulting in a number of new species records for the country (Kolev & van der Poorten 1997, Krpač & Mihajlova 1997, Melovski 2004, Verovnik & Micevski 2008, Micevski et al. 2009a, 2009b, Verovnik et al. 2010, Micevski 2013, Melovski & Bozhinovsk 2014). Additionally, several faunistic and species targeted surveys were published providing valuable new information on the distribution of several rare species in the country (Dincă et al. 2010, Franeta et al. 2012, Verovnik 2012, Verovnik et al. 2013, Melovski & Bozhinovsk 2014). Although the published surveys vastly improved the knowledge regarding the distribution of butterflies in Macedonia, most of the recent studies focused on already well surveyed areas like Mt. Galičica (Krpač et al. 2011), Mt. Baba (Micevski & Micevski 2002/2003) or Mt. Shar (Melovski 2003, Huemer et al. 2011, Abdija et al. 2013a, 2013b, 2013c, 2013d). Therefore large portions of the country, particularly its central and eastern parts, remain understudied.

Here we combined unpublished data from several visits to the Republic of Macedonia between 2010 and 2016. This study could thus be considered as a continuation of the previously published surveys (Verovnik et al. 2010, Verovnik 2012). Once more, the clear focus was on spring aspect of the fauna which is generally neglected. The study specifically targets the under surveyed regions in the south-western part of the country and the most important habitats for butterfly diversity (e.g. rocky slopes, gorges and gullies, dry grasslands). This enabled us to get a comprehensive overview of the local butterfly fauna and to provide new records for some rare and potentially threatened habitat specialist butterflies.

Materials and methods

Butterflies were observed during four surveys: July 2010 (Prespa Lake region and surroundings of Prilep), July 2012 (surroundings of Prilep), April/May 2015 (surroundings of Bitola, Prilep, and Makedonski Brod), May 2016 (surroundings of Bitola and Gevgelija). In total, 40 localities were visited (Fig. 1). They were pre-selected based on Google Earth satellite images with a specific preference for dry rocky grasslands and gorges. Adults were captured using entomological nets and released after their identification. For this purpose, Butterflies of Britain and Europe field guide was used as a primary source of information (Tolman & Lewington 2008).

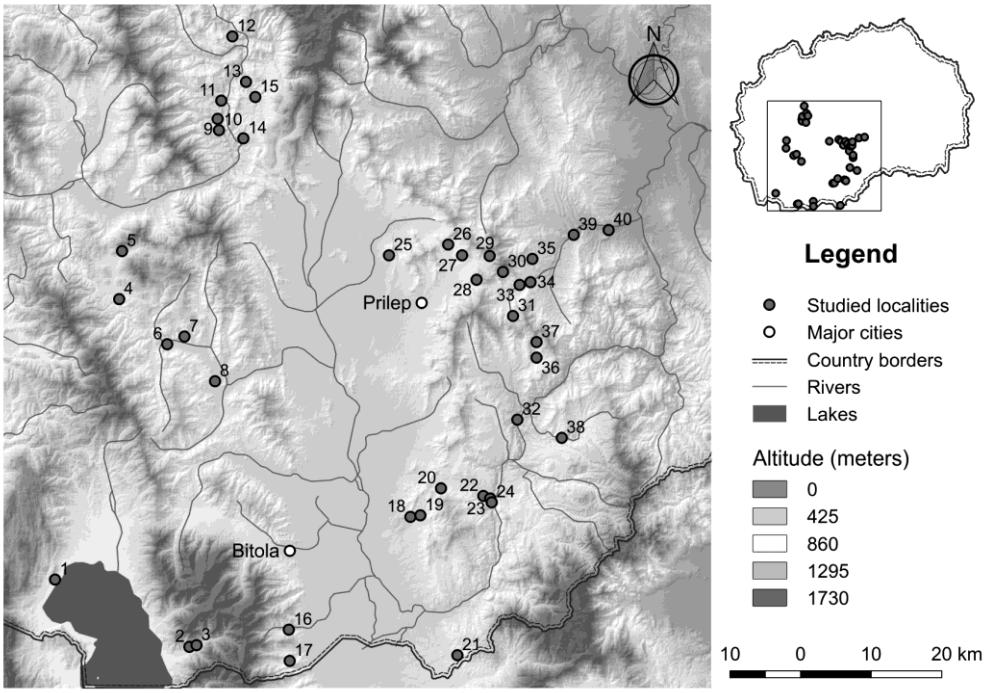

Figure 1. A map of the visited sites during four surveys of butterfly fauna in south-western part of the Republic of Macedonia. The numbering corresponds with the list of localities in the text.
Slika 1. Karta razporeditve obiskanih lokalitet med štirimi raziskavami dnevnih metuljev v Makedoniji. Oštevilčenje ustreza seznamu lokalitet v besedilu.

Results

List of localities

The list of localities contains the relevant toponyms, a short description of the habitat, altitude, coordinates and dates of the visits. Localities are arranged in geographical order from southwest towards northeast (Fig. 1).

1. Resen, Sirhan, rocky and bushy steep slopes along the road south of the village; 860 m; 40°59'38", 20°55'57"; 30.4.2015.
2. Prespa, Brajčino, rocky and bushy steep slopes N of the village; 1020 m; 40°54'29", 21°9'32"; 9.7.2010.
3. Prespa, Brajčino, small glades and mixed woodlands along dirt road northeast of the village; 1060 m; 40°54'37", 21°10'15"; 9.7.2010.
4. Bitola, Železnec, rocky slopes in the gorge along the road to Belica; 850 m; 41°21'5", 21°2'27"; 26.4.2015.
5. Bitola, Cer, stony meadows and pastures on south facing slopes west from the village; 1000 m; 41°24'45", 21°2'45"; 26.4.2015.
6. Bitola, Žvan, partially overgrown meadows on southern facing slopes north of the village; 670 m; 41°17'38", 21°7'2"; 26.4.2015.
7. Bitola, Sopotnica, rocky slopes and meadows along the dirt road north of the village; 700 m; 41°18'13", 21°9'5"; 26.4.2015.
8. Bitola, Belče, meadows and pastures on south facing slopes north of the village; 650 m; 41°14'48", 21°12'11"; 26.4.2015.
9. Makedonski Brod, Treska Valley, Slatina, meadows, bushes and riparian vegetation along the road to Slatina; 520 m; 41°34'51", 21°12'30"; 1.5.2015.
10. Makedonski Brod, Treska Valley, Grešnica, meadows and bushes along the road to the village; 510 m; 41°33'59", 21°12'39"; 1.5.2015.
11. Makedonski Brod, Treska Valley, Dolni Manastirec, meadows and riparian vegetation along a dirt track west of the village; 510 m; 41°36'15", 21°12'53"; 1.5.2015.
12. Makedonski Brod, Treska Valley, Dolna Belica, rocky slopes along the road northwest of the village; 480 m; 41°41'9", 21°14'2"; 1.5.2015.
13. Makedonski Brod, Treska Valley, Modrište, bushes and meadows along the dirt road towards Vir Village; 550 m; 41°37'41", 21°15'25"; 1.5.2015.
14. Makedonski Brod, Treska Valley, Devič, screes and rocky slopes in a valley 1 km east of the village; 600 m; 41°33'22", 21°15'8"; 1.5.2015.
15. Makedonski Brod, Treska valley, Vir, rocky slopes along the road north of the village; 630 m; 41°36'31", 21°16'22"; 1.5.2015.
16. Bitola, Velušina, dry meadows on south facing slopes along the road west of the village; 850 m; 40°55'47", 21°19'34"; 27.4.2015.
17. Bitola, Kišava, dry meadows on south facing slopes above the road east of the village; 750 m; 40°53'23", 21°19'39"; 27.4.2015.
18. Bitola, Suvodol, grasslands and pastures north of the quarry; 700 m; 41°4'22", 21°31'56"; 27.4.2015.
19. Bitola, Suvodol, grasslands and pastures in a small valley east of the village near artificial lake; 700 m; 41°4'28", 21°32'56"; 27.4.2015.
20. Bitola, Makovo, bushy meadows along the road 1 km west of the village; 800 m; 41°6'32", 21°35'3"; 25.5.2016.
21. Bitola, Živojno, pastures and grasslands in a small valley southeast of the village; 770 m; 40°53'45", 21°36'356"; 25.5.2016.
22. Bitola, Rapeš, partially overgrown meadows 1 km southeast of the village; 640 m; 41°5'55", 21°39'20"; 27.4.2015.

23. Bitola, Rapeš, bushy and rocky south-east facing slopes above the river Crna reka; 470 m; 41°5'43", 21°40'1"; 27.4.2015, 25.5.2016.
24. Bitola, Rapes, hay meadows and riparian vegetation at Crna reka east of the village; 450 m; 41°5'26", 21°40'10"; 25.5.2016.
25. Prilep, Mali Mramorani, rocky and grassy south facing slopes east of the village; 740 m; 41°24'22", 21°29'55"; 5.7.2012.
26. Prilep, Prisad, quarry north of the town, bushy and rocky slopes east of the quarry; 920 m; 41°25'10", 21°35'57"; 14.7.2010, 6.7.2012.
27. Prilep, Prisad, dry grasslands and screes on south facing slopes of Mt. Ćave; 1020 m; 41°24'20", 21°37'21"; 6.7.2012.
28. Prilep, Pletvar, bushy and rocky slopes above the village; 1060 m; 41°22'27", 21°38'48"; 14.7.2010, 5.7.2012, 7.7.2012, 28.4.2015.
29. Prilep, Krstec, in the village at a spring and on grassy slopes north of the village; 1080 m; 41°24'16", 21°40'9"; 6.7.2012.
30. Prilep, Pletvar, steep rocky slopes above the quarry on southern slopes of Mt. Kozjak; 1200 m; 41°23'2", 21°41'30"; 7.7.2012.
31. Prilep, Belovodica, rocky and bushy slopes along the road southeast of the village; 990 m; 41°19'40", 21°42'29"; 6.7.2012.
32. Prilep, Mariovo, meadows and riparian vegetation at a bridge over river Crna reka; 370 m; 41°11'44", 21°42'50"; 8.7.2012.
33. Prilep, Trojaci, partially overgrown meadows along the main road southwest from the village; 670 m; 41°22'2", 21°43'11"; 28.4.2015.
34. Prilep, Trojaci, orchards and meadows along the road in the village and along a small stream; 550 m; 41°22'14", 21°44'17"; 14.7.2010, 8.7.2012.
35. Prilep, Toplica, wet patches in the village at a small spring; 670 m; 41°24'1", 21°44'30"; 6.7.2012.
36. Prilep, Veprčani, bushes and small clearings along the road in a gully northwest of the village; 790 m; 41°16'28", 21°44'50"; 8.7.2012.
37. Prilep, Veprčani, partially overgrown screes and rocky pastures above the quarry northwest of the hamlet; 1030 m; 41°17'39", 21°44'51"; 8.7.2012.
38. Prilep, Vitolište, screes and rocky slopes west of the village; 740 m; 41°10'19", 21°47'19"; 8.7.2012.
39. Gradsko, Raec, bushy and rocky slopes in a gorge 3 km west from the village, along an abandoned road; 300 m; 41°25'50", 21°48'44"; 14.7.2010, 28.4.2015.
40. Gradsko, Raec, south facing rocky and bushy slopes 3 km northeast from the village; 240 m; 41°26'10", 21°52'17"; 14.7.2010, 5.7.2012, 28.4.2015.

List of species

Butterfly species are listed in taxonomical order (Tab. 1) in principle following the nomenclature of the Fauna Europaea (Fauna Europaea 2016). Butterflies were not collected during our surveys, therefore the genitalia were not measured. We list *Leptidea sinapis* as *Leptidea sinapis/juvernica* species complex, although it is very likely that all specimens observed belong to the first mentioned species. Specifically, in the Southern Balkan Peninsula, *L. juvernica* is limited to high mountains hygrophilous vegetation (Shtinkov et al. 2016), while our surveys were limited to lower altitudes and mostly thermophilous localities.

Table 1. The distribution of butterfly species observed during our surveys in southwestern part of Macedonia. 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 štirimi raziskavami v jugozahodnem delu Makedonije. Lokalitete so oštevilčene tako kot v poglavju Seznam lokalitet. D&S je okrajšava za Denis & Schiffermüller.

Species	Localities
Papillionidae	
Iphiclides podalirius (Linnaeus, 1758)	4, 10, 15, 19, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40
Papillio machaon Linnaeus, 1758	7, 10, 13, 14, 15, 26, 27, 28, 31, 40
Zerynthia cerisy (Godart, 1824)	24
Zerynthia polyxena ([D&S], 1775)	10, 19, 22, 23, 39
Pieridae	
Aporia crataegi (Linnaeus, 1758)	2, 3, 20, 21, 23, 24, 38
Pieris balcana (Lorkovic, 1968)	3, 8, 14, 21, 24, 34, 40
Pieris ergane (Geyer, 1828)	3, 5, 6, 7, 14, 28, 33, 34, 39
Pieris mannii (Mayer, 1851)	32, 40
Pieris napi (Linnaeus, 1758)	1, 6, 7, 8, 13, 16, 17, 19, 21, 22, 28, 39
Pieris rapae (Linnaeus, 1758)	7, 13, 14, 21, 28, 34, 35, 36, 38, 39, 40
Pieris brassicae (Linnaeus, 1758)	2
Pontia edusa (Fabricius, 1777)	10, 18, 19, 21, 22, 25, 26, 27, 28, 29, 32, 34, 35, 36, 38
Anthocharis cardamines (Linnaeus, 1758)	6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 22, 23, 28, 33, 39, 40
Anthocharis gruneri Herrich-Schäffer, 1851	4, 5, 10, 11, 13, 15, 28, 39
Euchloe ausonia (Hübner, 1804)	14, 22, 23, 24
Euchloe penia (Freyer, 1852)	12, 13, 15, 28
Colias alfacariensis Ribbe, 1905	6, 10, 13, 15, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 38, 39, 40
Colias croceus (Fourcroy, 1785)	1, 2, 3, 7, 8, 11, 16, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 34, 35, 36, 37, 38, 40
Gonepteryx cleopatra (Linnaeus, 1767)	25
Gonepteryx rhamni (Linnaeus, 1758)	1, 4, 5, 7, 10, 12, 13, 15, 18, 19, 23, 27
Leptidea duponcheli (Staudinger, 1871)	2, 5, 6, 23, 25, 26, 27, 28, 34, 35, 36, 40
Leptidea sinapis/juvernica	4, 5, 6, 7, 8, 9, 11, 13, 14, 15, 17, 23, 25, 26, 28, 33, 34, 39
Lycaenidae	
Satyrium acaciae (Fabricius, 1787)	2, 3, 40
Satyrium ilicis (Esper, 1779)	3, 24, 28
Satyrium spini ([D&S], 1775)	26, 27, 28, 30, 31
Satyrium w-album (Knoch, 1782)	34
Favonius quercus (Linnaeus, 1758)	34
Callophrys rubi (Linnaeus, 1758)	1, 5, 6, 8, 14, 15, 17, 20, 21, 24, 28, 33
Lycaena alciphron (Rottemburg, 1775)	20, 24, 34
Lycaena phlaeas (Linnaeus, 1761)	2, 3, 7, 8, 16, 18, 19, 20, 21, 23, 24, 25, 28, 29, 32, 34, 35, 36, 38, 39
Lycaena thersamon (Esper, 1784)	25, 32, 36
Lycaena tityrus (Poda, 1761)	1, 2, 10, 17, 18, 20, 23, 25, 28, 29, 32, 34, 38, 39
Lycaena virgaureae (Linnaeus, 1758)	2, 3
Tarucus balkanica (Freyer, 1844)	24, 32, 39
Leptotes pirithous (Linnaeus, 1767)	34
Cupido alcetas (Hoffmannsegg, 1804)	34
Cupido argiades (Pallas, 1771)	10, 14
Cupido minimus (Fuessly, 1775)	9, 13, 14, 24, 25, 26, 27, 28, 29, 31, 34, 36, 37, 38
Cupido osiris (Meigen, 1829)	2, 9, 20, 24, 25
Celastrina argiolus (Linnaeus, 1758)	3, 7, 16, 17, 25, 32, 34, 40
Pseudophilotes bavius (Eversmann, 1832)	9, 13, 14
Pseudophilotes vicrama (Moore, 1865)	9, 14, 15, 24, 25, 26, 27, 28, 30, 35, 36, 37, 39
Scolitantides orion (Pallas, 1771)	9, 12, 15, 39
Glaucopsyche alexis (Poda, 1761)	6, 9, 13, 14, 18, 23, 24, 28, 40
Iolana iolas (Ochsenheimer, 1816)	23, 24
Phengaris alcon ([D&S], 1775)	28, 29
Cyaniris semiargus (Rottemburg, 1775)	3, 24
Plebejus argyrognomon (Bergstrasser, 1779)	3

Species	**Localities**
Plebejus argus (Linnaeus, 1758)	3, 20, 21, 26, 29, 31, 34, 36
Plebejus idas (Linnaeus, 1761)	24, 25, 26, 28, 29, 30, 34, 35
Aricia agestis ([D&S], 1775)	2, 3, 6, 9, 10, 13, 14, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40
Aricia artaxerxes (Fabricius, 1793)	3
Aricia anteros (Freyer, 1838)	20
Polyommatus bellargus (Rottemburg, 1775)	28, 31, 34, 38, 40
Polyommatus coridon (Poda, 1761)	34
Polyommatus daphnis ([D&S], 1775)	25, 29, 34, 35, 36, 39
Polyommatus eros (Ochsenheimer, 1808)	3
Polyommatus icarus (Rottemburg, 1775)	1, 2, 3, 6, 18, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 32, 34, 35, 36, 37, 38, 39, 40
Polyommatus thersites (Cantener, 1835)	2, 23, 24, 25, 26, 31, 34, 40
Polyommatus escheri (Hübner, 1823)	35
Polyommatus amandus (Schneider, 1792)	3, 24
Polyommatus dorylas ([D&S], 1775)	28, 31
Polyommatus admetus (Esper, 1783)	2, 3, 25, 26, 28, 30, 34, 35
Polyommatus aroaniensis (Brown, 1976)	25, 26, 28, 29, 30
Polyommatus ripartii (Freyer, 1830)	3, 28, 34, 36
Nymphalidae	
Libythea celtis (Laicharting, 1782)	6, 23, 24
Apatura ilia ([D&S], 1775)	29
Apatura iris (Linnaeus, 1758)	3
Limenitis reducta Staudinger, 1901	21, 23, 24, 25, 29, 34, 39, 40
Aglais io (Linnaeus, 1758)	3, 6, 7, 8, 9, 13, 34
Aglais urticae (Linnaeus, 1758)	29
Nymphalis antiopa (Linnaeus, 1758)	6, 11, 31, 34, 39
Nymphalis polychloros (Linnaeus, 1758)	6, 7
Polygonia c-album (Linnaeus, 1758)	3, 11, 15, 20, 34, 36, 39, 40
Vanessa atalanta (Linnaeus, 1758)	3, 9, 21, 24, 29
Vanessa cardui (Linnaeus, 1758)	1, 3, 7, 9, 10, 13, 14, 15, 20, 21, 23, 24, 25, 27, 28, 29, 30, 31
Araschnia levana (Linnaeus, 1758)	11
Argynnis adippe ([D&S], 1775)	3, 36
Argynnis aglaja (Linnaeus, 1758)	28, 29
Argynnis niobe (Linnaeus, 1758)	2, 3, 25, 26,29, 34
Argynnis pandora ([D&S], 1775)	3, 21, 23, 24, 25, 26, 27, 28, 34, 38
Argynnis paphia (Linnaeus, 1758)	3, 29, 34
Issoria lathonia (Linnaeus, 1758)	3, 8, 13, 14, 18, 20, 21, 24, 25, 26, 28, 29, 30, 35, 36, 37, 38
Boloria dia (Linnaeus, 1767)	8, 9, 29, 34
Brenthis daphne (Bergstrasser, 1780)	3, 25, 29, 34, 40
Brenthis hecate ([D&S], 1775)	20, 25
Melitaea athalia (Rottemburg, 1775)	3
Melitaea phoebe ([D&S], 1775)	2, 3, 21
Melitaea ornata Cristoph, 1893	39
Melitaea arduinna (Esper, 1783)	20
Melitaea cinxia (Linnaeus, 1758)	20, 24
Melitaea didyma (Esper, 1778)	2, 3, 20, 21, 24, 25, 28, 29, 30, 31, 37, 40
Melitaea trivia ([D&S], 1775)	2, 23, 30, 35
Aphantopus hyperanthus (Linnaeus, 1758)	3, 34
Brintesia circe (Fabricius, 1775)	2, 3, 25, 26, 27, 28, 29, 30, 34, 35, 36, 37, 38, 40
Maniola jurtina (Linnaeus, 1758)	2, 3, 20, 21, 23, 24, 25, 26, 28, 29, 34, 35, 36, 37, 40
Hyponephele lupinus (O. Costa, 1836)	34
Hyponephele lycaon (Kuhn, 1774)	25, 38
Pyronia tithonus (Linnaeus, 1767)	32, 34
Kirinia roxelana (Cramer, 1777)	3, 29, 34, 39
Lasiommata maera (Linnaeus, 1758)	39
Lasiommata megera (Linnaeus, 1767)	12, 20, 21, 23, 30, 32, 33, 34, 35, 36, 40

Species	Localities
Pararge aegeria (Linnaeus, 1758)	3, 9, 13, 21, 34, 39
Coenonympha arcania (Linnaeus, 1761)	3
Coenonympha leander (Esper, 1784)	21, 23, 24
Coenonympha pamphilus (Linnaeus, 1758)	2, 6, 8, 16, 18, 20, 21, 22, 25, 29, 30, 31, 32, 33, 34, 38, 39, 40
Melanargia galathea (Linnaeus, 1758)	2, 3, 25, 26, 28, 29, 34, 36, 38
Melanargia larissa (Geyer, 1828)	2, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 38, 39, 40
Hipparchia senthes (Fruhstorfer, 1908)	27, 30, 31
Hipparchia syriaca (Staudinger, 1871)	28, 29, 30, 31, 34, 35, 38
Satyrus ferula (Fabricius, 1793)	26, 27, 28, 29, 30, 31, 38
Chazara briseis (Linnaeus, 1764)	26, 27, 28, 30, 37, 40
Pseudochazara cingovskii (Gross, 1973)	26, 27, 28, 30, 31, 37, 38
Pseudochazara anthelea (Hübner, 1824)	40
Hesperiidae	
Erynnis tages (Linnaeus, 1758)	5, 6, 11, 13, 14, 15, 25, 28, 34, 39, 40
Carcharodus alceae (Esper, 1780)	6, 23, 24, 34, 35, 39, 40
Carcharodus floccifera (Zeller, 1847)	34
Carcharodus lavatherae (Esper, 1783)	25, 30
Carcharodus orientalis Reverdin, 1913	3, 9, 21, 23, 24, 34
Muschampia tessellum (Hübner, 1803)	21
Pyrgus alveus (Hübner, 1803)	28
Pyrgus armoricanus (Oberthür, 1910)	1, 20, 21, 24, 27, 28, 34, 36, 40
Pyrgus serratulae (Rambur, 1839)	24, 25
Pyrgus cinarae (Rambur, 1839)	2, 3, 25, 26, 28, 29, 30, 34, 35, 36, 38
Pyrgus sidae (Esper, 1784)	20, 24, 25
Pyrgus malvae (Linnaeus, 1758)	3, 6, 9, 11, 13, 14, 20, 21, 24, 25, 27, 31
Spialia orbifer (Hübner, 1823)	21, 23, 24, 25, 28, 36, 40
Ochlodes sylvanus (Esper, 1777)	2, 3, 24, 25, 28, 29, 34
Thymelicus acteon (Rottemburg, 1775)	25, 29
Thymelicus lineola (Ochsenheimer, 1808)	3, 21, 23, 24, 25, 26, 28, 29, 30, 34, 37
Thymelicus sylvestris (Poda, 1761)	3, 20, 21, 23, 24, 25, 26, 34

Discussion

A total of 131 species were encountered during the survey representing roughly 65% of the butterfly fauna of Macedonia. Given the size of the surveyed area and lack of high alpine localities, the number of the species observed is relatively high and could be attributed to sampling in spring and summer period when butterfly diversity is the highest. Also, wide variety of habitats was surveyed and potentially butterfly rich sites were selected over intensively managed areas.

The multivoltine species like *Aricia agestis*, *Polyommatus icarus* and *Lycaena phleas* were the most widespread and are generally known as common in Macedonia (Schaider & Jakšić 1989). In contrast, several rare and locally distributed species were encountered during our surveys. Records of two of these, *Gonepteryx cleopatra* and *Pseudochazara cingovski*, were published and discussed separately (Verovnik et al. 2013, Micevski & Micevski 2014), while additional interesting species observations are briefly presented below:

- *Muschampia tessellum* – This butterfly was mentioned for the first time for Macedonia by Thurner (1964) for the surroundings of Ohrid and Struga towns, but without further details on locality or collector. An additional record is roughly depicted in the atlas from the region southwest of Dojran Lake (Schaider & Jakšić 1989). The species was also reported from Grupčin village east of Skopje (Russell 1992), however, the record was later revoked due to confusion with even more local *Muschampia cribrellum* (Eversmann, 1841) (Dincă et al. 2010, Peter Russell pers. comm.). The species was recently found on Mt. Suva Planina south of Skopje (Nikola Micevski, pers. comm.). We discovered this impressively large skipper at Živojno village not far from the Greek border. The habitat is dominated by overgrazed grasslands, but small gullies with steep, partially eroded slopes still provide some flower rich patches (Fig. 2a). No host plants were detected at the site, but observation of two territorial males (Fig. 2b) patrolling the small valley indicates potential residence of the species in this area.

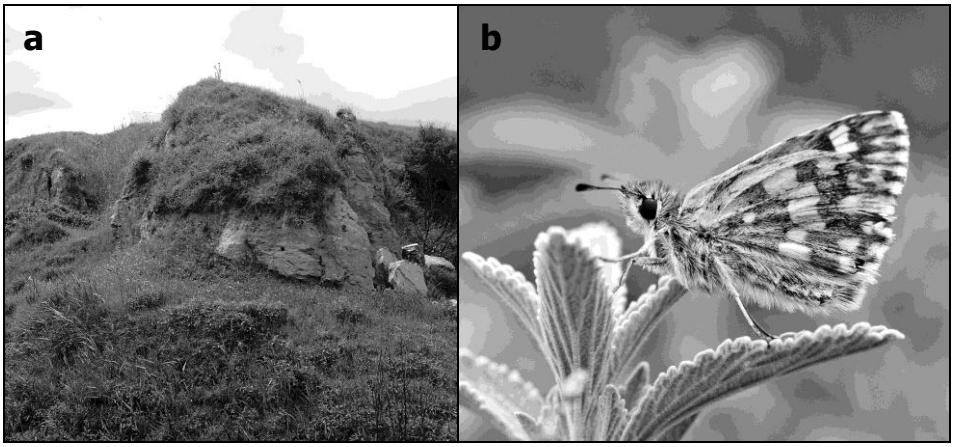

Figure 2. Habitat (a) and territorial male (b) of Tessellated Skipper *Muschampia tessellum* discovered at Živojno village southeast of Bitola.
Slika 2. Habitat (a) in teritorialni samec (b) debeloglavčka vrste *Muschampia tessellum*, najden pri vasi Živojno jugovzhodno od Bitole.

- *Anthocharis gruneri* – The species is locally distributed in Macedonia in the Vardar valley and Ohrid Lake region (Schaider & Jakšić 1989). We found it at several sites in the upper part of the Treska Valley, which is not unexpected given the known presence of the species in the lower part of the valley (Thurner 1964, Verovnik 2012) and recent observations from the southern Serbia (Popović & Milenković 2012). More interestingly, the species was found for the first time in the Raec Gorge and at Pletvar Pass, both well studied localities with extensive faunistic records (Alberti 1922, Schaider 1984, Russell 1992). Additionally, we recorded it on dry rocky slopes at Cer and Železnec villages filling the gap between the Treska Valley and Mt. Galičica. Apparently, the species is more widespread in Macedonia than previously thought and will probably be recorded in additional localities during future spring surveys.

- *Euchloe penia* – This is another extremely local species known only from the lower and middle part of the Treska Valley (Thurner 1964, Verovnik et al. 2010). Two new sites further south in the upper part of the Treska Valley are only a small extension of its known range, however, this is a good indication of potentially wider distribution of the species in the region. It was rather common during both visits at Pletvar Pass, a known stronghold of the species (Russell 1992, Hainsch 1993).
- *Tarucus balkanicus* – This attractive little blue is distributed in the hottest parts of Macedonia, which include the Vardar Valley, surroundings of Štip and Ohrid town (Thurner 1964, Schaider & Jakšić 1989, Verovnik et al. 2010, Verovnik 2012). We found the species at two sites, both in the valley of the river Crna reka east of Bitola. *Paliurus spina-christi* Mill., the host plant of the species, is common on steep rocky slopes at both sites, therefore the presence of local populations is not questionable. These new localities are well outside its known range in Macedonia.
- *Cupido alcetas* – This is a very rare species in Macedonia, known only from Ohrid region, Mt. Shar (Lešok) and central part of the Treska Valley (Thurner 1964, Schaider & Jakšić 1989, Verovnik et al. 2010). We found a single specimen along the road near a small stream in Trojaci village. Based on two consecutive observations, the presence of streams and riparian vegetation seems to be important habitat requirement for this species.
- *Pseudophilotes bavius* – Historically, the species was known from the lower Treska Valley (Thurner 1964), where it is still present (Verovnik 2012), and from the valley of the Babuna and Topolka Rivers south of Veles town (Schaider 1984). Despite several visits by the authors to both valleys near Veles in spring, the species could not be re-found there. The situation is also deteriorating at the Treska-Matka dam site, where overgrowing of the larval habitat is a serious problem (Verovnik 2012). Observing strong populations at three new sites further up the Treska Valley is therefore a welcoming relief, as the species is nearly extinct at the previously known sites. The species is listed in the Habitats Directive (Council Directive 92/43/EGS 2009), therefore the newly discovered populations should be targeted for long term conservation.
- *Polyommatus escheri* – Owing to the rarity of its hostplant *Astragalus monspessulanus* (Bernh.) in Macedonia, the species has so far been recorded only at three localities (Micevski et al. 2009b). We observed a single male mud puddling at a spring in Toplica village, which is less than 10 km away from a historically known site in the Raec Gorge, central Macedonia (Thurner 1964). No host plants were observed in the vicinity, but as this butterfly is relatively sedentary (Verovnik 2004) a local population is likely to occur in close proximity of the village.
- *Polyommatus aroaniensis* – The species was first mentioned for Macedonia by Kolev & van der Poorten (1997) from the vicinity of Prilep and Mt. Galičica (Petrina Planina). Recently it was also found near Mariovo in southern Macedonia (Melovski & Bozhinovsk 2014). Our records came from several sites in vicinity of Pletvar Pass and at Mali Mramorani village, northeast of Prilep. The identification of this species is, however, tentative and based on lack of white stripe on the hind wing underside (Fig. 3), which is considered the main characteristic of the species (Pamperis 2009). However, it has been recently shown that this character is extremely variable in closely related *P. ripartii* (Lovrenčić et al. 2016), which is also present in this region.

Figure 3. A male of the Grecian Anomalous Blue *Polyommatus aroaniensis* mud puddling on a road in Trojaci village. A vestigial white stripe on hind wings, typical for the species, is visible.
Slika 3. Samec modrina vrste *Polyommatus aroaniensis* med srkanjem mineralov na cesti v vasi Trojaci. Vidna je komaj opazna bela proga na zadnjih krilih, ki je značilna za to vrsto.

- *Araschnia levana* – First recorded for Macedonia by Thomas (1993) and subsequently reported as new for the country by Melovski (2003, 2004). The species is becoming more widespread in the region (Verovnik et al. 2010) and our record from Dolni Manastirec in the upper part of the Treska Valley is in line with this observation.
- *Melitaea ornata* – Based on the adult characteristics, the species was first reported for Macedonia by Verovnik et al. (2010), followed by several additional observations in southeastern part of the country (Verovnik 2012). Its presence in Macedonia has also been confirmed using larval stage, with conspicuous red head of the caterpillars being a more reliable taxonomic character (Russell et al. 2015). This study also concluded that the species should be more widespread in the country. We found specimens with typical phenotype just at a single locality in the Raec Gorge in spring 2015.

Among the species observed, the endemic *Pseudochazara cingovskii* is one of the most threatened butterflies worldwide. Only a few localities are known, all within the territory of the Republic of Macedonia. Habitat destruction due to quarrying is considered as the largest threat for this butterfly. However, its critically endangered status (CR) has recently been downgraded to endangered (EN) due to new data on distribution and population size (Verovnik et al. 2013). Additional European red list species (van Swaay et al. 2010) recorded during our surveys are: *Carcharodus lavatherae*, *Carcharodus floccifera*, *Thymelicus acteon*, *Zerynthia cerisy*, *Pseudophilotes vicrama*, *Aricia anteros*, *Polyommatus eros*, *Polyommatus dorylas*, and *Chazara briseis*, all categorized as near threatened (NT). The majority of them were observed at one or two localities and are not widespread in the country. A notable exception is

P. vicrama found at 13 sites. Considering the red list of butterflies of Macedonia (Krpač & Darcemont 2012), 18 of the observed species are listed. Yet, this red list assessment should be considered tentative, given the lack of sufficient butterfly data coverage, specific studies of habitat requirements and major threats for the butterflies in the country.

The butterfly data coverage for Macedonia is still insufficient and there are many regions with very limited butterfly records. This is especially true for the north-eastern part of the country, where further surveys should be targeted covering at least some of the unstudied areas. By providing new records for several rare, local and potentially threatened butterfly species we hope to contribute to their conservation and long term survival. We also wish to encourage further butterfly surveys in Macedonia and call for a more concerted effort on a modern butterfly distribution atlas, which is essential for red list assessments and conservation decisions.

Povzetek

V obdobju zadnjih šestih let (2010–2016) smo štirikrat obiskali Republiko Makedonijo, kjer smo se osredotočili na popisovanje dnevnih metuljev v slabše raziskanih območjih na jugozahodu države. Skupno smo obiskali 40 lokacij in zabeležili 131 vrst, kar pomeni približno 65 % vseh za Makedonijo znanih vrst. Tako velik delež opaženih vrst pripisujemo kombinaciji popisovanja v pomladanski in poletni sezoni ter načrtnemu iskanju za dnevne metulje potencialno vrstno bogatih življenjskih okolij. S tem smo v popis zajeli tudi nekatere redke in potencialno ogrožene habitatne specialiste. Najbolj zanimiva je najdba debeloglavčka vrste *Muschampia tessellum* pri vasi Živojno, jugovzhodno od Bitole. Ta vrsta je bila glede na zgodovinske vire znana iz dveh območij, naša najdba pa je druga recentna za Makedonijo. Favnistično so zanimive tudi nove najdbe za vrste *Araschnia levana*, *Melitaea ornata*, *Anthocharis gruneri*, *Euchloe penia*, *Tarucus balkanicus*, *Cupido alcetas*, *Pseudophilotes bavius*, *Polyommatus aroaniensis* in *Polyommatus escheri*. Za slednjega je najdba v vasi Topolec četrta za Makedonijo.

Naravovarstveno najvidnejša je najdba okarja *Pseudochazara cingovskii*, ki pa je podrobneje obravnavana v predhodni objavi (Verovnik et al. 2013). Od drugih vrst jih je devet vključenih v rdeči seznam na evropskem nivoju kot potencialno ogrožene (NT), v rdečem seznamu Makedonije pa jih je navedenih 18. To priča o veliki naravovarstveni vrednosti območja raziskave in ohranjenosti nekaterih posebnih življenjskih okolij, na katera so vezane ogrožene vrste metuljev. Razveseljujejo tri nove najdbe modrina vrste *Pseudophilotes bavius*, ki je navedena v habitatni direktivi in sodi med najbolj ogrožene vrste dnevnih metuljev v Makedoniji.

Gledano v celoti je favna metuljev še vedno nepopolno raziskana, saj obstajajo večja območja, v katerih niso bili opravljeni nobeni favnistični popisi. To velja predvsem za severovzhodni del države, kjer bi v prihodnje bilo smiselno organizirati obširnejše raziskave. Prav tako je nujno bolj sistematsko in organizirano popisovanje favne metuljev Makedonije, ki bi omogočilo pripravo sodobnega atlasa razširjenosti te naravovarstveno zelo pomembne skupine žuželk.

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First records of six ant species (Hymenoptera: Formicidae) for Slovenia

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Abstract. Six ant species recorded for the first time in Slovenia are presented: *Camponotus gestroi*, *Hypoponera eduardi*, *Lasius lasioides*, *Tapinoma* cf. *nigerrimum*, *Temnothorax jailensis* and *Temnothorax turcicus*. They were found in the period of the last 9 years, five of them in southwestern Slovenia in the Submediterranean region, while *T. turcicus* was recorded in northeastern Slovenia. Findings of *C. gestroi* and *T. jailensis* considerably extend their previously known ranges in Europe.

Key words: ants, Slovenia, Mediterranean species, faunistics

Izvleček. Prve najdbe šestih vrst mravelj (Hymenoptera: Formicidae) za Slovenijo – Predstavljamo šest vrst mravelj, ki so bile prvič zabeležene v Sloveniji: *Camponotus gestroi*, *Hypoponera eduardi*, *Lasius lasioides*, *Tapinoma* cf. *nigerrimum*, *Temnothorax jailensis* in *Temnothorax turcicus*. Najdene so bile v obdobju zadnjih 9 let, od tega pet vrst v jugozahodni Sloveniji v submediteranski regiji, medtem ko je bila *T. turcicus* odkrita v severovzhodni Sloveniji. Najdbi vrst *C. gestroi* in *T. jailensis* znatno povečujeta njuni doslej znani območji razširjenosti v Evropi.

Ključne besede: mravlje, Slovenija, mediteranske vrste, favnistika

Introduction

Investigations of the Slovenian ant fauna became more systematic only in the last 20 years. As the result of more extensive sampling and included literature data, first general review of the Slovenian ant fauna, which included 105 species, was prepared (Bračko 2000). In the last checklist of ants of Slovenia, 132 species were listed (Bračko 2007). In the following years, two additional species were mentioned for the country, i.e. *Myrmica hellenica* Finzi, 1926 (Seifert et al. 2009) and *Myrmoxenus gordiagini* Ruzsky, 1902 (Bračko 2010). Within Slovenia, the ant fauna is not uniformly distributed. The richest region is the southwestern (Submediterranean) part of the country, where approximately 75% of all Slovenian species have been found (Bračko 2007).

The article presents six ant species recorded in Slovenia for the first time, five of them from the southwestern and one from the northeastern parts of the country.

Materials and methods

The faunistic studies that we refer to were conducted in the years 2008 to 2016. The main collection method applied was direct sampling (hand collecting), while in one case pitfall trapping was applied as well. In the latter case, 7 cm diameter plastic pots placed in the ground with vinegar as the fixative were used. All specimens were preserved in 70% ethanol. We used the relevant taxonomic literature (Seifert 1992, 2007, 2012), as well as high quality images of the type specimens on the AntWeb website (http://www.antweb.org) for species identification. All specimens are kept in the collection of ants of the first author.

Results and discussion

We found six new species for the Slovenian ant fauna. Five of them were recorded in the southwestern part (Submediterranean region) of the country, proving that ants are richly represented here and that additional faunistic investigations in this region can still bring new species. Based on their known ranges, *Hypoponera eduardi* and *Temnothorax turcicus* could be expected for southwestern and northeastern Slovenia, respectively, while the findings of *Camponotus gestroi* and *Temnothorax jailensis* were rather unexpected and considerably extended their previously known ranges in Europe. New records of the two *Temnothorax* species are valuable as in general they have been rarely collected and the literature data on them are scarce. The probable reason is that they are small-sized arboricolous species with small colonies and consequently often overlooked in faunistic studies.

In the following text we present the list of records of each species, with WGS84 coordinates of each locality, followed by notes on each species. Localities are shown in Fig. 1.

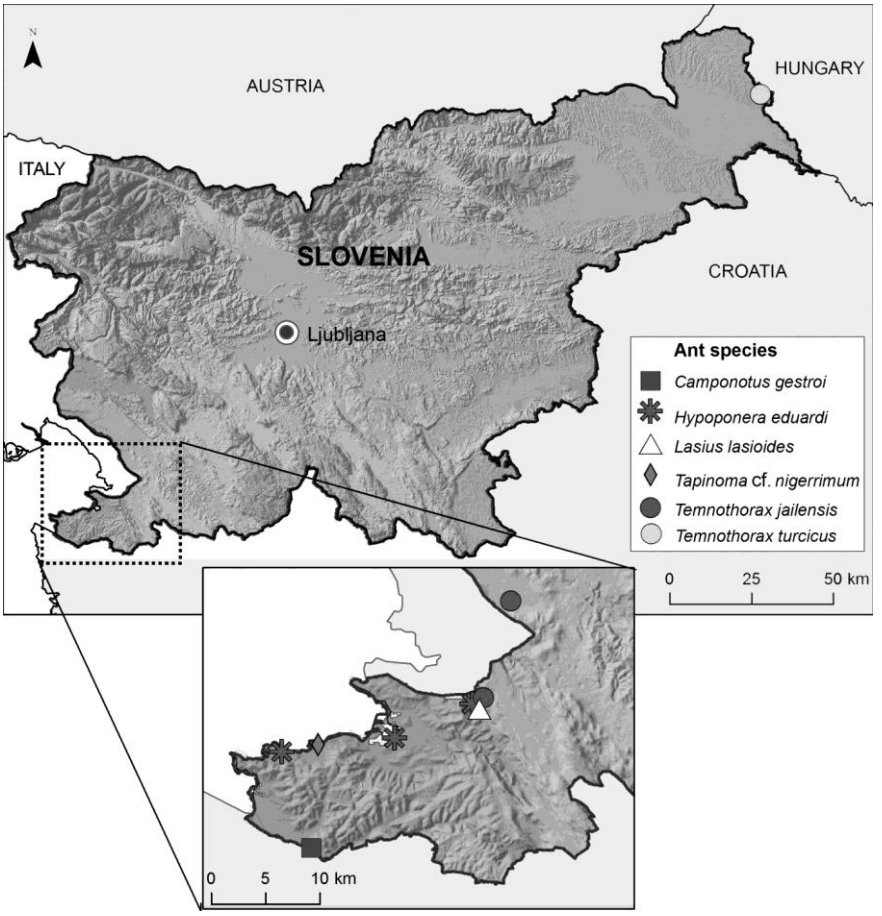

Figure 1. Localities of six ant species recorded in Slovenia for the first time.
Slika 1. Lokalitete šestih vrst mravelj, ki so bile prvič najdene v Sloveniji.

***Camponotus gestroi* Emery, 1878**

Record: Patchy karst meadow with surrounding scrub and trees, 0.5 km S of Dragonja village, Piran, SLO, 45°27.19'N, 13°39.61'E, 30 m a.s.l., 21.5.2016, hand collecting, leg. G. Bračko & L. Česnik.

The finding of *C. gestroi* in Slovenia was rather unexpected. Its so far known distribution range extends from southern Europe to Iran (Bračko et al. 2014a). In the Balkan Peninsula, it has been reported from Greece (Borowiec & Salata 2012), southern Bulgaria (Lapeva-Gjonova et al. 2010, Lapeva-Gjonova & Kiran 2012), Republic of Macedonia (Bračko et al. 2014a) and southern Montenegro (Bračko et al. 2014b), while in Italy it is known from the southern part of the mainland, Sardinia and Sicily (Poldi et al. 1995). Slovenian record indicates that the range of *C. gestroi* extends much further to the north. We found this species at the limestone hill in the lower Dragonja Valley in Coastal Slovenia. The hill is known for its species rich

eumediterranean flora (Wraber 2002) and many Mediterranean invertebrate species (Kostanjšek 2003, Gogala et al. 2007), including several other Mediterranean ants which we have collected during the past myrmecological surveys of the site, e.g. *Aphaenogaster epirotes* (Emery, 1895), *Camponotus dalmaticus* (Nylander, 1849), *Messor capitatus* (Latreille, 1798), *Temnothorax exilis* (Emery, 1869), *Tetramorium* cf. *semilaeve* André, 1883 (Bračko, unpubl. data).

***Hypoponera eduardi* (Forel, 1894)**

Records: Grassy, partly shrubby bank of a brackish lagoon, Škocjanski zatok, 2 km E of Koper, SLO, 45°32.73'N, 13°45.39'E, 3 m a.s.l., 15.10.2009, pitfall traps, leg. S. Polak; Forest edge along the road, 1 km NW of Osp, SLO, 45°34.48'N, 13°50.86'E, 30 m a.s.l., 23.6.2012, hand collecting, leg. G. Bračko; Grassy bank along the road, 3 km W of Izola, SLO, 45°31.96'N, 13°37.45'E, 100 m a.s.l., 21.5.2016, hand collecting, leg. G. Bračko & L. Česnik.

H. eduardi is distributed in the Mediterranean region, Middle East and Central Asia, but occurs in many parts of the world as a tramp species (Bolton & Fisher 2011). In Central Europe, two other related species, *H. ergatandria* (Forel, 1893) and *H. punctatissima* (Roger, 1859), can be found in heated buildings or outdoors in mounds of decomposing, heat-producing organic material (Seifert 2013). Since *Hypoponera* ants are small and cryptobiotic (Schmidt & Shattuck 2014), they are hard to detect, therefore three new records of *H. eduardi*, all from Coastal Slovenia, suggest that it is not so rare in this part of the country at least. The species could be expected here, as it was already found in Trieste, Italy (Finzi 1928) and central Istria, Croatia (Bračko, unpubl. data).

***Lasius lasioides* (Emery, 1869)**

Record: Grassy bank along the path, Osp, SLO, 45°34.22'N, 13°51.37'E, 30 m a.s.l., 23.6.2012, hand collecting, leg. G. Bračko.

This species' distribution range spreads from the Mediterranean region towards the east to Central Asia (Bračko et al. 2014a). The closest known records of *L. lasioides* to the Slovenian one are from North Dalmatia, Croatia (Bračko, unpubl. data). Our locality is in the vicinity of a limestone rock wall above Osp village (southwestern Slovenia), where we have already found several other Mediterranean ant species, e.g. *Aphaenogaster muelleriana* Wolf, 1915, *Camponotus dalmaticus*, *Messor capitatus*, *Temnothorax exilis*, *Temnothorax* cf. *recedens* (Nylander, 1856) (Bračko, unpubl. data).

***Tapinoma* cf. *nigerrimum* (Nylander, 1856)**

Record: Urban park, next to the city cemetery in Izola, SLO, 45°32.32'N, 13°39.97'E, 3 m a.s.l., 20.4.2008 & 30.5.2011, hand collecting, leg. G. Bračko.

In Slovenia, two species of the genus *Tapinoma* are widespread, i.e. *T. erraticum* (Latreille, 1798) and *T. subboreale* Seifert, 2012 (the latter listed under the name *T. ambiguum* Emery, 1925 in Bračko (2007)). Here we report on the third *Tapinoma* species found in the coastal town of Izola. It belongs to the taxonomically still unresolved *Tapinoma nigerrimum* complex, which includes three described and one undescribed species (Dekoninck et al. 2015). They are distributed in the Mediterranean region and have larger workers and usually form much larger colonies compared to *T. erraticum* and *T. subboreale* (Seifert 2012, Dekoninck et al. 2015). One species of the complex was reported outside its natural range

from few cities in Germany, Belgium and the Netherlands, to where it was imported with soil and plant material and shows invasive behaviour (Seifert 2012, Dekoninck et al. 2015, Noordijk 2016). Regarding the Slovenian record, a large nest was discovered, spreading several meters along the herbaceous border in an urban park in Izola. The origin of the finding is not clear. This could present the natural site of the species, with the next closest records coming from Rab Island and Northern Dalmatia, Croatia (Bračko 2006) and from northern Italy (Venice) (Emery 1925). It is possible, however, that the colony was established here after being transported with soil and plant material from other parts of the Mediterranean area.

***Temnothorax jailensis* (Arnoldi, 1977)**

Records: Thermophilic open forest on a rocky slope, 1 km SW of Kastelec, Kozina, SLO, 45°34.79'N, 13°51.63'E, 290 m a.s.l., 14.6.2014, hand collecting, leg. G. Bračko; Karst meadow with some trees, Lipica, Sežana, SLO, 45°39.62'N, 13°53.46'E, 410 m a.s.l., 20.5.2016, hand collecting, leg. G. Bračko.

This is a rarely recorded arboricolous species known from few localities in Austria (Schlick-Steiner et al. 2003), Hungary (Csősz et al. 2011), Czech Republic (Vodka et al. 2010), Slovakia (Werner & Wiezik 2007) and Ukraine (Crimea) (Radchenko 1995). In addition, Vodka et al. (2010) mention unpublished and unspecified records from Italy and the Balkans. We found it at two localities in southwestern Slovenia: two colonies on pubescent oak (*Quercus pubescens*) at a height of approximately 1.5 to 2 m, in a highly thermophilic open forest near Kastelec, and few individual workers again on *Q. pubescens* in Lipica. These are the first specified localities of the species from the Mediterranean region.

***Temnothorax turcicus* (Santschi, 1934)**

Record: Meadow with some trees, 1 km NW of Kobilje, Lendava, SLO, 46°41.38'N, 16°22.63'E, 190 m a.s.l., 11.5.2012, hand collecting, leg. G. Bračko.

This is another rarely recorded arboricolous species known from the eastern part of Central Europe, southern part of the Balkan Peninsula and western Anatolia (Wagner et al. 2011). We collected a single worker on sessile oak (*Quercus petraea*). Since *T. turcicus* was reported from eastern Austria, southern Slovakia (Wagner et al. 2011) and from the vicinity of Budapest, Hungary (S. Csősz, pers. comm. 2016), its finding near Kobilje village in northeastern (Subpannonian) Slovenia is not surprising.

Povzetek

Po doslej objavljenih podatkih je bilo na ozemlju Slovenije najdenih 134 vrst mravelj (Bračko 2007, 2010, Seifert et al. 2009), pri čemer je z vrstami najbogatejši jugozahodni (submediteranski) del države. S favnističnimi raziskavami, ki so potekale v obdobju zadnjih 9 let, smo našli šest doslej za Slovenijo neregistriranih vrst, od tega pet v jugozahodnem delu države v submediteranski regiji (*Camponotus gestroi*, *Hypoponera eduardi*, *Lasius lasioides*, *Tapinoma* cf. *nigerrimum* in *Temnothorax jailensis*) ter eno v severovzhodnem delu (*Temnothorax turcicus*). Večina mravelj je bila nabrana z metodo direktnega vzorčenja (ročnega nabiranja), v enem primeru pa s talnimi pastmi. Za določevanje smo poleg

taksonomske literature nabrane osebke primerjali tudi z visoko kvalitetnimi fotografijami tipskih primerkov na spletni strani AntWeb (http://www.antweb.org). Medtem ko sta bili vrsti *H. eduardi* in *T. turcicus* na podlagi njunega pojavljanja na sosednjih območjih pričakovani, pa sta bili najdbi vrst *C. gestroi* in *T. jailensis* precej presenetljivi in znatno povečujeta njuna doslej znana areala razširjenosti v Evropi. Vrsta *C. gestroi* je bila do sedaj registrirana precej južneje na Balkanu in v južni Italiji. Našli smo jo na apnenčastem griču v dolini Dragonje, znanem po rastišču eumediteranske flore in nahajališču več mediteranskih nevretenčarskih vrst. Vrsta *L. lasioides*, ki smo jo zabeležili v Ospu, je bila slovenskemu ozemlju najbliže poznana iz severne Dalmacije. Kriptično živeča vrsta *H. eduardi* je bila najdena na treh lokalitetah na Obali, tako da predvidevamo, da je tu dosti pogostejša, kot so kazale dosedanje raziskave. V mestnem parku v Izoli smo odkrili večje mravljišče vrste *T.* cf. *nigerrimum* (eno izmed štirih mediteranskih vrst iz taksonomsko še nerazrešenega kompleksa *T. nigerrimum*). Ni jasno, ali najdba pomeni naravno območje razširjenosti vrste, ali pa je bila kolonija tja prinesena s prstjo in rastlinami iz drugih delov Mediterana, kot je bilo pri vrsti iz omenjenega kompleksa že opaženo iz nekaj mest v srednji in zahodni Evropi. Odkrili smo tudi dve redko zabeleženi arborikalni vrsti iz rodu *Temnothorax*. Vrsto *T. jailensis* smo našli na dveh lokalitetah (Kastelec in Lipica) na puhastem hrastu, *T. turcicus* pa na gradnu pri vasi Kobilje.

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Altitudinal distribution and habitat use of the common wall lizard *Podarcis muralis* (Linnaeus, 1768) and the Horvath's rock lizard *Iberolacerta horvathi* (Méhely, 1904) in the Kočevsko region (S Slovenia)

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Abstract. The study reports on the distribution and habitat use of two lizard species in the Kočevsko region: Horvath's rock lizard and common wall lizard. Extensive sampling across an altitudinal span of 200 to 1,100 m a.s.l. in the study area revealed 62 localities with populations of both or either species. At 11 of these localities (18%) species occurred in syntopy, at 42 locations (68%) only common wall lizards were found, while at 9 locations (14%) only Horvath's rock lizards were recorded. Both species occurred across the entire altitudinal span but exhibited an opposite pattern of relative abundances and frequencies, which increased with increasing altitude in Horvath's rock lizard and with decreasing altitude in common wall lizard. The habitat use of common wall lizard was more general (it was found in seven habitat types) than Horvath's rock lizard that was registered only in three habitat types with rocks.

Key words: *Podarcis muralis*, *Iberolacerta horvathi*, altitudinal gradient, habitat use, Kočevsko region, Slovenia

Izvleček. Višinska razširjenost in raba prostora pozidne kuščarice *Podarcis muralis* (Linnaeus, 1758) in velebitske kuščarice *Iberolacerta horvathi* (Méhely, 1904) na Kočevskem (J Slovenija) – V raziskavi smo pridobili skupno 62 novih podatkov o razširjenosti dveh vrst kuščaric na Kočevskem: za pozidno kuščarico (*Podarcis muralis*) in velebitsko kuščarico (*Iberolacerta horvathi*). Od vseh 62 lokacij sta se vrsti pojavljali sintopično na 11 lokacijah (18 %), na 42 lokacijah (68 %) je bila zabeležena le pozidna kuščarica, na 9 lokacijah (14 %) pa izključno velebitska kuščarica. Obe vrsti sta na Kočevskem razširjeni čez celotni višinski gradient, ki se razteza med 200 m n.m. v dolini reke Kolpe do 1100 m n.m. na najvišjih vrhovih planot. Vendar pa se vrsti pojavljata v višjih relativnih gostotah na različnih nadmorskih višinah, in sicer je velebitska kuščarica pogostejša v višjih legah, pozidna kuščarica pa v nižjih. Kar zadeva rabo prostora, smo ugotovili, da je pozidna kuščarica nagnjena bolj k splošni rabi prostora kot velebitska kuščarica. Pozidna kuščarica je bila najdena v sedmih različnih habitatnih tipih, medtem ko je bila velebitska kuščarica najdena le v treh, in sicer: v naravnih in umetnih ostenjih in presvetljenem gozdu.

Ključne besede: *Podarcis muralis*, *Iberolacerta horvathi*, višinski gradient, raba prostora, Kočevsko, Slovenija

Introduction

Horvath's rock lizard (*Iberolacerta horvathi* (Méhely, 1904)) and the common wall lizard (*Podarcis muralis* (Laurenti, 1768)) are small lacertid lizards that exhibit a sympatric distribution, where the distribution range of *I. horvathi* overlaps completely with the range of *P. muralis* (Sillero et al. 2014) and have similar life-history traits and ecology (heliothermy, diet, habitat use, activity, etc. (review in Žagar 2016)). Horvath's rock lizard is one of the eight species currently recognized in the genus *Iberolacerta* Arribas, 1997 (Mayer & Arribas 1996, Odierna et al. 1996, Arribas 1999a, 1999b, Almeida et al., 2002, Mayer & Arribas, 2003, Arribas & Carranza 2004, Carranza et al. 2004, Crochet et al. 2004, Arribas et al. 2006, Arnold et al. 2007, Galán et al. 2007, Mayer & Pavlicev 2007). Seven of these species live in the Pyrenees and in the northern and central mountains of the Iberian Peninsula, while one, Horvath's rock lizard, occurs in Central and South-eastern Europe (Gasc et al. 1997, Arnold et al. 2007, Sillero et al. 2014). Today, the distribution of Horvath's rock lizard is restricted to a relatively small range extending across the eastern Alps, pre-Alps and northern Dinaric Mountains (Bischoff 1984, Sillero et al. 2014, Žagar et al. 2014). It occurs in at least four countries: Italy (Lapini & Dolce 1983, De Luca 1989, Lapini et al. 1993, 2004, Lapini & Dal Farra 1994, Rassati 2010), Austria (Grillitsch & Tiedemann 1986, De Luca 1989, Tiedemann 1992, Grillitsch et al. 2001, Cabela et al. 2002, 2004, 2007), Slovenia (Brelih 1954, Brelih & Džukić 1974, De Luca 1989, Tome 1996, Mršić 1997, Tome 2001, Žagar et al. 2007, 2013, Žagar 2008a, 2008b, Krofel et al. 2009, Cafuta 2010) and Croatia (Méhely 1904, Karaman 1921, Arnold 1987, De Luca 1989, Tvrtković & Veen 2006, Kryštufek et al. 2008, Jelić 2014). It likely occurs also in Bosnia and Hercegovina, but has not been discovered there yet (Žagar et al. 2014). The report on the population found in Karwendel Gebirge in south Germany (Capula & Luiselli 1990) was strongly disputed (Bischoff 1991, Faberl & Faberl 1991, Tiedemann 1992, Capula & Luiselli 1993, Franzen et al. 1993, Schmidtler & Schmidtler 1996) and has not been re-confirmed (Cabela et al. 2004).

The common wall lizard has the largest distributional range of all species of the genus *Podarcis* Wagler, 1830 (Gasc et al. 1997, Sillero et al. 2014). Previous studies revealed that this species originated from multiple glacial refugia (Gassert et al. 2013, Salvi et al. 2013), and multiple lineages were identified within three Mediterranean peninsulas (Iberian, Apennine and Balkan; Salvi et al. 2013). Its widespread distribution expands across most of Central Europe, the northern part of Iberian Peninsula, large parts of the Apennine and the Balkan Peninsulas and stretches to the east into North Turkey (Gasc et al. 1997, Sillero et al. 2014). The northernmost native distribution is probably still unresolved because results from a recent genetic study suggested that the population on Jersey (Channel Islands, UK) and in the Chausey archipelago may be of native origin (Michaelides et al. 2015), while in the past it has been believed that the species distribution does not extend beyond the Netherlands and that common wall lizards found in UK were introduced (Arnold 1995). In Slovenia, it is relatively common and widespread (Tome 1996, Mršić 1997, Tome 2001, Krofel et al. 2009).

Syntopic populations of *I. horvathi* and *P. muralis* have been most frequently found at low and middle altitudes in Slovenia (Brelih 1954, Žagar et al. 2007, Žagar 2008a) as well as elsewhere (Bischoff 1984, Arnold 1987, De Luca 1989, Lapini et al. 1993, Richard & Lapini 1993, Grillitsch et al. 2001, Cabela et al. 2002, 2007, Lapini et al. 2004, Rassati 2010).

The species tandem studied here is not unique, since other *Iberolacerta-Podarcis* species pairs with completely or partly attitudinally segregated distributional patterns have been observed also in the Iberian Peninsula, where other species of *Iberolacerta* occur (e.g. Moreira et al. 1999, Arribas et al. 2006, Monasterio et al. 2010).

In several parts of the species range, *I. horvathi* populations tend to be denser at higher altitudes (e.g. De Luca 1989), while density in *P. muralis* follows an opposite trend (e.g. Krofel et al. 2009, Žagar et al. 2013). In general, both species are found on rocky substrates with sparse vegetation (Arnold 1987; Arnold & Ovenden, 2004; Arnold et al. 2007; Cabela et al. 2007; Žagar et al. 2013), except that Horvath's rock lizards are more associated with rocks, while common wall lizards occur in a wider variety of different habitats (Arnold & Ovenden 2004).

In this study, an extensive sampling across an altitudinal span of 200 to 1,100 m a.s.l. was conducted in the Kočevsko region in order to comprehensively recognise syntopic and allotopic occurrence, altitudinal distribution and habitat use of Horvath's rock lizard and common wall lizard.

Materials and methods

The study was limited to the Kočevsko region, where we collected data on the presence and relative abundances (using transect line counts) of the study species in the period between 2006 and 2015 (Fig. 1, Annex 1). Part of the data collected in the 2006–2008 period was obtained within the framework of a diploma thesis (Žagar 2008a) and was published in a study of habitat use of reptile community in the Kočevsko region (Žagar et al. 2013). Specifically, in that work we included information on the altitude, exposition, vegetation cover and habitat type of 10 reptile community members, from which we included for *I. horvathi* and *P. muralis* finds from 33 localities that are also included in this analysis. The data of the 2009–2015 period was collected within the framework of a PhD thesis (Žagar 2016). Species recognition was done by either coming very close to the lizard or photographing it, to inspect the position of scales on the head or colouration of the throat region. The species can readily be identified upon either of these characteristics (Tome 1999, Arnold & Ovenden 2004). We did not distinguish sex or age of individuals in this data set (Annex 1).

Locations were described as allotopic, when all visits of that location confirmed the presence of only one species, and syntopic, when both species were found at least once during the same visit. Transect line counts (Buckland et al. 1993) were conducted in one or up to three replicates (Annex 1). We summed all observations per transect and corrected for the number of times that we walked that transect (divided by number of replicates) to calculate the frequency of individuals recorded on each transect. We grouped transects into five altitudinal belts, each encompassing 200 m of altitude (Tab. 1). Thereupon, we determined the relative abundances for each altitudinal belt by summing up frequencies of individuals and dividing it by the summed length of transects inside each altitudinal belt.

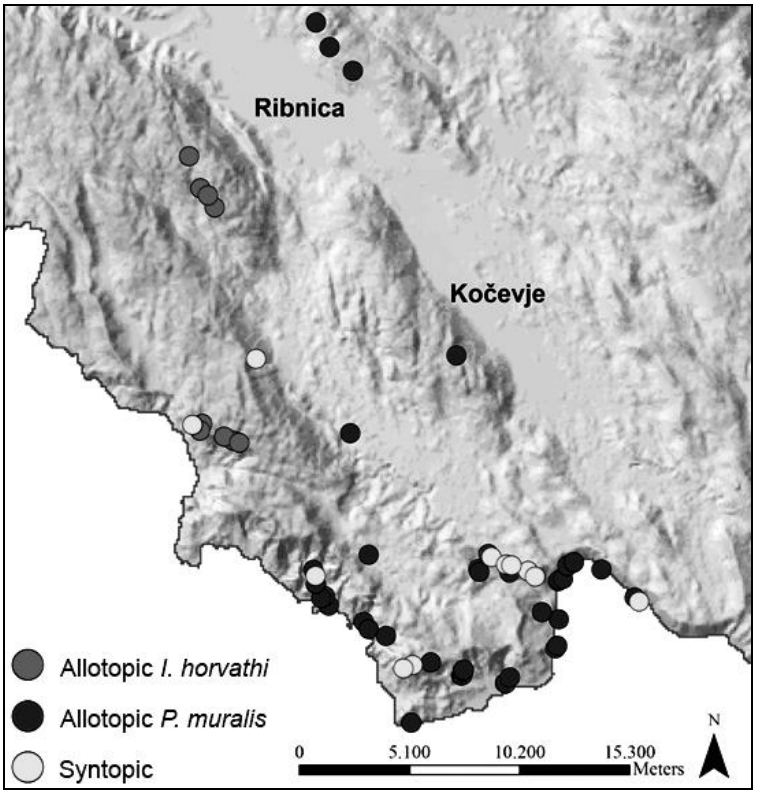

Figure 1. Map of the Kočevsko region with localities where one or both studied species, Horvath's rock lizard (*Iberolacerta horvathi*) and common wall lizard (*Podarcis muralis*), were found (N = 62) in the 2006–2015 period (see Annex 1).

Slika 1. Karta razširjenosti lokacij (N = 62) na Kočevskem, kjer je bila najdena ena ali obe preučevani vrsti, velebitska kuščarica (*Iberolacerta horvathi*) in pozidna kuščarica (*Podarcis muralis*), v obdobju 2006–2015 (glej Prilogo 1).

Table 1. Distribution of transects across five altitudinal belts with corresponding frequencies corrected for the replicated transect visits (No. of ind.) and calculated relative abundances of Horvath's rock lizard (*Iberolacerta horvathi*) and common wall lizard (*Podarcis muralis*) in the Kočevsko region.

Tabela 1. Razporeditev transektov v petih višinskih razredih in pripadajoče frekvence osebkov z upoštevanjem števila pregledov posameznega transekta (No. of ind.) in preračunane relativne gostote (ind./km) za vrsti velebitska kuščarica (*Iberolacerta horvathi*) in pozidna kuščarica (*Podarcis muralis*) na Kočevskem.

ALTITUDINAL BELT (m a.s.l.)	**No. of transects**	**Total distance of transects (m)**	***P. muralis***		***I. horvathi***	
			No. of ind.	**Relative abundance (ind./km)**	**No. of ind.**	**Relative abundance (ind./km)**
100–299	20	5430	50	9.21	3	0.55
300–499	10	3960	30	7.57	1	0.25
500–699	16	5470	26	4.75	4	0.73
700–899	6	2720	19	6.96	6	2.21
900–1099	10	2910	12	4.12	37	12.71
SUM	**62**	**20490**				

We compared the observed frequencies of lizards (corrected for replicated transect visits, Tab. 1) in five altitudinal belts with expected frequencies (if species were equally distributed across the altitudinal span in the study area corrected for the total distance of surveyed transects in each altitudinal belt) using the Chi square test.

For assessing habitat use, one of the seven different habitat types were assigned to each transect occupied by study species: (i) natural rock area, (ii) urban area, (iii) agricultural land, (iv) water bank, (v) road, (vi) artificial rock area, and (vii) open forest (Annex 1). Habitat types describe the typical areas where transects were located in the study area. Natural rock areas were naturally occurring rock cliffs and screes, urban area included backyards, cemeteries and house ruins, agricultural land included grasslands, pastures and crop fields, water banks were banks of rivers, streams or lakes, roads were gravel or asphalt roads, artificial rock areas comprised of any rocky ground or walls originating from human activities, and open forest were located in forests with <85% crown coverage (Žagar et al. 2013). We calculated the relative proportion of allotopic and syntopic populations in each habitat type to present it graphically (Fig. 2).

Results

Syntopic and allotopic occurrence

Results represent a dataset of 62 localities, at which one or both study species, Horvath's rock lizard and common wall lizard, were found in the Kočevsko region within the 2008–2015 period (Fig. 1, Annex 1). Both species were found to occur in syntopy at 10 localities (16%), common wall lizard was allotopic at 43 locations (69.5%) and Horvath's rock lizard at 9 locations (14.5%) (Fig. 1). Syntopic populations were found across the whole altitudinal span but with the majority of them located at middle altitudes (average altitude of syntopic populations (N = 10) was 620 m a.s.l., lower quartile range = 512 m a.s.l., upper quartile range = 813 m a.s.l., Annex 1). The lowest syntopic population was found at the entrance to Bilpa cave at 200 m a.s.l. and the highest at Kameni zid at 1,061 m a.s.l. (Annex 1).

Altitudinal distribution

The highest relative abundances of Horvath's rock lizard were determined for the highest altitudinal belt (900–1099 m a.s.l.) and relative abundances decreased with decreasing altitude (Tab. 1, Fig. 2). The opposite pattern was observed for the common wall lizard; relative abundance was highest at the two lowest altitudinal belts (100–299 and 300–499 m a.s.l.) and decreased with increasing altitude (Tab. 1, Fig. 2). Results of the Chi square test to compare observed frequencies of lizards (Tab. 1) in five altitudinal belts with expected frequencies (if species were equally distributed across the altitudinal span, see also Methods) showed significant differences between expected and observed frequencies for both species (for Horvath's rock lizard: $\chi^2 = 145.27$, df = 4, $P < 0.0001$); for common wall lizard: $\chi^2 = 11.31$, df = 4, $P = 0.0233$). Results of comparing altitudes from all finds of both species also showed a statistically significant difference between the species (Horvath's rock lizard, N = 71,

median = 948 m a.s.l., and common wall lizard, N = 205, median = 430 m a.s.l., Mann-Whitney U tests: U = 1425, Z = 10.10, P < 0.0001).

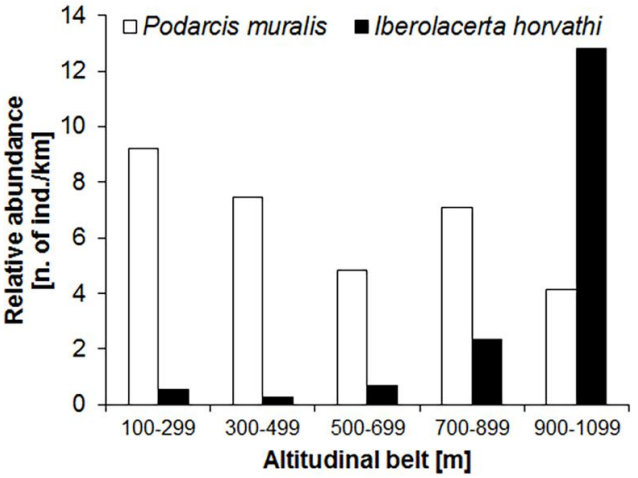

Figure 2. Relative abundances of the studied species across five altitudinal belts.
Slika 2. Relativne gostote preučevanih vrst v petih razredih nadmorskih višin.

Habitat use

The study species were found in seven different habitat types; Horvath's rock lizard in three and common wall lizard in seven of them (Fig. 3, Annex 1). Allotopic populations of common wall lizard were found in all seven habitat types, syntopic populations in all three habitat types where Horvath's rock lizard was found: in natural and artificial rocky habitats and in open forests (Fig. 2). These three habitat types occurred throughout the altitudinal range (artificial rock: 203–1058 m a.s.l. (min–max), natural rock: 208–1055 m a.s.l. (min–max), open forest: 336–1118 m a.s.l. (min–max); Annex 1). On the other hand, four habitat types exclusively occupied by common wall lizard (agricultural land, road, urban area, and water banks) were mostly limited to middle and lower altitudes (agricultural land: 588 a.s.l. (one location), roads: 204–612 a.s.l. (min–max), urban area: 229–959 a.s.l. (min–max), water banks: 204–274 m a.s.l. (min–max); Annex 1).

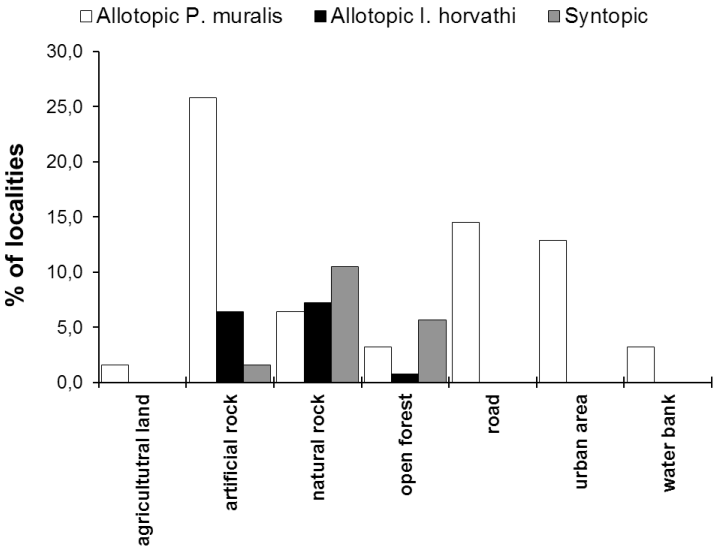

Figure 3. Relative proportion of allotopic and syntopic populations of Horvath's rock lizard (*Iberolacerta horvathi*) and common wall lizard (*Podarcis muralis*) in seven different habitat types in the Kočevsko region.
Slika 3. Relativni delež alotopičnih in sintopičnih populacij za vrsti velebitska kuščarica (*Iberolacerta horvathi*) in pozidna kuščarica (*Podarcis muralis*) v sedmih habitatnih tipih na Kočevskem.

To check whether the changes in relative abundance with altitude can be explained by observed differences in habitat use between the species due to changes in habitat availability across the altitude, we decided to repeat the comparison of altitudes between the species by including findings in only three habitat types that occurred throughout the altitudinal range and were used by both species (artificial and natural rock areas and open forest). Results showed that in these habitat types, too, Horvath's rock lizard was found at significantly higher altitudes (N = 71, median = 948 m a.s.l.) than common wall lizard (N = 113, median = 507 m a.s.l..; Mann-Whitney U tests: U = 815, Z = 9.09, P < 0.0001).

Discussion

In conclusion, we have found that in the Kočevsko region, Horvath's rock lizard and the common wall lizard – two lizard species, which exhibit a high resemblance in overall body plan and many ecological characteristics – occurred across the entire altitudinal span but exhibited an opposite pattern of relative abundances and frequencies, which increased with increasing altitude in Horvath's rock lizard and with decreasing altitude in common wall lizard. The observed pattern of habitat use suggests that the common wall lizard occupies here a more diverse array of habitat types than Horvath's rock lizard.

Jointly, the opposite pattern in relative abundances across the altitudinal span and wider use of habitat types of the common wall lizard compared to Horvath's rock lizard suggest that the species segregate to some extent in their spatial distribution and spatial niches in the Kočevsko region. However, compared to other studies of distribution of these two species (see introduction), our results showed an interestingly high altitudinal overlap in the distribution of the two species and relatively high proportion of syntopic populations (16%), as well as an overlap in three habitat types. Previous studies reported that syntopic populations of studied species occurred only in a limited zone of middle altitudes, while Horvath's rock lizard was found in allotopic populations at higher altitudes and the common wall lizard in allotopic populations at lower altitudes (De Luca 1989, Lapini et al. 1993, Richard & Lapini 1993, Lapini et al. 2004, Cabela et al. 2007, Rassati 2010). So far, this is the first observation of syntopic populations found across the entire altitudinal span of an area for these two species. This may be due to the specific topography of the Kočevsko region where altitudes do not exceed 1,100 m a.s.l. (Perko & Orožen Adamič 1998), whereas other study areas had higher altitude ranges (over 2,000 m a.s.l. in the Alpine region or up to 1,757 m a.s.l. at Velebit). Horvath's rock lizard was found there in places up to the highest peaks in Velebit (De Luca 1989) or up to 2,000 m a.s.l. in the Alps (De Luca 1989, Lapini et al. 1993, Richard and Lapini 1993, Lapini et al. 2004, Cabela et al. 2007, Rassati 2010).

The found between-species differences in altitudinal distribution, not only in the Kočevsko region but elsewhere, reinforce that Horvath's rock lizard is a high-altitude species that can also occur in lowlands but on rarer occasions, while the common wall lizards' populations are most abundant in lowlands and become less dense at higher altitudes. Recent research revealed that both species also exhibit differences in physiological characteristics and that Horvath's rock lizard has adaptations that are potentially advantageous in high-altitude areas that are climatically thermally more restrict (lower yearly average air temperatures and shorter activity periods for lizards) compared to lowlands. For example, the study species differ in seasonal variation of their preferred body temperatures in terms that Horvath's rock lizard exhibits a more accurate thermoregulation across the seasons than the common wall lizard (Osojnik et al. 2013). The differences between the species were also observed on the cellular level where Horvath's rock lizard had higher potential metabolic activity than the common wall lizard, which may be advantageous in thermally restrictive environment together with more precise thermoregulatory behaviour as exhibited by Horvath's rock lizard (Žagar et al. 2015).

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Annex 1. Locality descriptions with presence of studied species that were surveyed in the period between 2006 and 2015 in Kočevsko region and sorted by altitude. Surveys done in spring (before 30th June of the calendar year) are labelled with (1), while (2) corresponds to surveys done in summer (after 1st July of the calendar year). During each survey, we either made counts of individuals on a predetermined transect route or we only noted presence (P) or absence (/) of studied species. Maximum numbers of individuals counted are in bold. In cases when the maximum number of individuals was found more than once per location, only the first such count is in bold. Abbreviations: Alt. – average altitude, GKY and GKX = Y and X coordinates of the Gauss Krüger coordinate system, Sp. pres. – species presence, *P.m.* = Common wall lizard (*Podarcis muralis*) and *I.h.* = Horvath's rock lizard (*Iberolacerta horvathi*), A = Allotopic, S = Syntopic.

Priloga 1. Opisi lokacij v Kočevski regiji, kjer sta bili zabeleženi ena ali obe preučevani vrsti v obdobju raziskave med leti 2006 in 2015. Lokacije so razporejene po nadmorski višini. Najdbe, ki so bile zabeležene na popisih pred 30. junijem v koledarskem letu, so označene z (1) in tiste po1. juliju v koledarskem letu z (2). Na posameznem obisku lokacije smo prešteli osebke na predhodno določenem transektu (N) ali pa smo zabeležili le prisotnost vrste (P = vrsta prisotna, / = vrsta ni prisotna). Največje število osebkov iz transektnih popisov na posamezni lokaciji je poudarjeno (v primeru ponavljanja je poudarjeno le časovno prej zabeleženo največje število osebkov). Okrajšave: Alt. – povprečna nadmorska višina, GKY in GKX = Y in X koordinate Gauss Krügerjevega koordinatnega sistema, Sp.pres. – prisotnost vrste, *P.m.* = pozidna kuščarica (*Podarcis muralis*) in *I.h.* = velebitska kuščarica (*Iberolacerta horvathi*), A = alotopična populacija, S = sintopična populacija.

Locality	**Alt. (m)**	**GKX GKY**	**Habitat type**	**Sp. pres.**	***P.m.* 2006 (1)**	***I.h.* 2006 (1)**	***P.m.* 2007 (1)**	***I.h.* 2007 (1)**	***P.m.* 2007 (2)**	***I.h.* 2007 (2)**	***P.m.* 2008 (1)**	***I.h.* 2008 (1)**	***P.m.* 2008 (2)**	***I.h.* 2008 (2)**	***P.m.* 2010 (1)**	***I.h.* 2010 (1)**	***P.m.* 2011 (1)**	***I.h.* 2011 (1)**	***P.m.* 2011 (2)**	***I.h.* 2011 (2)**	***P.m.* 2012 (1)**	***I.h.* 2012 (1)**	***P.m.* 2012 (2)**	***I.h.* 2012 (2)**	***P.m.* 2013 (1)**	***I.h.* 2013 (1)**	***P.m.* 2013 (2)**	***I.h.* 2013 (2)**	***P.m.* 2014 (1)**	***I.h.* 2014 (1)**	***P.m.* 2014 (2)**	***I.h.* 2014 (2)**	***P.m.* 2015 (1)**	***I.h.* 2015 (1)**
med Žlebi in Grgeljem	203	495705 42336	artificial rock	**A - *P.m.***	**5**	**0**			0	0	5	0																						
med Bilpo in Lazami	204	497228 41041	road	**A - *P.m.***																	**12**	**0**							P	/			P	/
pri Žlebih	204	494406 42644	water bank	**A - *P.m.***	0	0			**1**	**0**	0	0																						
pri Gorenji Žagi	207	4936854 1801	artificial rock	**A - *P.m.***	**4**	**0**			0	0	3	0																					P	/
Bilpa	208	497441 40858	natural rock	**S**																	**6**	**3**							P	P	P	P	P	P
med Gorenjo Žago in Žlebi	215	493751 41851	road	**A - *P.m.***			**1**	**0**	0	0	1	0									0	0												
pri Gorenji žagi	215	493920 41899	artificial rock	**A - *P.m.***			**8**	**0**	5	0	3	0																					P	/
Žlebi	215	494412 42675	artificial rock	**A - *P.m.***			1	0	1	0	**2**	**0**									P	/												
med Kobilno jamo in Gorenjo Žago	219	494125 42501	artificial rock	**A - *P.m.***	1	0			0	0	**2**	**0**																					P	/
med Sapnikom in Brsnikom	226	493567 38681	artificial rock	**A - *P.m.***	2	0			1	0	**4**	**0**																					P	/
med Lobičem in Žlebi	228	494419 42673	natural rock	**A - *P.m.***	2	0			0	0	**5**	**0**																					P	/
Maverc	229	493728 40033	urban area	**A - *P.m.***					**2**	**0**	2	0	2	0																			P	/
Sapnik	230	493652 38810	urban area	**A - *P.m.***	0	0			0	0	**2**	**0**																						

Annex 1 / Priloga 1. Continued. / Nadaljevanje.

Locality	Alt. (m)	GKX GKY	Habitat type	Sp. pres.	*P.m.* 2006 (1)	*I.h.* 2006 (1)	*P.m.* 2007 (1)	*I.h.* 2007 (1)	*P.m.* 2007 (2)	*I.h.* 2007 (2)	*P.m.* 2008 (1)	*I.h.* 2008 (1)	*P.m.* 2008 (2)	*I.h.* 2008 (2)	*P.m.* 2010 (1)	*I.h.* 2010 (1)	*P.m.* 2011 (1)	*I.h.* 2011 (1)	*P.m.* 2011 (2)	*I.h.* 2011 (2)	*P.m.* 2012 (1)	*I.h.* 2012 (1)	*P.m.* 2012 (2)	*I.h.* 2012 (2)	*P.m.* 2013 (1)	*I.h.* 2013 (1)	*P.m.* 2013 (2)	*I.h.* 2013 (2)	*P.m.* 2014 (1)	*I.h.* 2014 (1)	*P.m.* 2014 (2)	*I.h.* 2014 (2)	*P.m.* 2015 (1)	*I.h.* 2015 (1)
pokopališče v Fari	238	491217 37083	urban area	**A - *P.m.***	3	0			3	0	**6**	**0**									P	/											P	/
med Grivacom in Gladloko	245	486880 35251	road	**A - *P.m.***					0	0	**1**	**0**	0	0																				
pri Gladloki	245	486880 35251	artificial rock	**A - *P.m.***	**1**	**0**			1	0	1	0																						
Mirtoviči	260	483050 40666	urban area	**A - *P.m.***					1	0	**2**	**0**	1	0																				
Srobotnik	266	484664 39915	urban area	**A - *P.m.***	**1**	**0**					1	0	0	0																				
Mirtoviški potok	274	482871 41106	water bank	**A - *P.m.***					0	0	**3**	**0**	2	0																				
nad cerkvijo v Fari	288	491251 37067	road	**A - *P.m.***			**3**	**0**	2	0	0	0																						
pokopališče sv. Štefan	310	491452 37337	urban area	**A - *P.m.***			**12**	**0**	8	0	1	0					P	/															P	/
pri Srobotniku	336	484894 39571	open forest	**A - *P.m.***			0	0			2	0	**3**	**0**																			P	/
Kostel	348	492939 40372	urban area	**A - *P.m.***	0	0			**4**	**0**	1	0									P	/												
nad vasjo Planina zapuščen kamnolom	378	489201 37430	artificial rock	**A - *P.m.***	2	0			3	0	**4**	**0**																						
kamnolom v Podstenah	384	491440 42191	artificial rock	**A - *P.m.***	1	0			2	0	**5**	**0**																					P	/
od Planine na Planinsko steno	430	489253 37450	road	**A - *P.m.***	10	0			3	0	**11**	**0**																						
med Friškovo grabo in Dolenjim Potokom	435	489983 42358	road	**A - *P.m.***	0	0			1	0	**6**	**0**																						
pri Dolenjem Potoku	435	490044 42240	artificial rock	**A - *P.m.***	0	0			0	0	**1**	**0**																						
pot na Krempo	459	482701 41016	open forest	**A - *P.m.***			0	0			**5**	**0**	1	0																				
od vasi Podstene do sten	499	492289 42271	artificial rock	**S**	0	0			0	0	**1**	**1**																						
pod Podstenami	501	490457 43051	road	**A - *P.m.***			0	0	0	0	**5**	**0**									P	/											P	/
od Planine na Planinsko steno	506	489309 37690	road	**A - *P.m.***	**6**	**0**			0	0	0	0																						

Annex 1 / Priloga 1. Continued. / Nadaljevanje.

Locality	Alt. (m)	GKX GKY	Habitat type	Sp. pres.	*P.m.* 2006 (1)	*I.h.* 2006 (1)	*P.m.* 2007 (1)	*I.h.* 2007 (1)	*P.m.* 2007 (2)	*I.h.* 2007 (2)	*P.m.* 2008 (1)	*I.h.* 2008 (1)	*P.m.* 2008 (2)	*I.h.* 2008 (2)	*P.m.* 2010 (1)	*I.h.* 2010 (1)	*P.m.* 2011 (1)	*I.h.* 2011 (1)	*P.m.* 2011 (2)	*I.h.* 2011 (2)	*P.m.* 2012 (1)	*I.h.* 2012 (1)	*P.m.* 2012 (2)	*I.h.* 2012 (2)	*P.m.* 2013 (1)	*I.h.* 2013 (1)	*P.m.* 2013 (2)	*I.h.* 2013 (2)	*P.m.* 2014 (1)	*I.h.* 2014 (1)	*P.m.* 2014 (2)	*I.h.* 2014 (2)	*P.m.* 2015 (1)	*I.h.* 2015 (1)
pri Srobotniku	507	485700 39266	natural rock	**A - *P.m.***	2	0					**4**	**0**	3	0																				
na Podstenah 1	512	490601 42918	natural rock	**S**	1	1			0	0	**2**	**4**																					P	P
pod Planinsko steno	513	489248 37615	natural rock	**A - *P.m.***	1	0			1	0	**3**	**0**																						
na Podstenah 2	515	492625 42002	natural rock	**S**	0	1			**3**	**1**	0	1																						
na Podstenah 3	515	491281 42557	natural rock	**S**	0	1			**1**	**1**	0	0																					P	P
od vasi Podstene do sten	521	491514 42527	open forest	**S**	0	0			0	0	**2**	**1**																						
kamnolom pri Kočevski Reki	575	484048 48638	artificial rock	**A - *P.m.***			0	0	2	0	**5**	**0**									P	/											P	/
pot na Krempo	588	482433 41682	agricultu -ral land	**A - *P.m.***			0	0			**1**	**0**	0	0																				
od Planine na Planinsko steno	612	489309 37690	road	**A - *P.m.***			**3**	**0**	2	0	3	0																						
na planinski poti na Krempo 1	615	482433 42036	open forest	**A - *P.m.***	**3**	**0**					1	0	0	0																				
med Gornjo Brigo in Borovcem pri Kočevski Reki	616	484898 43018	artificial rock	**A - *P.m.***	0	0			**1**	**0**	1	0																						
Planinska stena	652	487781 38035	artificial rock	**A - *P.m.***																	**3**	**0**											P	/
na planinski poti na Krempo 2	676	482339 42317	natural rock	**A - *P.m.***	0	0					**2**	**0**	0	0																				
območje Stevniki na Mali gori	681	484171 65412	artificial rock	**A - *P.m.***													P	/			**4**	**0**									P	/	P	/
zahodno od Špičastega vrha na Mali gori	726	482454 67654	artificial rock	**A - *P.m.***													**11**	0	P	0	P	/	P	/	P	/	P	/	P	/			P	/
Gornje niše na Mali gori	760	483079 66525	artificial rock	**A - *P.m.***													P	/			**4**	**0**									P	/	P	/
pod Kuželjsko steno	766	486949 37909	open forest	**S**	0	0			0	0	**1**	**1**																						
Kuželjska stena	813	486505 37768	natural rock	**S**	0	2			1	1							**2**	**4**			P	P	P	P			P	P	P	P				
na Žurgarski steni 1	828	476722 49022	natural rock	**S**	0	1					5	0	**4**	**1**			P	P																

Annex 1 / Priloga 1. Continued. / Nadaljevanje.

Locality	Alt. (m)	GKX GKY	Habitat type	Sp. pres.	*P.m.* 2006 (1)	*I.h.* 2006 (1)	*P.m.* 2007 (1)	*I.h.* 2007 (1)	*P.m.* 2007 (2)	*I.h.* 2007 (2)	*P.m.* 2008 (1)	*I.h.* 2008 (1)	*P.m.* 2008 (2)	*I.h.* 2008 (2)	*P.m.* 2010 (1)	*I.h.* 2010 (1)	*P.m.* 2011 (1)	*I.h.* 2011 (1)	*P.m.* 2011 (2)	*I.h.* 2011 (2)	*P.m.* 2012 (1)	*I.h.* 2012 (1)	*P.m.* 2012 (2)	*I.h.* 2012 (2)	*P.m.* 2013 (1)	*I.h.* 2013 (1)	*P.m.* 2013 (2)	*I.h.* 2013 (2)	*P.m.* 2014 (1)	*I.h.* 2014 (1)	*P.m.* 2014 (2)	*I.h.* 2014 (2)	*P.m.* 2015 (1)	*I.h.* 2015 (1)
pred Žurgarsko steno	899	477181 49089	artificial rock	**A - *I.h.***	0	3					**0**	**6**	0	0			/	P																
na Žurgarski steni 2	948	477075 48768	natural rock	**A - *I.h.***	0	1					0	3	**0**	**13**					/	P									/	P				
Fridrikštajn	959	488966 52243	urban area	**A - *P.m.***													P	/			**10**	**0**							P	/				
Male Bele stene	976	476572 61464	artificial rock	**A - *I.h.***											**0**	**5**	/	P			/	P							/	P			/	P
Taborska stena	991	478628 48293	natural rock	**A - *I.h.***	**0**	**1**					0	0	0	0																				
ob cesti pod Velikimi Belimi stenami	996	477087 59976	artificial rock	**A - *I.h.***											/	P	**0**	**9**	/	P	/	P	/	P	0	8	/	P	/	P	/	P	/	P
Kameni zid	1028	479672 52082	natural rock and open forest	**S**													**2**	**3**	/	P	2	2							P	P			P	P
na Taborski steni 1	1029	478193 48482	natural rock	**A - *I.h.***	0	3					**0**	**4**	0	1																				
na Taborski steni 2	1055	478891 48207	natural rock	**A - *I.h.***	**0**	**1**					0	1	0	0																				
na ovinku pred Velikimi Belimi stenami	1058	477753 59090	artificial rock	**A - *I.h.***													/	P			**0**	**8**							/	P	/	P	/	P
Velike Bele stene na robu sten	1118	47744 59648	natural rock and open forest	**A - *I.h.***																	**0**	**4**							/	P				

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SHORT COMMUNICATION

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First record of *Opilo germanus* Chevrolat, 1843 (Coleoptera: Cleridae) from Italy with remarks on its distribution in Europe

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Abstract. The checkered beetle *Opilo germanus* Chevrolat, 1843 is reported from Italy for the first time. The species is extremely rare in Europe and its biology is not well known. In the past, single specimens have been collected only at a few localities throughout the continent. The classification of *O. germanus* is complicated, since some authors consider it synonymous to *O. abeillei*, *O. domesticus*, *O. pallidus* or *O. mollis.* Localities where *O. germanus* was collected in Europe are listed and its distribution range is compared to the abovementioned species. The distribution range of *O. germanus* is not identical to neither of the species, suggesting distinct ecological preferences. Further faunistic data may help resolve the complicated taxonomy of the genus *Opilo.*

Key words: biogeography, distribution, Cleridae, Italy, *Opilo germanus*

Izvleček. Prvi podatek o pisancu *Opilo germanus* Chevrolat, 1843 (Coleoptera: Cleridae) v Italiji s komentarjem njegove razširjenosti po Evropi – V prispevku poročamo o prvi najdbi hrošča pisanca *Opilo germanus* Chevrolat, 1843 v Italiji. Ta vrsta je zelo redka v Evropi, slabo je poznana tudi njena biologija. Doslej je bilo najdenih le nekaj primerkov z območja celotnega kontinenta. Klasifikacija *O. germanus* je nejasna, nekateri avtorji ga obravnavajo kot sinonim vrstam *O. abeillei*, *O. domesticus*, *O. pallidus* ali *O. mollis.* Podajamo vse lokacije, kjer je vrsta bila najdena, in primerjamo areal razširjenosti s prej omenjenimi vrstami. Razširjenost *O. germanus* se ne prekriva z nobeno od vrst, kar kaže na različne ekološke preference. Nadaljnji favnistični podatki bodo pomagali pri razrešitvi zapletene taksonomije rodu *Opilo.*

Ključne besede: biogeografija, razširjenost, Cleridae, Italija, *Opilo germanus*

Introduction

Opilo germanus is a checkered beetle belonging to the subfamily Clerinae within the family Cleridae. It was first described by M. Chevrolat in 1843, who collected a single specimen in Hamburg in northern Germany (Chevrolat 1843). It has been, however, considered a separate species by the general entomological public only during a brief period in the late 19th and early 20th centuries. Since then, many authors synonymised it with *O. mollis* (Linnaeus, 1758), *O. domesticus* (Sturm, 1837) and *O. pallidus* (Olivier, 1795) (Hubenthal 1916, Korge 1960). Furthermore, Gerstmeier (2013) synonymized *O. germanus* under *O. abeillei* Korge, 1960. This makes tracing the history of this taxa complicated, and a detailed taxonomic study would be

needed to establish whether *O. germanus* is a separate species or just a synonym. Regardless the taxonomic opinion, novel faunistic findings should be interesting, since they may help resolve the complicated classification of the taxa.

Materials and methods

During the summer 2016, selected checkered beetle specimens deposited in the Slovenian Natural History Museum (Prirodoslovni muzej Slovenije) in Ljubljana were examined. The Slovenian Natural History Museum houses some of the largest and oldest insect collections in Slovenia. Since some recent communications on Cleridae have not considered *O. germanus* a separate species, the original description of Chevrolat (1843) was consulted. The specimen was revised using a stereomicroscope.

Results with discussion

During a study of checkered beetles deposited in the Slovenian Natural History Museum, a single specimen labelled as *O. germanus* was found. The specimen was pinned in the collection »Savo-zbirka-Coleoptera 16-003« in box number 16-003. The locality label reads: Triest, S. Luigi; 10. 8. 20; SPRINGER (Fig. 1). This is thus the first record of the species from Italy, although more than 95 years old.

Figure 1. Photograph of *O. germanus* deposited in the Slovenian Natural History Museum (Prirodoslovni muzej Slovenije) in Ljubljana (photo: E. Tihelka). Note the characteristic dark brown markings near the apex of the elytra (Korge 1960).
Slika 1. Fotografija *O. germanus*, ki je shranjen v Prirodoslovnem muzeju Slovenije v Ljubljani (foto: E. Tihelka). Vidne so značilne temne lise na koncu eliter (Korge 1960).

The body of *O. germanus* takes the colour of different shades of brown, specimens are typically about 9.5 mm long. The elytra are coarsely covered by dense rows of uniform and square-like punctures. These rows of punctures run in the same thickness and intensity all the way from the shoulders up to about 2/3 of the elytra length. Except for the 2nd row, the elytral interval is always smaller than the thickness of the elytra stria (Chevrolat 1843, Reitter 1893). However, the micro sculpture of the elytra itself cannot be considered a distinguishing feature, since it is similar for many beetles of the genus *Opilo*. Rather, *O. germanus* is specific for its dark brown markings in about 2/3 of its elytra. Because this feature shows remarkable uniformity in a number of specimens collected in different parts of the Palearctic region, several authors consider it to be a specific distinguishing feature of *O. germanus* (e.g. Kniephof 1913).

It would be interesting to investigate whether or not populations of *O. germanus* survived in Italy until the present day. *O. germanus* is distributed extremely scarcely through Europe and its biology is poorly understood (Reitter 1911, Burakowski et al. 1986), which makes attempts to rediscover it difficult. It was collected on oaks and old buildings in the past (Kniephof 1913, Hubenthal 1916). According to some authors, the beetle lives in the stems of madders (*Rubia* sp.) or brambles (*Rubus* sp.) with many exit holes of Hymenoptera (Hubenthal 1916). It was also recorded to occur together with *O. mollis* (Kniephof 1913), suggesting similar ecological preferences. According to Löbl et al. (2007), *O. germanus* is distributed throughout France, Germany, Poland, Portugal, Algeria and Tunisia, but typically only a few specimens are known from each country. Altogether, only eight records of the species as far as Europe is concerned are known (Tab. 1, Fig. 2). It is interesting to note that all the sites of *O. germanus* are located within a close proximity to the coastline. *O. germanus* was never reported from inland Europe. It can be speculated that the species may not be native to Europe, and that isolated populations were introduced via merchant trade. During the 19th century, Trieste was considered to be the most important port of the Austro-Hungarian Empire (Hubert 2015) and remains to be one of the most important trade hubs in the region. Other localities, where the species was collected, are also close to major ports (Hamburg, Le Havre, Marseille, Gdánsk). This is not a new idea, since Winkler (1959) already argued that *O. germanus* may not be native to northern Germany. If *O. germanus* is not native to Europe, where does its original distribution range lie? This question is hard to answer, given that the clerid was never collected outside of Europe, except for Algeria and Tunisia. However, since all of the nearly 70 species of the genus *Opilo* are probably native to the Old World, mainly to the Oriental realm (Kolibáč et al. 2005), it can be expected that the original distribution range of *O. germanus* lies somewhere in this territory.

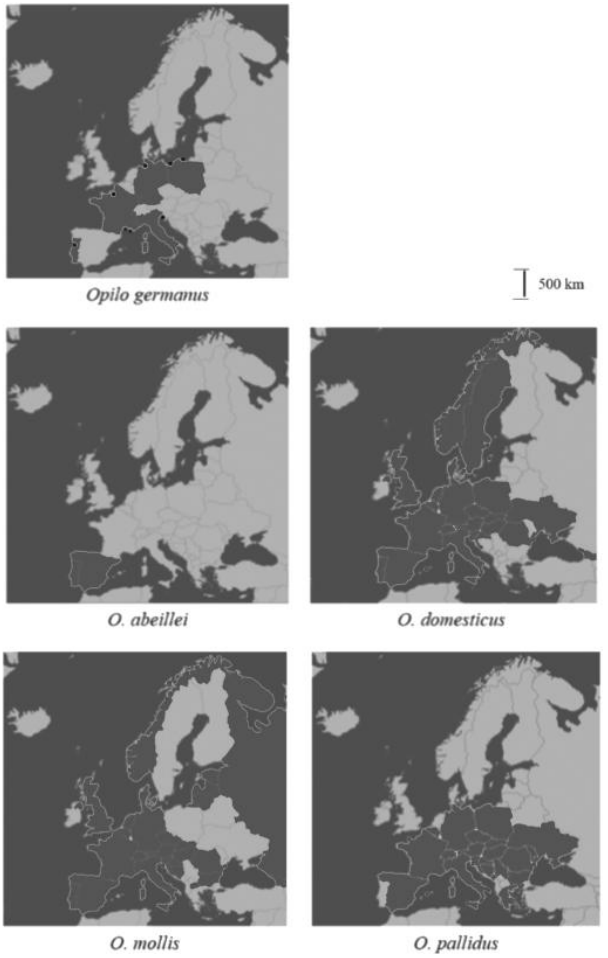

Figure 2. The known distribution range of *O. germanus* compared to the distribution ranges of *O. abeillei, O. domesticus, O. mollis* and *O. pallidus* (according to Löbl et al. 2007). Localities where *O. germanus* was collected are marked with black dots. For details on point localities see Tab. 1.

Slika 2. Poznana razširjenost *O. germanus* v primerjavi z razširjenostjo vrst *O. abeillei, O. domesticus, O. mollis* in *O. pallidus* (po Löbl et al. 2007). Z rdečimi pikami so označene lokalitete z *O. germanus.* Za podrobnosti o točkastih lokalitetah glej Tab. 1.

It could be expected that if *O. germanus* had an identical distribution range to some of the species, they probably are synonymous (all distribution ranges are in Fig. 2). While the distribution range of *O. abeillei* is limited to the Iberian Peninsula, *O. domesticus, O. mollis* and *O. pallidus* are distributed throughout continental Europe. It is apparent that the distribution range of *O. germanus* is not identical to neither of the aforementioned species. On the other hand, the distribution ranges of *O. domesticus, O. mollis* and *O. pallidus* overlap only partially with *O. germanus*. Distribution ranges suggest that *O. germanus* has distinct ecological preferences to all other mentioned species.

Table 1. Chronological overview of all localities at which *O. germanus* was collected in Europe.
Tabela 1. Kronološki pregled vseh lokalitet *O. germanus* v Evropi.

Locality	Time period	Comments	Reference
Surroundings of Hamburg (Germany)	1840s?	type specimen deposited in the National Museum of Natural History in Paris (according to Hubenthal 1916)	Chevrolat (1843)
Marseille (France)	second half of the 19th century?		de la Puebla & Bahillo (2000)
Rouen (France)	second half of the 19th century?		de la Puebla & Bahillo (2000)
Wieliszewo (Poland)	1900s-1910s?	1 spec.	Kniephof (1913)
Trieste (Italy)	10. 8. 1920	1 spec., coll. Slovenian Natural History Museum	
Międzyzdroje (Poland)	9.8.1924	coll. Koch	Korge (1960)
Coimbra (Portugal)	?		Korge (1960)
Provence (France)	?		de Mersaul (1857)

Since many authors do not consider *O. germanus* a separate species, it was very likely overlooked by researchers and it may be distributed much more widely than currently thought. It is recommended that larger private and public collections with a number of *Opilo* specimens are revised according to the description of Chevrolat (1843). This may help elucidate the problematic taxonomy and faunistics of beetles of the genus *Opilo.*

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A contribution to the Slovenian spider fauna – III

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Abstract. The study reports on first records of two spider species for Slovenian fauna, *Zodarion rubidum* and *Prinerigone vagans* from the Bela krajina region in southeastern Slovenia. Regarding their presence in the neighbouring countries and distribution in Europe, both species could be considered as expected. The finding of *Z. rubidum* during night time in the urban area demonstrates negligence of sampling at unconventional time and in anthropogenic habitats. Finding two new records during short term field survey also indicates undersampling of the spider fauna and supports the need for further faunistic work in the field of arachnology.

Key words: Araneae, first records, Bela krajina, *Zodarion rubidum*, *Prinerigone vagans*, spiders, Slovenia

Izvleček. Prispevek k favni pajkov Slovenije – III – Prispevek obravnava najdbi dveh vrst pajkov v Beli krajini, *Zodarion rubidum* in *Prinerigone vagans*, ki doslej v Sloveniji še nista bili najdeni. Glede na njuna areala v Evropi in potrjeno pojavljanje v sosednjih državah sta bili obe vrsti v Sloveniji pričakovani. Ulov vrste *Z. rubidum* v mestnem okolju ponoči kaže na zapostavljanje vzorčenja v nočnem času in v antropogenem okolju. Najdbi dveh novih vrst za slovensko araneofavno v kratkem času vzorčenja v Beli krajini kažeta na pomanjkljivo poznavanje favne pajkov Slovenije in potrebo po tovrstnih favnističnih študijah.

Ključne besede: Araneae, prve najdbe, Bela krajina, *Zodarion rubidum*, *Prinerigone vagans*, pajki, Slovenija

Introduction

Slovenian spider fauna currently comprises 750 species (Kostanjšek & Kuntner 2015, CKFF 2016). Compared to the number of recorded spider species in neighbouring countries according to the Fauna Europaea Database (Van Helsdingen 2013) and the variety of zoogeographical regions within Slovenia (such as Submediterranean, Dinaric, Alpine, Prealpine and Subpannonian) (Mršić 1997, Ciglič & Perko 2012), the checklist of Slovenian spiders is still far from complete. In Bela krajina in southeastern Slovenia, data of spiders derive from reports focused on endangered species (Polenec 1992), general surveys of invertebrates (Bole et al. 1980, Kos & Praprotnik 2000) and spider fauna (Kostanjšek 2002), first records for Slovenian fauna (Kostanjšek & Miller 2004, Kostanjšek 2010) and a study focused on spider species richness estimation (Budja 2008). Current knowledge on the araneofauna in Bela krajina is supplemented by several records on the hypogeic spiders (Kratochvil 1934, Nikolić 1963, Deeleman-Reinhold 1978, Nikolić & Polenec 1981).

In the present work, we report on two new species for the Slovenian spider fauna, specifically *Zodarion rubidum* Simon, 1914 from the family Zodariidae and *Prinerigone vagans* (Audouin, 1826) from the family Linyphiidae.

Materials and methods

Survey area

Sampling took place in Bela krajina, the region situated in southeastern Slovenia (Fig. 1). Bela krajina is mainly a karst area confined by the Gorjanci and Kočevski Rog mountain ranges in the north and west and the Kolpa River in the south and east. The area is a mosaic of agricultural land, forests, meadows and pastures.

Field surveys were performed during the »27th Biology Summer Research Camp – Dragatuš 2015« between 19. and 30. 7. 2015.

Figure 1. Sampling area in Bela krajina in southeastern Slovenia (dashed line on the inset), with locations of two new species for Slovenia: *Zodarion rubidum* and *Prinerigone vagans*.
Slika 1. Območje vzorčenja v jugovzhodni Sloveniji (črtkana črta na karti Slovenije) z označenimi lokacijami najdb vrst *Zodarion rubidum* in *Prinerigone vagans.*

Sampling methods, determination and specimen preparation

All specimens were collected with aspirator or forceps and preserved in denatured 70% ethanol. Determination, preparation and observation of the specimens with both light and electron microscopy were performed at the Department of Biology of the Biotechnical Faculty, University of Ljubljana. We used different determination keys for species identification (Roberts 1995, Nentwig et al. 2016, Oger 2016).

The epigyne of one female specimen was dissected and macerated in 15% KOH overnight to remove soft tissue. The prepared sample was inspected with Leica MZ FLIII stereo microscope and photographed by Leica DFC 425 C camera under 100× magnification.

For electron microscopic observation, the male specimen was briefly sonicated in ultrasonic bath PIO Sonis 2 T, air-dried, mounted on aluminium stubs and sputter-coated with platinum. The prepared samples were observed by Jeol JSM-7500F field emission scanning electron microscope.

Results and discussion

The two spider species, presenting the first records for Slovenia, belong to two different families, Zodariidae and Linyphiidae. They were found on one and two localities, respectively (Fig. 1).

Zodarion rubidum Simon, 1914 (fam. Zodariidae)

A single female was collected by araneological group during the night in the vicinity of school buildings in the Dragatuš village (45.52285°N, 15.17992°E; altitude: 176 m a. s. l.) on 21. 7. 2015. Finding of the specimen in the village supports the potential of anthropogenic environments as important, yet overlooked habitats for species rarely found in natural environments (Kostanjšek & Celestina 2008). Epigyne and the vulva are shown in Figs 2-3, respectively.

Like other members of the family Zodariidae, *Z. rubidum* specializes in ant-eating (Pekár & Křál 2002, Pekár 2004). *Zodarion rubidum* mimics red ants and often feeds on *Myrmica sabuleti*, *Tetramorium caespitum* or *Lasius platythorax*. It has up to 5 mm long body and hunts across open ground in the evening and during nighttime (Pekár & Křál 2002, Pekár 2004). Although it shows some spreading tendencies, the species is still considered Central-European (Nentwig et al. 2016). It has also been introduced to North America (Paquin & Dupérré 2006).

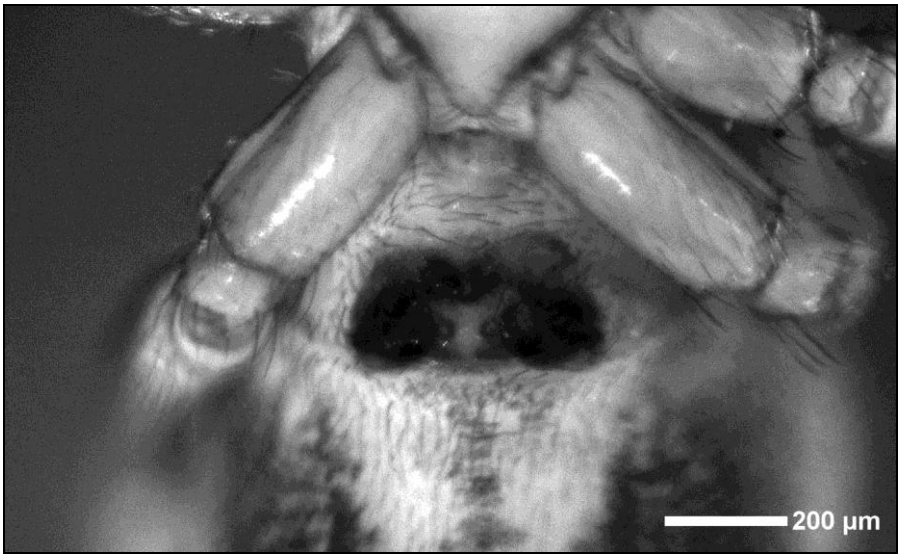

Figure 2. Ventral view of *Zodarion rubidum*, showing the distinctive epigynal morphology.
Slika 2. Trebušna stran *Zodarion rubidum* z značilno oblikovano epigino.

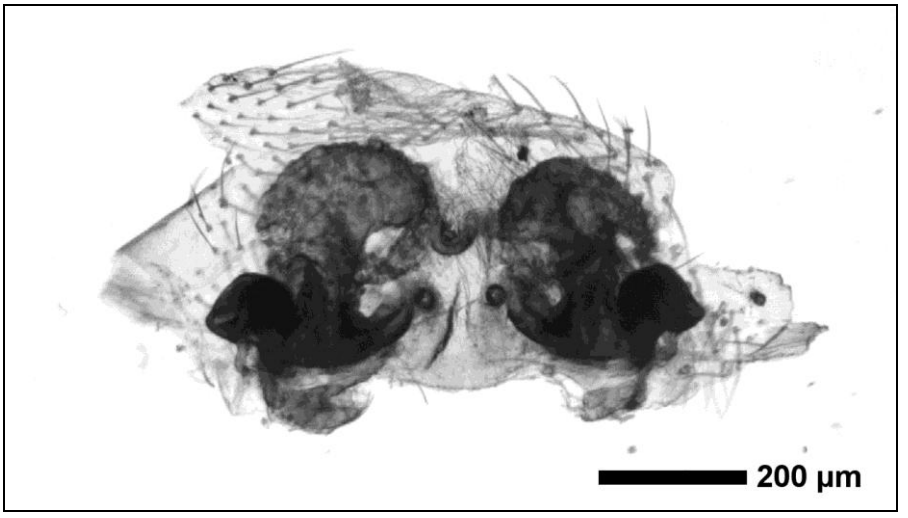

Figure 3. The morphology of the internal genitalia (vulva) isolated from the same specimen of *Z. rubidum*, depicted in Fig. 2.
Slika 3. Zgradba notranjih spolnih organov (vulve), izoliranih iz primerka *Z. rubidum*, prikazanega na Sl. 2.

Prinerigon e vagans (Audouin, 1826) (fam. Linyphiidae)

Two males were collected by Alja Pirnat and Urška Ratajc on two locations in gravel bars of the Kolpa River on 24. 7. 2015. One male was collected from gravel bars near the Vinica village (45.45869°N, 15.25861°E; altitude: 168 m a. s. l.), the other from gravel bars near the Žuniči village (45.47973°N, 15.36656°E; altitude: 161 m a. s. l.). The specimens were identified based on the distinctive shape of their patellar apophysis and morphology of the distal parts of their pedipalps (Fig. 4).

According to the available literature, *P. vagans* is widespread in western and central Europe (Nentwig et al. 2016), although uncommon in England (Harvey et al. 2002, British Arachnological Society 2016). This species inhabits wet habitats, such as wet grassy meadows, shores of lakes and gravel bars (Harvey et al. 2002, Nentwig et al. 2016). Adult specimens are usually found throughout the year, but are most abundant early to mid-summer and autumn (Harvey et al. 2002, Nentwig et al. 2016).

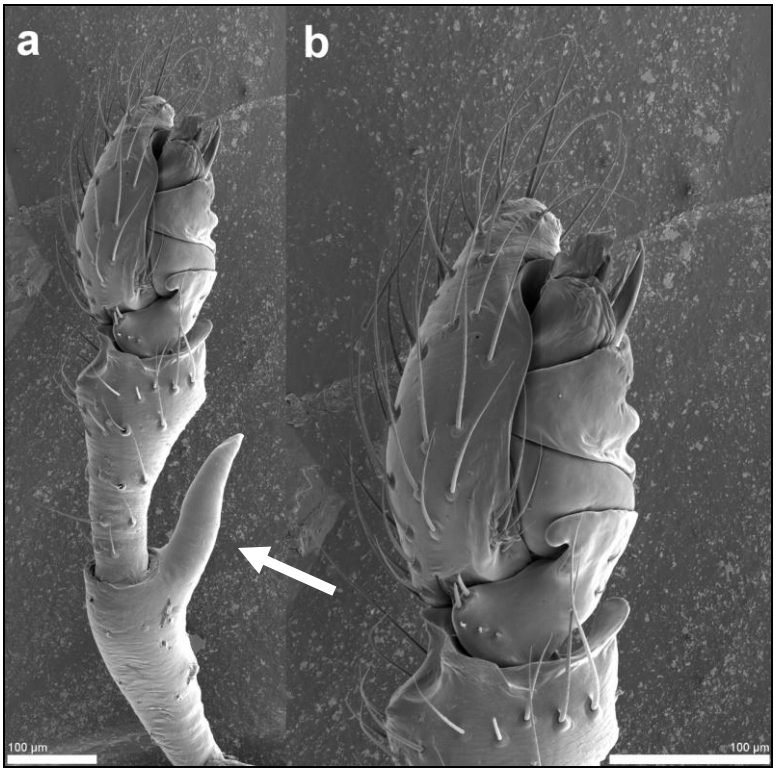

Figure 4. Distinctive patellar apophysis (arrow) of male pedipalp of *Prinerigone vagans* (4a) and detailed morphology of cymbium and bulbar sclerites (4b).
Slika 4. Značilna apofiza na pateli pedipalpa samca vrste *Prinerigone vagans* (7a) in povečan prikaz distalnega dela pedipalpa (7b).

According to known distribution and confirmed records in the neighbouring countries (Nentwig et al. 2016), the presence of both species in Slovenia could be expected. Finding of *Z. rubidum* in Bela krajina represents the southernmost record in the Balkans (Nentwig et al. 2016). The vicinity of the national border and high dispersal capabilities of spiders (Foelix 2011) imply the species may be present in Croatia, where it has not been recorded yet (Nentwig et al. 2016). The findings of the two new spider species in a relatively short survey period in July 2015 imply the Slovenian spider fauna is undersampled (Kostanjšek & Kuntner 2015). This supports the need for further faunistic work in the field of arachnology.

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New data on distribution of the European pond turtle *Emys orbicularis* (Linnaeus, 1758) in the Podravje region (NE Slovenia)

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Abstract. Ten new observations of the European pond turtle *Emys orbicularis* (Linnaeus, 1758) in the Podravje region are presented. One observation is fairly old, while the others have been made in the last six years. Most of the data are just random observations and do not give a complete overview of the species distribution in the Podravje region. New data suggest that the European pond turtle is more abundant in the Drava River basin than previously known. Distribution and population size of the species in the Drava River basin still remain to be investigated in detail and not only at the Natura 2000 Drava site, especially in the areas of potential habitats prior to planning any new activities.

Key words: European pond turtle, *Emys orbicularis*, Drava River, Natura 2000, Podravje, Slovenia

Izvleček. Novi podatki o razširjenosti močvirske sklednice *Emys orbicularis* (Linnaeus, 1758) v Podravju (SV Slovenija) – V prispevku navajamo deset novih podatkov o pojavljanju močvirske sklednice *Emys orbicularis* (Linnaeus, 1758) v Podravju. Eno opazovanje je starejšega datuma, ostala pa so iz zadnjih šestih let. Večina podatkov je bila zbrana ob naključnih opazovanjih, zato ne omogočajo celostnega vpogleda v razširjenost močvirske sklednice v Podravju. Novi podatki nakazujejo, da je močvirska sklednica v porečju reke Drave bolj pogosta, kot je bilo znano doslej. Zato bo treba ugotoviti njeno dejansko razširjenost in velikost populacije ne samo na območju Natura 2000 Drava, temveč v celotnem porečju reke Drave, še posebej na območjih, kjer so načrtovani posegi v njen potencialni habitat.

Ključne besede: močvirska sklednica, *Emys orbicularis*, reka Drava, Natura 2000, Podravje, Slovenija

Introduction

The knowledge of the distribution of the European pond turtle *Emys orbicularis* (Linnaeus, 1758) in Slovenia has improved in recent years (Grželj & Grželj 2012, Vamberger et al. 2013, Pekolj et al. 2015), but not for the Drava River basin. In the past 20 years, only three single observations have been reported for this region (Govedič & Janžekovič 2003), i.e. at Središče ob Dravi in 1997 at Slivniški ribniki in 1998, and at Borl in 2002. In the following publications on the distribution of reptiles no new data for the European pond turtle were reported for the Drava River basin (Janžekovič et al. 2008, Krofel et al. 2009, Vogrin 2009a, 2009b). Furthermore, there are no records of the European pond turtle occurring in the Drava River basin in Croatia along the Slovenian border (Šalamon et al. 2013).

In 2004, Natura 2000 sites were established in the Drava River basin, including the Natura 2000 site Drava (SI3000220) for the European pond turtle (Ur. l. RS 2004a). In 2007, the Natura 2000 Management Programme 2007–2013 was adopted (Vlada RS 2007). Despite the lack of data, this management plan did not propose additional field work for assessing the distribution of the European pond turtle. In 2015, the Natura 2000 Management Programme 2015–2020 was adopted (Vlada RS 2015), even though no additional information on the distribution of the pond turtle had become available. A single observation at Borl (Govedič & Janžekovič 2003) still remains the only record of the European pond turtle at the Natura 2000 site Drava. In this article we summarize new observations of the European pond turtles, older unpublished data and literature data for the Drava River basin.

Materials and methods

Our random observations and data gathered by the Herpetological Society – Societas herpetologica slovenica were summarized together for the Podravje region. Due to presence of the red-eared terrapin (*Trachemys scripta*) in the area (Krofel et al. 2009), only unambiguous observations are included. Most of the records are photo documented. If possible, sex of turtles was determined on the basis of eye colour in field or at photo. Combination of the number of growth rings, shield abrasion and size were used to distinguish between young and adult turtles.

Results and discussion

We gathered nine new observations during the past six years, supplemented by one older unpublished observation, all of them from the Podravje region. Most turtles were seen randomly during biological field work or when crossing the road. The only record from the clay pit at Janežovci in 2016 was the result of a focused visit (Tab. 1). All data are from locations

where the European pond turtle had previously not been known, with the exception of clay pit at Janežovci. Four observations are from the Natura 2000 site Drava.

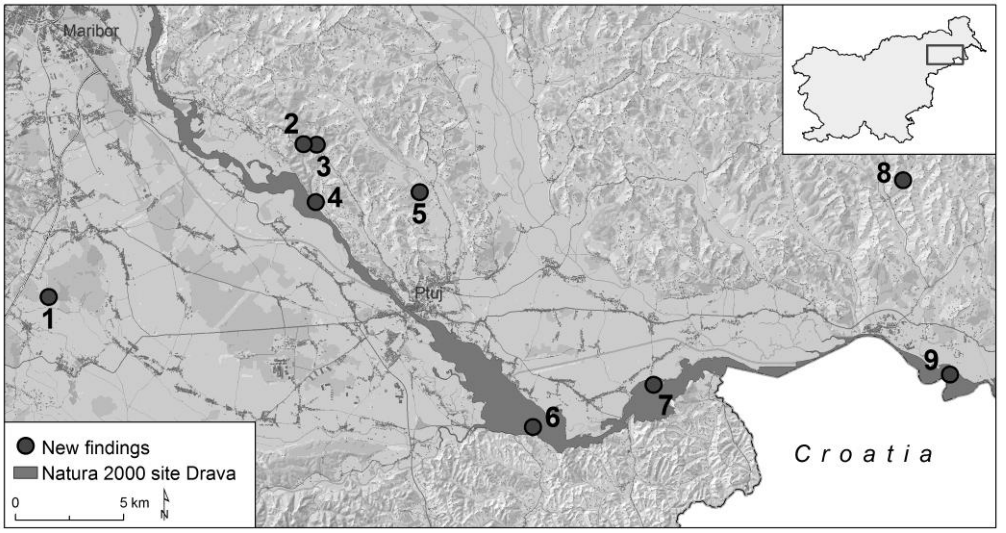

Figure 1. New observations of the European pond turtle in the Podravje region (with numbers on figure corresponding to ID Number in Tab. 1).
Slika 1. Nova opazovanja močvirske sklednice v Podravju (številke na sliki so enake ID-vrednostim v Tab. 1).

Surprisingly, as early as in 2002 Flis et al. (2002) stated in the Environmental Impact Assessment (EIA) for the expansion of Janežovci clay pit that very high population density of the European pond turtle was observed. The population size estimation was based on visual observation, since there are no research methods described and traps were not used for turtle research in Slovenia in 2002 as yet. Unfortunately, this information was not known in the time of proposals of Natura 2000 sites (Tome 2003), since EIA reports were not accessible to the public. In 2004, this area was recognized as an Ecosystem and Zoological Valuable Natural Feature (ekosistemska in zoološka naravna vrednota; Ur. l. 2004b). A few years later, after the implementation of the Habitats Directive in Slovenia, a new EIA report for Tourist Development of the Janežovci clay pit area was prepared (Flis et al. 2006). In this EIA report, the very high population density of the European pond turtle was still mentioned, but no additional research was carried out. It seems that in the evaluation of impacts and in the conclusions of the EIA as well as in the environmental permit issued by the authorities, species habitat requirements were largely neglected. Warning about the significant impact on the European pond turtle was later indicated in the EIA report for the Municipal Development Plan (Gregorc et al. 2009). Because construction works did not start during the two-year period, the building permit expired. According to the comparison of aerial photos of the clay pit area, the area hasn't changed much since 2002. As the European pond turtle is still present in these clay pits (Tab. 1), we conclude that the area has a high value for conservation of the species in the region, although its population size is not known. The proposal of Natura 2000 sites for the European pond turtle (Tome 2003) as well as for many other species was made on the existing data without additional research. In the case of the European pond turtle, the

proposal was based on occurrence data or observation density. The clay pit at Janežovci had been the only known location for the European pond turtle in the Drava River basin, where it was possible to observe several turtles at the same time. According to the used methodology of defining Natura 2000 network in 2003, we believe that the site certainly fulfilled all conditions for the establishment of a Natura 2000 site.

Table 1. Data on observations of the European pond turtle in the Podravje region. GKX, GKY refer to coordinates in Gauss-Krüger coordinate system.
Tabela 1. Podatki o opazovanjih močvirske sklednice v Podravju. GKX in GKY se nanaša na koordinate v Gauss-Krügerjevem koordinatnem sistemu.

ID	Location/ Najdišče	GKX, GKY	Number/ Sex/Age Št./Spol/ Starost	Type of observation / Način opazovanja	Date/ Datum	Observer/ Opazovalec
1	Western side of Požeg water reservoir	550396, 142553	One turtle	Visual observation	7.5.2013	M. Vogrin
2	Road parallel to a fishpond close to Vurberk	562187, 149621	One turtle	Found dead (run over)	26.5.2016	F. Janžekovič
3	Road parallel to a fishpond in the Grajena stream valley	562782, 149594	One female	Captured/ picture	16.6.2015	F. Janžekovič
4	Garden at Krčevina pri Vurbegu close to oxbow of the Drava River	562742, 146942	One male	Captured/ picture	28.4.2013	E. Šmigoc
5	Clay pit near Janževci in the Rogoznica stream valley	567556, 147405	Two young females	Visual observation/ picture	29.5.2011	D. Bordjan
			One male turtle	Visual observation/ picture	10.7.2016	N. Kirbiš & M. Vamberger
6	River bank 100 m from the mouth of the Dravinja River	572793, 136564	One turtle	Visual observation	29.7.2011	M. Vogrin
7	Oxbow of the Drava River near Gajevci	578369, 138506	One young male	Captured/ picture	14.3.2013	D. Bombek
8	Road in the Sirotka valley	589905, 147952	One adult	Captured/ picture	16.6.2016	T. Gregorc
9	Area of the present-day Ormož Basins Nature Reserve	592065, 138969	One turtle	Captured	Between 1990 and 1995	D. Denac

All data are just random observations, so actual distribution of the species in the Drava River basin is still unknown also at the Natura 2000 Drava site. However, even these random data provide firm evidence that European pond turtles do occur in the area from where it was largely unknown. New data suggest that the European pond turtle is more abundant in the Podravje region than previously known. The species is listed in Annex IV of the Habitats Directive and fully protected by our national legislation (Ur. l. RS 2004c). Its habitat is also protected, especially egg deposition sites that are subjects of environmental liability (okoljske odgovornosti; Ur. l. RS 2009), irrespective of whether they are located within Natura 2000

sites or not. Distribution and population size of the species in the Drava River basin still remain to be investigated in detail and not only at the Natura 2000 Drava site. Before the authorities issue any environmental permit for new activities in all potential habitats of the European pond turtle in the Podravje region, conservation status of the species should be considered independently of existing data. Results of the focused research into the species have to be considered as well. There are many other potential well suited habitats for the European pond turtle like oxbow lakes, gravel and clay pits, ponds and fishponds in the Podravje region.

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Interesting high altitude record of two common adders *Vipera berus* (Linnaeus, 1758) on the Pokljuka Plateau (Julian Alps, NW Slovenia)

Zanimiva najdba dveh osebkov navadnega gada *Vipera berus* (Linnaeus, 1758) na visoki nadmorski višini na Pokljuki (Julijske Alpe, SZ Slovenija)

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The common adder *Vipera berus* (Linnaeus, 1758) is the most widely distributed snake species in the world: its range extends from northern Scandinavia to the north of Albania and from Scotland on the west to the Sakhalin Island on Russia's Pacific coast in the east; it is found at altitudes from 0 to 2,600 m a.s.l. (Gasc et al. 1997, Andersson 2003, Carlsson 2003). Its habitats include hedgerows, forest edges, clearings, heaths, meadows, bogs and rocky slopes (Carlsson 2003). In Slovenia, the common adder is found mostly in hilly and mountainous parts of the Alps and the Dinarides (Tome 1996, Krofel et al. 2009). Individuals have also been reported from the Prekmurje region (Cafuta 2010), but the common adder is usually found at higher altitudes and is rare in lowlands (Krofel et al. 2009). It is more adapted to colder temperatures and higher humidity and therefore often found on northern slopes, in contrast with *V. aspis* and *V. ammodytes* (Mebert et al. 2015). The common adder is a protected species in Slovenia; it is legally protected by the Decree on Protected Wild Animal Species (Ur. l. RS 2004) and listed as a vulnerable species (V) in the »Slovenian Red Data List« (Ur. l. RS 2002).

Here we report on two individuals of the common adder, which were found on 2. 4. 2016 on the NE slope of Viševnik Mt above the Pokljuka Plateau in the Julian Alps, at 1,928 m a.s.l. (Fig. 1). Both were basking on a branch of dwarf mountain pine *Pinus mugo*, just above the entrance to a newly discovered cave (46,35994° N; 13,90077° E) (Fig. 2). The surrounding vegetation is composed of grasses and alpine heath *Erica carnea*, which were overlain by approx. 2 m thick snow cover at the time of its detection. The maximum temperature on that day was 9.6°C, and the lowest -1.5°C during the night (measurements taken at the nearest weather station Rudno polje at 1,344 m a.s.l.; ARSO 2016). The cave is located approx. 600 m higher than the weather station, hence we can assume the temperatures there were several degrees lower. Above the entrance the snow had melted due to the warmer air current coming out of the cave. One common adder individual was coloured sandy brown, with a distinctive zigzag pattern, while the other was melanistic. Both responded to our presence by moving, with one individual coiling into a defensive position (Fig. 1).

Our finding is currently the highest record of the common adder in Slovenia, which includes information on exact location and a photograph of individuals. Up to now, the finding at Mali vrh, Belščica (the Karavanke mountain chain) at 1,886 m a.s.l. was considered the highest based on exact locality (Krofel et al. 2009). Krofel et al. (2009) disregarded the report from the area of Prehodavci in the Julian Alps at 2,100 m a.s.l. (Tome 1996) as the highest, as it contained no information on exact locality.

The common adder hibernates up to eight months, depending on the altitude, latitude, and exposition of its habitat; the hibernation is terminated when the maximum air temperatures reach 8° or 12°C for males and females, respectively (Viitanen 1967). Prestt (1971) reports on the following hibernation period for southern England: from the end of September till the beginning of March for adult males and till the end of March for adult females. Andersson (2003) estimates that the hibernation period north of the Arctic Circle in Sweden lasts from the beginning of September till the beginning of May for adult males and till the middle of May for reproductive females. These data refer to low altitudes (up to 450 m a.s.l.). To the best of our knowledge, there is no information on duration of hibernation of common adder at such high altitudes as our finding. It may be that the relatively warm air, coming from the cave, contributed to an earlier termination of hibernation

in these two individuals. Considering the presence of snow and low air temperatures in the area, we can hypothesize that the two individuals stayed in the vicinity of the cave entrance due to the warmer air, which provided a more suitable environment, especially during nighttime. It may be that caves at high altitudes represent potential refuges for snakes during low temperatures, as they provide more stable temperatures than the surface.

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Figure 1. Two specimens of the common adder (*V. berus*) found on 2. 4. 2016 at the entrance to a cave at 1,928 m a.s.l. on Pokljuka, NW Slovenia (photo: David Škufca).
Slika 1. Navadna gada (*V. berus*), najdena 2. 4. 2016 na vhodu jame na Pokljuki, SZ Slovenija, na 1.928 m nmv (foto: David Škufca).

Figure 2. Cave entrance on Pokljuka, NW Slovenia, above which the two common adders (*V. berus*) were found (photo: David Škufca).
Slika 2. Vhod jame na Pokljuki, SZ Slovenija, nad katerim sta bila najdena navadna gada (*V. berus*) (foto: David Škufca).

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Prispevki naj bodo napisani v programu Word for Windows, v pisavi "Times New Roman CE 12", z levo poravnavo in 3 cm robovi na A4 formatu. Med vrsticami naj bo dvojni razmak, med odstavki pa prazna vrstica. Naslov prispevka in naslovi posameznih poglavij naj bodo natisnjeni krepko v velikosti pisave 14. Latinska imena rodov in vrst morajo biti pisana ležeče. Uredniku je potrebno prispevek oddati v primerni elektronski obliki (disketa, CD, elektronska pošta) v Rich text (.rtf) ali Word document (.doc) formatu.

Naslov prispevka (v slovenskem in angleškem jeziku) mora biti informativen, jasen in kratek. Naslovu naj sledijo celotna imena avtorjev in njihovi naslovi (vključno z naslovi elektronske pošte).

Izvleček v slovenskem jeziku mora na kratko predstaviti namen, metode, rezultate in zaključke. Dolžina izvlečka naj ne presega 200 besed za znanstveni članek oziroma 100 besed za kratko znanstveno vest. Pod izvlečkom naj bodo ključne besede, ki predstavljajo področje raziskave. Njihovo število naj ne bo večje od 10. Sledi abstract in key words v angleškem jeziku, za katere velja enako kot za izvleček in ključne besede.

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NAVAJANJE LITERATURE

Navajanje literature v besedilu mora biti na ustreznem mestu. Kadar citiramo enega avtorja, pišemo Schultz (1987) ali (Schultz 1987), če sta avtorja dva (Parry & Brown 1959) in če je avtorjev več (Lubin et al. 1978). Kadar navajamo citat večih del hkrati, pišemo (Ward 1991, Pace 1992, Amman 1998). V primeru, ko citiramo več del istega avtorja objavljenih v istem letu, posamezno delo označimo s črkami (Lucas 1988a, b). Literatura naj bo urejena po abecednem redu.

Primeri:

- članke iz revij citiramo:

Schultz J.W. (1987): The origin of the spinning aparatures in spiders. Biol. Rev. 62: 123-134.

Parry D.A., Brown R.H.J. (1959): The hydraulic mechanism of the spider leg. J. Exp. Biol. 36: 654-657.

Lubin Y.D., Eberhard W.G., Montgomery G.G. (1978): Webs of Miagrammopes (Araneae: Araneaidae) in the neotropics. Psyche 85: 1-13.

Lucas S. (1988a): Spiders in Brasil. Toxicon 26: 759-766.

Lucas S. (1988b): Spiders and their silks. Discovery 25: 1-4.

- knjige, poglavja iz knjig, poročila, kongresne povzetke citiramo:

Foelix R.F. (1996): Biology of spiders, 2. edition. Harvard University Press, London, pp. 155-162.

Nentwig W., Heimer S. (1987): Ecological aspects of spider webs. In: Nentwig W. (Ed.), Ecophysiology of Spiders. Springer Verlag, Berlin, 211 pp.

Edmonds D.T. (1997): The contribution of atmospheric water vapour to the formation of a spider's capture web. In: Heimer S. (Ed.), Proceedings of the 17th European Colloquium of Arachnology. Oxford Press, London, pp. 35-46.

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FORMAT AND FORM OF ARTICLES
Papers should be written with Word for Windows using "Times New Roman CE" size 12 font, align left and margins of 3 cm on A4 pages. Double spacing should be used between lines and paragraphs should be separated with a single empty line. The title and chapters should be written bold in font size 14. The latin names of all genera and species must be written italic. All submissions should be sent to the editor in the appropriate electronic version on diskette, CD or via e-mail in Rich text format (.rtf) or Word document (.doc) format.

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Papers should not exceed a total of ten illustrations and/or tables, with their positon amongst the text clearly indicated by the author(s). Tables with their legends should be submitted on separate pages. Titles of tables should appear above them, and titles of illustrations and photographs below. Illustrations and tables should be cited shortly in the text (Tab. 1 or Tabs. 1-2, Fig. 1 or Figs. 1-2).

LITERATURE
References should be cited in the text as follows: a single author is cited, as Schultz (1987) or (Schultz 1987); two authors would be (Parry & Brown 1959); if a work of three or more authors is cited, (Lubin et al. 1978); and if the reference appears in several works, (Ward 1991, Pace 1992, Amman 1998). If several works by the same author published in the same year are cited, the individual works are indicated with the added letters a, b, c, etc. (Lucas 1988a, b). The literature should be arranged in alphabetical order.

Examples (use the the following forms):

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Parry D.A., Brown R.H.J. (1959): The hydraulic mechanism of the spider leg. J. Exp. Biol. 36: 654-657.
Lubin Y.D., Eberhard W.G., Montgomery G.G. (1978): Webs of Miagrammopes (Araneae: Araneaidae) in the neotropics. Psyche 85: 1-13.
Lucas S. (1988a): Spiders in Brasil. Toxicon 26: 759-766.
Lucas S. (1988b): Spiders and their silks. Discovery 25: 1-4.

- for books, chapters from books, reports, and congress anthologies:
Foelix R.F. (1996): Biology of spiders, 2. edition. Harvard University Press, London, pp. 155-162.
Nentwig W., Heimer S. (1987): Ecological aspects of spider webs. In: Nentwig W. (Ed.), Ecophysiology of Spiders. Springer Verlag, Berlin, 211 pp.
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