

**New records of *Cordulegaster heros* (Odonata: Cordulegastridae)
on its northern area border in Slovakia**

**Nové nálezy páskovce velkého *Cordulegaster heros* (Odonata: Cordulegastridae)
na severní hranici areálu na Slovensku**

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Abstract. The occurrence of *Cordulegaster heros* Theischinger, 1979 was studied in details in the southern part of Slovakia during 1997-2009. At present four regions with its occurrence are known – the Borská nížina Lowland, the Malé Karpaty Mts. in the western Slovakia, the Revúcka vrchovina Highlands and the Stolické vrchy Hills in central Slovakia. The species was found at totally 44 localities, which lay at the altitude from 194 to 516 m a.s.l. with its main occurrence in the range of 201-300 m a.s.l. The evaluation of occurrence was based on records of larvae. Area of *Cordulegaster heros* in southern Slovakia is seemingly disjunctive.

INTRODUCTION

Cordulegaster heros Theischinger, 1979 is in the centre of faunistic-ecological investigation in last years (cf. BOUDOT 2001; BEDJANIČ & ŠALAMUN 2003; BLAŠKOVIČ et al. 2003; HOLUŠA 2005, 2007a, 2007b, 2009; TÓTH 2006; JANSKÝ & DAVID 2008; SCHWEIGHOFER 2008; CSORDÁS et al. 2009; STAUFER & HOLUŠA in press). We know its biogeographical occurrence according to present records – it is an East-Mediterranean species, the area of which reaches into central Europe. An interesting fact on this species is its discovery in very Central Europe (Niederösterreich) in 1979 (THEISCHINGER 1979).

Its area involves the whole Balkan Peninsula, however at present we have only information about its disjunctive area in this region. The southernmost occurrence is located in the southern Greece (there in subspecies *C. heros pelionensis* Theischinger, 1979) (THEISCHINGER 1979). Further the species is known from Macedonia, Montenegro, Albania, Croatia and Bulgaria (there in subspecies *C. heros heros* Theischinger, 1979) (VAN PELT 2006). The easternmost occurrence is known from the eastern part of Greece and also from Romania (region of Banat) (HOLUŠA unpubl.). Very numerous populations occur in the western part of its area, i.e. in Slovenia (KOTARAC 1997; KOTARAC et al. 2006). The occurrence was confirmed in the eastern Italy as at the westernmost point of its area (BEDJANIČ & ŠALAMUN 2003). Northernwards area border runs into Austria, where the species occurs in south western Waldviertel (district Melk) at its northwestern area border (RAAB et al. 2006; SCHWEIGHOFER 2008). Isolated occurrences are known from the territory of Hungary (CSORDÁS et al. 2009) and the northern Hungary (TÓTH 2006). The northernmost known occurrence lays in the Malé Karpaty Mts. and the Borská nížina Lowland in the western Slovakia, where it was found for the first time as late as in 2001 (BLAŠKOVIČ et al. 2003; JANSKÝ & DAVID 2008). Its absolutely northernmost occurrence is

the record from the Czech Republic (STAUFER & HOLUŠA, in press), however this records was “classified” as an occasional „visit“.

The authors’ hypothesis supposes its potential occurrence in regions with suitable habitats in Slovakia – i.e. in the belt of regions on the southern slopes of the Carpathians Mts., especially regions that naturally proceed to Hungarian territory without interruption of large lowlands.

The knowledge on occurrence and ecology of this species is very important also from the perspective of its listing to the species requiring protection – Annex II and IV of Council Directive 92/43/EHS.

STUDY AREA AND METHODS

Intensive investigations of water habitats were carried out during the period of 1997-2009 (from May to September) in the whole area of the southern slopes of the Carpathians Mts. in Slovakia in selected areas (regions are listed from east to west) – the Vihorlat Mts., Popričný Mt., the Východoslovenská pahorkatina Hillyland, the Slanské vrchy Hills, the Slovenský kras Karst, the Juhoslovenská kotlina Basin, the Cerová vrchovina Highlands, the Revúcka vrchovina Highlands, the Stolické vrchy Hills, the Krupinská planina Plateau, the Štiavnické vrchy Mts., the Malé Karpaty Mts., the Borská nížina Lowland, the Chvojnická pahorkatina Hillyland and the Dyjskomoravský úval Vale (Fig. 2). Suitable watercourses, where the occurrence of *C. heros* could be expected (especially localities up to the altitude of 400 m a.s.l.) were chosen in these regions.

Middle and lower parts of streams (especially with suitable character of stream basin, i.e. smaller meandering streams in cultural landscape or in forest complexes) were searched there. Adults were searched during summer days for, however larvae were in the centre of focus above all from spring till autumn. 10 m-sections with suitable material of streams sediment in all types of watercourses were looked for larvae and also exuviae (Fig. 3, 4). Adults were caught or photographed for determination; larvae were caught by sluicing of sediments. Materials of sediment were recovered for a detailed pedological analysis (HOLUŠA in prep.)

RESULTS

Cordulegaster heros was found in 44 localities (Tab. 1). Out of that number the occurrence is known in 11 localities and hence it means only a confirmation of the occurrence in these localities (BLÁŠKOVICH et al. 2003; JANSKÝ & DAVID 2008), however 33 localities are “completely” new. The species is currently known in 59 localities in Slovakia. The region of the Malé Karpaty Mts. and the Borská nížina Lowland are “known regions” of the occurrence (cf. BLÁŠKOVICH et al. 2003; JANSKÝ & DAVID 2008). Completely new, and to a certain degree surprising findings, are the records from the Revúcka vrchovina Highlands and the Stolické vrchy Hills in central Slovakia (Fig. 2, 9).

The localities lie in the altitude from 194 to 516 m a.s.l. with its main occurrence in the range of 201-300 m a.s.l. (43 % of all localities), the average altitude is 319 m a.s.l. Generally (including also published records) the localities lie in the altitude from 160 to 516 m a.s.l. (Fig. 1).

In the survey there can be found detailed information of authors’ findings, including the notes if it is a “known” locality of occurrence of *C. heros*.

DISCUSSION

The investigation of the occurrence of *Cordulegaster heros* during 1997-2009 was concentrated into regions with an expected occurrence, i.e. southern parts (slopes) of the Carpathians Mts. – (the regions are listed from the east to the west) Popričný Mt., the Vihorlat Mts., the Slanské vrchy Hills, the Slovenský kras Karst, the Revúcka vrchovina Highlands, the Stolické vrchy Hills, the Cerová vrchovina Highlands, the Štiavnické vrchy Hills, the Malé Karpaty Mts., the Borská nížina Lowland, the Chvojnická pahorkatina

Hillyland and the Dyjskosvratecký úval Vale. This was the original hypothesis of HOLUŠA (2005, 2009). From the selected regions, the species was found (confirmed) in already „known“ regions, i.e. the Malé Karpaty Mts. and the Borská nížina Lowland. Completely new occurrence places come from central Slovakia, i.e. the Revúcka vrchovina Highlands and the Stolické vrchy Hills. The distance between recorded regions, i.e. the locality in central Slovakia and the nearest locality in the Malé Karpaty Mts. is approximately 190 km.

The absence of the occurrence in the region of southern part of the Slanské vrchy Hills and the Cerová vrchovina Highlands still remains indistinct, since these are the regions with a direct connection to Hungarian localities.

The occurrence of larvae was confirmed in 98 % localities, i.e. it is the occurrence of permanent populations. Low abundances were found in the Borská nížina Lowland, in some cases larvae were not found. The populations in this region could depend on migration from regions with permanent numerous populations, i.e. the Malé Karpaty Mts. The habitats of found localities relate to the species demands, since very numerous populations and more instars of larvae were found in some localities. The highest found density of larvae (majority of last larval instar – 14) was 25 per 0.25 m² – at the locality in the Malé Karpaty Mts (Fig. 4).

The occurrence of *C. heros* was confirmed in habitats, that have character of natural streams and streamlets with clear water and the width of the basin from 20 to 420 cm and the depth 2-18 cm. All localities lie in the forest complexes (Fig. 5, 6, 7, 8). According to preliminary results, partial river straightening, altitude, soil fraction 5-20 mm, covering with organic material and the stream basin slope (HOLUŠA 2009) appear to be important factors for the occurrence of the species. These results are based on an analysis of several localities from the Malé Karpaty Mts. (i.e. N = 8), more exact results shall be drawn from the analysis of all the localities set (i.e. N = 44) (HOLUŠA in prep.)

A probable influence of the geological parent rocks to the occurrence seems to be of a high interest. The numerous populations occur in regions, where the geests of crystallines (specially geests of granit) lie in stream-basins, i.e. the southern part of the Malé Karpaty Mts., where this species occurrence ends in the central part of the Malé Karpaty Mts., which is the territory where the mountain parent rocks change from crystalline into the limestone.

The species *C. heros* occupies the northernmost part of its area in Slovakia. The northernmost locality with a permanent population is the locality of Ratkovské Bystré village – the part of Rybné (grid mapping code 7386) with coordinates: 48°39'49.72''N and 20°02'24.18''E. However, the locality has approximately the same geographical position as the locality Hlboké village – Šranek stream in the Borská nížina Lowland (BLAŠKOVIC et al. 2003).

The borders of the species area are still unknown, not even in Slovakia. The border could be probably situated across Austria (Niederösterreich) towards the western Slovakia, i.e. regions of the Borská nížina Lowland and the Malé Karpaty Mts. Between these regions and the next small area, i.e. the Revúcka vrchovina Highlands and the Stolické vrchy Hills, there is a “gap” of 190 km. We still suppose that *C. heros* could survive also in this territory, however the populations would be locally limited and also extremely difficult to be found. The occurrence of *C. heros* is absolutely excluded in lowland areas along the Váh, Hron and Ipel' rivers, due to the absence of streams or a sole occurrence of streams “destroyed” by human activity. The area of *C. heros* in the southern Slovakia is seemingly disjunctive. The absence in some regions may occur as a result of a different character of parent rock geest in streams.

The species was found in the southernmost part of the Malé Karpaty Mts., in very narrow steep streamlets (habitat type of *Cordulegaster bidentata* Selys, 1843) in a forest complex of beech forests (*Fagus sylvatica* L.). Only in one locality the occurrence of *C. heros* was found with a syntopic occurrence of *C. bidentata*, however larvae of both species were not found in the same microhabitats.

The *C. heros* has an apparent increasing abundance, however according to the authors' idea, it cannot be assumed as a "shift" northernwards, but only as a present lack of knowledge of detail occurrence as well as of ecological demands. Many historical records concernig the species of *Cordulegaster boltoni* (Donovan, 1807) were the records of *C. heros*, because the species *C. boltoni* still remains without reliable specimen evidence in Slovakia (HOLUŠA 2007a). There is not the overlap of areas of *C. boltoni* and *C. heros*, which is known from Austria (SCHWEIGHOFER 2008).

Populations in Slovakia could be "expansive" only with respect to a possible "paradrop" of individual specimens into more distant regions. It could be also the reason for finding *C. heros* in the territory of the Czech Republic, where one female was found recently, which was evaluated as an occasional "migrant" (STAUFER & HOLUŠA in press).

SUMMARY

Cordulegaster heros Theischinger, 1979 is an East-Mediterranean species, the area of which reaches into central Europe. The borders of the species area are still unknown, not even in Slovakia, i.e. in the northernmost part of its area. The occurrence of *C. heros* was studied in details in the southern part of Slovakia during 1997-2009. Intensive investigations of water habitats were carried out in all area of southern slopes of the Carpathians Mts. in Slovakia in selected areas (regions are listed from east to west) – Popričný Mts., the Vihorlat Mts., the Slanské vrchy Hills, the Slovenský kras Karst., the Revúcka vrchovina Highlands., the Stolické vrchy Hills, the Cerová vrchovina Highlands, the Štiavnické vrchy Hills, the Malé Karpaty Mts., the Borská nížina Lowland and the Chvojnická pahorkatina Hillyland (Fig. 2). Suitable watercourses, where the occurrence of *C. heros* could be expected (especially localities up to the altitude of 400 m a.s.l.) were chosen in these regions. *Cordulegaster heros* was found in 44 localities in the four regions – the Borská nížina Lowland, the Malé Karpaty Mts. in the western Slovakia, the Revúcka vrchovina Highlands and the Stolické vrchy Hills, however 33 localities (regions of the Revúcka vrchovina Highlands and the Stolické vrchy Hills) are "completely" new. The localities lie at the altitude from 194 to 516 m a.s.l. with its main occurrence in the range of 201-300 m a.s.l. (43 % of all localities), the average altitude is 319 m a.s.l. Generally (including also published records) the localities lie at the altitude from 160 to 516 m a.s.l.

The borders of the species area are still unknown, even in Slovakia, where area is seemingly disjunctive. The border could be probably situated across Austria (Niederösterreich) towards the western Slovakia, i.e. regions of the Borská nížina Lowland and the Malé Karpaty Mts. Between these regions and the next small area, i.e. the Revúcka vrchovina Highlands and the Stolické vrchy Hills, there is a "gap" of 190 km.

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SOUHRN

Cordulegaster heros Theischinger, 1979 je východomediterránní druh vážky, jehož areál zabírá celý Balkánský poloostrov a sahá až do střední Evropy. Přesné rozšíření, zda se druh vyskytuje po celém zmíněném území, nebo se zde vyskytuje disjunktně, není doposud známo. Nejseverněji zasahuje druh svým areálem na území Slovenska, avšak i zde je jeho přesné rozšíření neznámé.

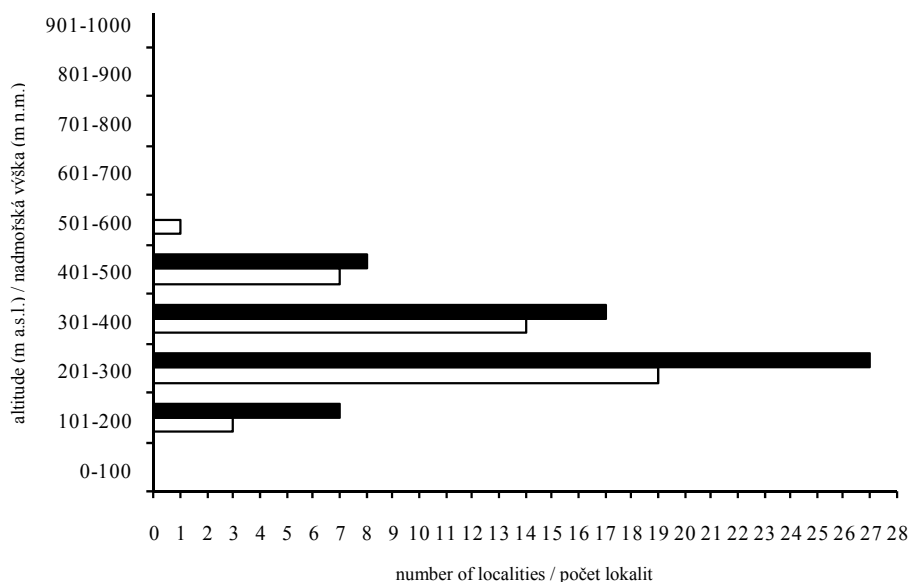
V letech 1997-2009 byl prováděn detailní průzkum menších vodotečí v oblastech jižního Slovenska, tj. ve vybraných oblastech jižních svahů Karpat – Popričný, Vihorlat, Slanské vrchy, Slovenský kras, Revúcka vrchovina, Stolické vrchy, Cerová vrchovina, Štiavnické vrchy, Malé Karpaty, Borská nížina a Chvojnická pahorkatina. V těchto oblastech byly vybrány vodní toky, kde bylo možné očekávat výskyt *C. heros*, tj. především polohy do nadmořské výšky 400 m.

Cordulegaster heros byl v rámci průzkumu zjištěn na 44 lokalitách ve čtyřech regionech – Borská nížina, Malé Karpaty v oblasti západního Slovenska, v oblasti Revúcké vrchoviny a Stolických vrchů v oblasti středního Slovenska. 33 lokalit z uvedeného množství je zcela „nových“ (oblast Revúcka vrchovina a Stolické vrchy). Výskyt byl zjištěn v nadmořské výšce od 194 do 516 m, s těžištěm výskytu mezi 201-300 m n.m. (43 % všech lokalit), průměrná nadmořská výška 319 m. Celkově se (včetně literárních znalostí) lokality nacházejí v nadmořské výšce v rozmezí od 160 do 516 m.

Přesná hranice rozšíření v oblasti jižního Slovenska je doposud neznámá. Na základě zjištěných výsledků se jeví, že areál je nesouvislý (disjunktivní). Mezi dosavadními známými oblastmi, tj. Borská nížina a Malé Karpaty a „nově zjištěnou“ arelou – tj. oblast Revúcké vrchoviny a Stolických vrchů ve středním Slovensku, je vzdálenost cca 190 km. Zda se druh vyskytuje i v místech této disjunkce bude předmětem dalšího výzkumu.

Fig. 1. The number of localities with the occurrence of *Cordulegaster heros* in the territory of Slovakia according to the sea level (white column – authors' data (N=44); black – including published data (N=59))

Obr. 1. Počet lokalit s výskytem *Cordulegaster heros* na území Slovenska v závislosti na nadmořské výšce (bíle – data autorů (N=44); černě – včetně literárních dat (N=59))



Tab. 1. Description of localities with *Cordulegaster heros* recordsTab. 1. Popis lokalit s výskytom druhu *Cordulegaster heros*

(M – male/samec; F – female/samice; L – larvae/larvy; E – exuviae/exuvie; OH – lgt. Otakar Holuša; MK – lgt. Matúš Kúdela)

Number of loc.	Biogeographical region	Locality name with local name	Code of grid mapping	Geographical coordinates		altitude (m a.s.l.)	Data	Found specimen (lgt.)	Published records
				N	E				
1.	Borská nížina Lowland	Lakšárska Nová Ves village: „Pri Husárovských rybníkoch“ place	7468	48°34'10.47"	17°09'18.56"	209	27.VII.2008	1L (OH)	BLÁŠKOVIČ et al. 2003
2.	Borská nížina Lowland	Lakšárska Nová Ves village – part of Horné Vály: Lakšársky potok stream	7468	48°34'05.58"	17°07'42.57"	195	3.VII.2005 13.VII.2006 7.VII.2007 27.VII.2008	3M+4L+2E (OH) 1M (OH) 2L (OH) 1M (OH)	
3.	Borská nížina Lowland	Lakšárska Nová Ves village – Šišulákovci part: Lakšársky potok stream	7468	48°34'23.04"	17°08'23.38"	200	27.VII.2008	1M (OH)	BLÁŠKOVIČ et al. 2003
4.	Borská nížina Lowland	Šaštín Stráže village: Šaštínsky potok stream	7368	48°37'16.91"	17°09'52.05"	194	27.VII.2008	2M/1F (OH)	
5.	Malé Karpaty Mts.	Borinka village – Košariska part	7768	48°17'36.48"	17°07'33.93"	432	1.XI.2009	2L (OH)	
6.	Malé Karpaty Mts.	Borinka village: valley of Stupavského potoka stream – small left-hand affluent	7768	48°15'18.35"	17°07'01.09"	330	18.X.2009	2L (OH)	
7.	Malé Karpaty Mts.	Bratislava city – Krasňany part	7768	48°12'03.44"	17°07'37.92"	204	1.X.2009	9L (OH)	JANSKÝ & DAVID 2008
8.	Malé Karpaty Mts.	Bratislava city – Rača part: place under Malá Baňa hill	7768	48°12'00.47"	17°08'20.00"	242	1.X.2009	1L (OH)	JANSKÝ & DAVID 2008
9.	Malé Karpaty Mts.	Bratislava city – Rača part: valley of Kopanice	7768	48°13'25.62"	17°08'51.35"	265	1.X.2009	4L (OH)	
10.	Malé Karpaty Mts.	Červený Kameň village: Kamený potok stream	7669	48°23'33.01"	17°17'56.39"	307	1.IX.2008	2L (OH)	
11.	Malé Karpaty Mts.	Červený Kameň village – Papiernička part: Zajačí jarok stream	7669	48°23'21.13"	17°17'43.29"	338	1.IX.2008 21.V.2009	25L (OH) 10L (OH)	
12.	Malé Karpaty Mts.	Harmónia village – Piesok part	7669	48°22'50.93"	17°16'15.14"	486	22.XI.2009	4L (OH)	
13.	Malé Karpaty Mts.	Harmónia village – Piesok part: Panský dom place	7669	48°22'56.01"	17°15'40.82"	483	22.XI.2009	3L (OH)	
14.	Malé Karpaty Mts.	Jabloňové village – Škvorovci part	7668	48°20'32.38"	17°07'06.48"	286	1.XI.2009	4L (OH)	

Tab. 1. Continuation
Tab. 1. Pokračování

Number of loc.	Biogeographical region	Locality name with local name	Code of grid mapping	Geographical coordinates		altitude (m a.s.l.)	Data	Found specimen (lgt.)	Published records
15.	Malé Karpaty Mts.	Kuchyňa village: Modranská cesta place – Malina stream	7569	48°24'04.11"	17°10'58.87"	312	3.X.2009	1L (OH)	
16.	Malé Karpaty Mts.	Kuchyňa village: Svanepošská dolina valley – Javorinka stream	7669	48°23'56.79"	17°10'07.36"	281	3.X.2009	2L (OH)	
17.	Malé Karpaty Mts.	Lozomo village: Balgava place	7668	48°19'11.90"	17°04'06.88"	238	1.XI.2009	4L (OH)	JANSKÝ & DAVID 2008
18.	Malé Karpaty Mts.	Lozomo village – Rusniaky part: Suchý potok stream	7668	48°19'25.14"	17°05'15.30"	252	1.XI.2009	2L (OH)	
19.	Malé Karpaty Mts.	Mariánka village: under Bazgovič hill	7769	48°14'50.57"	17°04'44.30"	280	18.X.2009	3L (OH)	
20.	Malé Karpaty Mts.	Mariánka village: Vápenický potok stream	7768	48°13'25.51"	17°02'53.14"	235	18.X.2009	2L (OH)	
21.	Malé Karpaty Mts.	Modra village: Žliebok stream	7669	48°21'27.83"	17°18'04.43"	313	1.IX.2008	3L (OH)	BLÁŠKOVIC et al. 2003
22.	Malé Karpaty Mts.	Modra village – Piesok part: small left-hand affluent of Kamenný potok stream	7669	48°22'20.00"	17°17'55.53"	340	1.IX.2008 28.VI.2009	9L (OH) 6E (OH)	
23.	Malé Karpaty Mts.	Modra village: under Smčič vrch hill	7669	48°20'02.39"	17°17'01.79"	293	15.XI.2009	1L (OH)	
24.	Malé Karpaty Mts.	Modra village: Štúrova lavička place	7669	48°20'34.36"	17°17'29.10"	261	15.XI.2009	4L (OH)	
25.	Malé Karpaty Mts.	Pernek village: Kostolný potok stream	7668	48°21'57.89"	17°09'28.92"	334	15.XI.2009	2L (OH)	JANSKÝ & DAVID 2008
26.	Malé Karpaty Mts.	Pezinok Down: Kučirdorfská dolina valley	7669	48°20'19.29"	17°15'14.57"	293	15.XI.2009	5L (OH)	JANSKÝ & DAVID 2008
27.	Malé Karpaty Mts.	Rohožník village: Rohožnícký potok stream	7569	48°26'25.08"	17°11'50.40"	293	3.X.2009	1L (OH)	
28.	Malé Karpaty Mts.	Sološnica village: Sološnícký potok stream	7569	48°27'04.41"	17°14'42.17"	275	3.X.2009	8L (OH)	JANSKÝ & DAVID 2008
29.	Malé Karpaty Mts.	Stupava village: Vápenný potok stream – under Kamenný vršok hill	7768	48°17'05.44"	17°03'40.02"	230	18.X.2009	2L (OH)	
30.	Malé Karpaty Mts.	Svätý Jur village	7769	48°15'50.22"	17°11'24.48"	303	1.X.2009	2L (OH)	

Tab. 1. Continuation
Tab. 1. Pokračování

Number of loc.	Biogeographical region	Locality name with local name	Code of grid mapping	Geographical coordinates	altitude (m a.s.l.)	Data	Found specimen (fgt.)	Published records
31.	Malé Karpaty Mts.	Železná Studienka village: small left-hand unnamed affluent	7868	48°11'07.08'' 17°04'43.45''	234	27.VII.2008	10M+5L (OH)	JANSKÝ & DAVID 2008
32.	Malé Karpaty Mts.	Železná Studienka village: Bystrická stream	7868	48°11'32.34'' 17°04'49.86''	242	27.VII.2008	15L (OH)	JANSKÝ & DAVID 2008
33.	Revúcka vrchovina Highlands	Hámor village: Slatvina stream	7386	48°36'45.10'' 20°04'27.25''	344	6.IX.2009	9L (OH)	
34.	Revúcka vrchovina Highlands	Rákoš village: Turčok stream	7387	48°36'24.35'' 20°10'20.84''	284	6.IX.2009	5L (OH)	
35.	Revúcka vrchovina Highlands	Ratkovské Bystré village: Bystrý potok stream	7386	48°38'43.06'' 20°02'55.92''	454	6.IX.2009	6L (OH)	
36.	Revúcka vrchovina Hills	Ratkovské Bystré village: Čierny potok stream	7386	48°39'38.93'' 20°02'28.87''	491	6.IX.2009	1L (OH)	
37.	Revúcka vrchovina Highlands	Ratkovské Bystré village: Krupovský potok stream	7386	48°39'23.44'' 20°03'02.78''	433	6.IX.2009	2L (OH)	
38.	Revúcka vrchovina Highlands	Ratkovské Bystré village – Rybné part: small right-hand unnamed affluent of Turiec stream	7386	48°39'49.72'' 20°02'24.18''	516	6.IX.2009	1L (OH)	
39.	Revúcka vrchovina Highlands	Ratkovské Bystré village: Turiec stream	7386	48°39'26.49'' 20°02'53.47''	456	2.VII.2008 6.IX.2009	1M (MK) 1L (OH)	
40.	Stolické vřehy Hills	Sirk village: Bystrá dolina – Bystrý potok stream	7386	48°37'43.18'' 20°05'24.93''	390	5.IX.2009	2L (OH)	
41.	Stolické vřehy Hills	Sirk village: Revúcka dolina – Východný Turiec stream	7386	48°38'04.40'' 20°06'12.53''	379	3.VII.2008 5.IX.2009	5M (MK) 4L (OH)	
42.	Stolické vřehy Hills	Sirk village: Valašská valley – Valaský potok stream	7386	48°38'07.18'' 20°06'06.07''	384	5.IX.2009	1L (OH)	
43.	Stolické vřehy Hills	Turčok village: Uhliarska valley – Turčok stream	7386	48°38'33.44'' 20°08'20.97''	364	5.IX.2009	2L (OH)	
44.	Stolické vřehy Hills	Turčok village: Zlatná valley	7386	48°38'35.83'' 20°08'59.21''	358	5.IX.2009	5L (OH)	

Fig. 2. Study area and distribution of *Cordulegaster heros* in the geosystems in Slovakia (until now knowledge): black colour – regions with found occurrence of *C. heros*; grey colour – study area (Vv – the Vihorlat Mts.; Vp – the Východoslovenská pahorkatina Hillyland; Sv – the Slanské vrchy Hills; Sk – the Slovenský kras Karst; Jk – the Juhoslovenská kotlina Basin; Cv – the Cerová vrchovina Highlands; Rv – the Revúcka vrchovina Highlands; Sov – the Stolické vrchy Hills; Kp – the Krupinská planina Plateau; Stv – the Štiavnické vrchy Hills; Mk – the Malé Karpaty Mts.; Bn – the Borská nížina Lowland; Cp – the Chvojnická pahorkatina Hillyland; Du – the Dyjskomoravský úval Vale)

Obr. 2. Zájmová oblasť a rozšíření druhu *Cordulegaster heros* v geosystémech Slovenska (dosavadní znalosti): černá barva – oblasti se zjištěním druhu *C. heros*; šedá barva – zájmová oblast (Vv – Vihorlat; Vp – Východoslovenská pahorkatina; Sv – Slanské vrchy; Sk – Slovenský kras; Jk – Juhoslovenská kotlina; Cv – Cerová vrchovina; Sov – Stolické vrchy; Kp – Krupinská planina; Stv – Štiavnické vrchy; Mk – Malé Karpaty; Bn – Borská nížina; Cp – Chvojnická pahorkatina; Du – Dyjskomoravský úval)

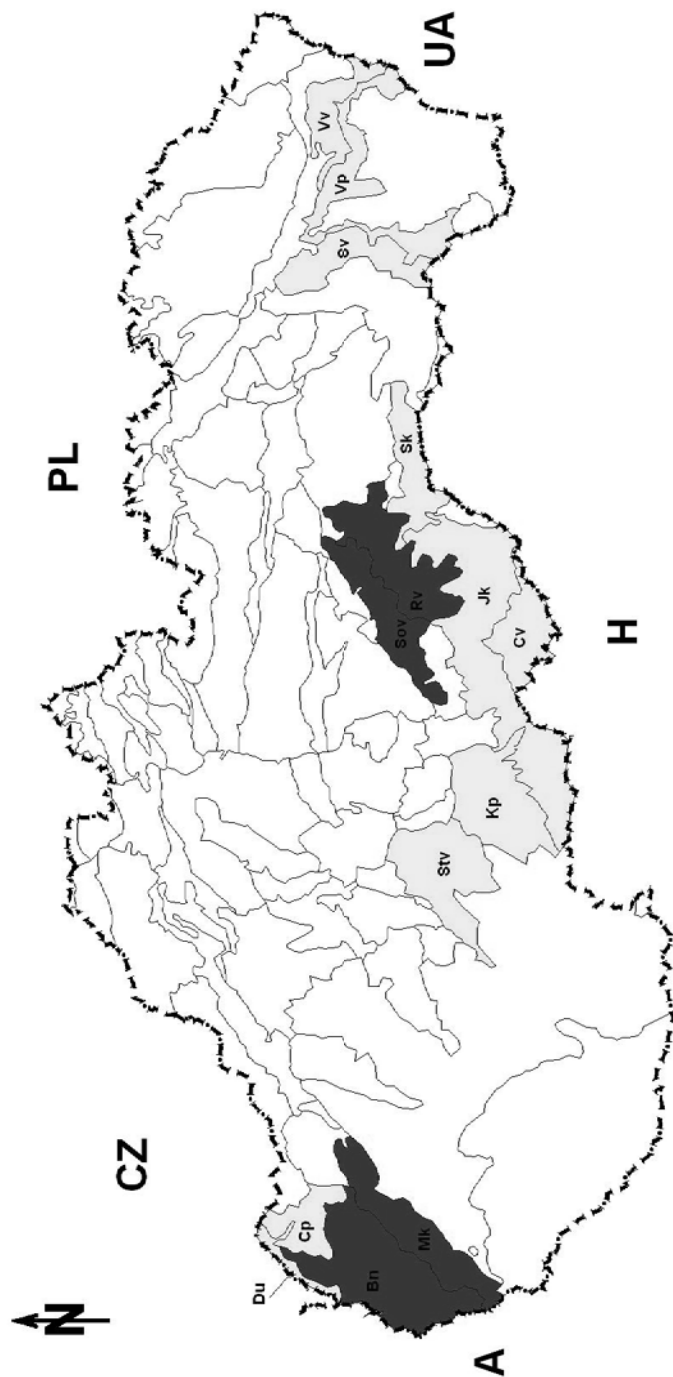


Fig. 3. Exuvia of *Cordulegaster heros* in the locality Modra village – Piesok part: small left-hand affluent of Kamenný potok stream, the Malé Karpaty Mts., Slovakia (28.VI.2009), photo O. Holuša

Obr. 3. Exuvie druhu *Cordulegaster heros* na lokalitě Modra – Piesok: levostranný přítok Kamenného potoku, Malé Karpaty, Slovensko (28.VI.2009), foto O. Holuša



Fig. 4. The most numerous found density of larvae of *Cordulegaster heros* in the locality Červený kameň village – Papiernička part: Zajačí jarok stream, the Malé Karpaty Mts., Slovakia (1.IX.2008), photo O. Holuša

Obr. 4. Nejpočetnější zjištěná densita larev druhu *Cordulegaster heros* na lokalitě Červený kameň – Papiernička: Zajačí jarok, Malé Karpaty, Slovensko (1.IX.2008), foto O. Holuša





Fig. 5. Habitat of *Cordulegaster heros* in the locality Lakšárska Nová Ves village – part of Horné Valy – Lakšársky potok stream, the Borská nížina lowland, Slovakia (3.VII.2005), photo O. Holuša

Obr. 5. Biotop druhu *Cordulegaster heros* na lokalitě Lakšárska Nová Ves – místní část Horné Valy – Lakšársky potok, Borská nížina, Slovensko (3.VII.2005), foto O. Holuša

Fig. 6. Habitat of *Cordulegaster heros* in the locality Červený kameň village – Papiernička part – Zajačí jarok stream, the Malé Karpaty Mts., Slovakia (1.IX.2008), photo O. Holuša

Obr. 6. Biotop druhu *Cordulegaster heros* na lokalitě Červený kameň – Papiernička – Zajačí jarok, Malé Karpaty, Slovensko (1.IX.2008), foto O. Holuša

Fig. 7. Habitat of *Cordulegaster heros* in the locality Sirk – Revúcka dolina – Východný Turiec stream, the Stolický vrchy Hills, Slovakia (5.IX.2009), photo O. Holuša

Obr. 7. Biotop druhu *Cordulegaster heros* na lokalitě Sirk – Revúcka dolina – Východný Turiec, Stolické vrchy, Slovensko (5.IX.2009), foto O. Holuša

Fig. 8. Habitat of *Cordulegaster heros* in the locality Rákoš village – Turiec stream, the Revúcka vrchovina Hills, Slovakia (6.IX.2009), photo O. Holuša

Obr. 8. Biotop druhu *Cordulegaster heros* na lokalitě Rákoš – potok Turiec, Revúcka vrchovina, Slovensko (6.IX.2009), foto O. Holuša

Fig. 9. Distribution of *Cordulegaster heros* in Slovakia (until now knowledge)

● – authors' data, ○ – literary record

Obr. 9. Rozšíření druhu *Cordulegaster heros* na území Slovenska (dosavadní znalosti)

● – zjištění autorů, ○ – literární údaj

