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Carabid beetles (Coleoptera, Carabidae) in the Thaya valley

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Abstract

In the year 2010, ground beetles (Coleoptera, Carabidae) of open habitats were methodically assessed for the first time in the Austrian part of the National Park (Thayatal). During the European Territorial Cooperation (ETZ) project "Nature without borders - Priroda bez Hranic" at the Thaya valley (Lower Austria and South Moravia) 20 different sites of open habitats, including dry grasslands of different size, geology, vegetation cover and exposition as well as meadows of different management, were sampled using pitfall traps. The survey contributes to basic data of the invertebrate inventory in the National Park. Moreover it adds to existing data from standardised samples in the forests of the Austrian part of the National Park taken in 2005 as well as sporadic collections since 1988 in different habitats of the Czech part of the National Park (Podyjí).

Within the project, carabid species richness increased by 30 species in the Austrian part, including 5 species, which were new for both National Parks along the border river Thaya. In total, one third of the Eastern-Austrian Carabids (124 species) were listed in the Austrian part and 243 species have been listed in the Czech part of the National Park.

The carabid species compositions of open habitats in National Park Thaya valley differ in dry grassland and meadows. Moreover the different xerothermophilous species compositions on different dry grassland sites reflect the typical small-scale distribution of diverse habitat-varieties in the National Park.

For a better understanding of dynamic processes over space and time, further research is necessary concerning connectivity or disjunction of fragmented small scale habitats and their mobile (threatened) fauna elements. Research synergies between arthropods and other taxa are possible.

Keywords

Thaya, carabidae, meadow, grassland

Introduction

The Inter-National Park Thayatal-Podvjí protects the Thaya chasm near Hardegg in the north-eastern region called “Waldviertel”, which is a colline zone in Lower Austria. The National Park Podyjí was established on the Czech side of the river in 1991 and is nearly 5 times larger than the Austrian part at the southern (right) river side. With a size of 1330 hectares, the National Park Thaya Valley is the smallest of the Austrian national parks, but due to its high biodiversity, it is a conservation area of international importance.

The huge number of plants, animals and habitats results from a special geology and geomorphology of the Thaya Valley. The high biodiversity in the small area of the national park is also due to its location at a climatic border between the harsh, humid climate in the west and the pannonian continental climate from in the east (drier and warmer).

Since the establishment of the National Park Thaya Valley in the year 2000, scientific research boosted in the area (Wurth-Waitzbauer & Übl 2010) and was initially focussed on flora and vegetation (Wrbka et al 2001a, 2001b, 2006a, 2006b, 2010). Considering the huge diversity of evertebrates, only few taxa have been studied on the Austrian riverside, which are so far land snails (Reischütz 2010), crayfish (Wurth-Waitzbauer & Pekny 2010), spiders (Markut et al. 2011, 2012), caddisflies-mayflies-stoneflies (Holovsky 2011), grasshoppers (Sachslehner, in prep.), bugs (Rabitsch 2005), cicadas (Kunz 2010), wild bees (Neumayer 2010) and ants (Harl 2010).

Within the large group of beetles, the carbabid beetles were selected as areliable bio-indicator for terrestrial habitats. The carabids of the forests had been surveyed from Waitzbauer et al. 2010. The aim of the presented study was to add basic inventory data and to analyse carabid communities of different open habitats in terms of conservation biology and zoogeography.

Methods

From April to October 2010, 20 sites were sampled (Table 1) using 3 pitfall traps on each site (plastic cups; 7cm diameter; half-filled with ethylene glycol used as trapping and conservation liquid; sheltered with a transparent plastic foil fixed with long nails). The selected sampling sites were dry grasslands (DG) and meadows (ME) within the area of the Austrian part of the National Park Thaya Valley. They differ concerning geology, vegetation, exposition, slope inclination, management, surrounding vegetation, distance to other open habitats and size. The

Carabids were determined (MÜLLER-MOTZFELD 2004b) and ecological preferences as well as geographical distributions of the species were taken from HURKA 1996, MÜLLER-MOTZFELD 2004a, 2004b, MARGGI 1992 and GAC 2009.

Table 1: Characteristics of the sampling sites. [1]DG: dry grassland; ME: meadows (extensive use); [2]Geologische Bundesanstalt Wien (2004); [3]STEJSKAL 2011; [4]WRBKA et al. 2001a, 2001b

site number	type[1]	field name	geology[2]	slope inclination [°]	exposition	base of topsoil	site code[3]	field code vegetation[4]
1	DG	Schwalbenfelsen	Bitter gneiss	12-24	SW-SSW(-S)	shallow	A3	TV01
2	DG	Fugnitztal Nord	marble	25-33	SSE-S-SSW	shallow	A8	TD09
3	DG	Hadl	marble	18-20	SW	medium	A14	TC02
4	DG	Kreuzmaiß	marble	22-24	SW-WSW	shallow	A14	TC08
5	DG	Reginafelsen	calc-silicate gneiss	21-32	SW(-WSW)	medium	A7	TU04
6	DG	Meixnersteig	calc-silicate gneiss	27-35	SSE	shallow	A7	TU10
7	DG	Burgberg	calc-silicate gneiss	25-30	SSW	very shallow	A44	TU01
8	DG	Einsiedler_TR	marble	0-10	WSW-W	shallow	A17	TF07
9	DG	Ochsengraben	calc-silicate gneiss	20-35	SSE	shallow to medium	A16	TG01
10	DG	Umlaufberg TR	orthogneiss	25-35	SSW	medium	A23	TI06
11	DG	Steinerne Wand	biotite to two-mica granite	18-30	ESE	shallow	A35	TN16
12	ME	Rosenthal	higher fluviatile sediments	±0	right riverbank of Fugnitz (slip-off slope)	deep	A12	WE01
13	ME	Fugnitzsee	water logging, half-bog	±0	former meander of the river Fugnitz	deep	A9	WD10
14	ME	Fugnitzbrache	higher fluviatile sediments	±0	left riverbank of Fugnitz (NO bank)	deep	A11	WD01
15	ME	Fugnitzwiesen	higher fluviatile sediments	±0	right riverbank of Fugnitz (NO bank)	medium	A10	WC11
16	ME	Einsiedlerwiese	higher fluviatile sediments	±0 (3-7)	right riverbank of Thaya (S bank, slip-off slope)	shallow to medium	A18	WF08
17	ME	Untere Bärenmühle	higher fluviatile sediments	±0	right riverbank of Thaya (W bank)	shallow to medium	A19	WF10
18	ME	Große Umlaufwiese	higher fluviatile sediments	±0	right riverbank of Thaya (ONO bank)	medium	A25	WI10
19	ME	Wendlwiese	higher fluviatile sediments	±0	orographisch rechtes Thayaufer (WNW-Ufer, slip-off slope)	deep	A33	WK05
20	ME	Fugnitzsee 2	water logging, half-bog	±0	former meander of the river Fugnitz	deep	A9	WD13

Results

In total, 584 individuals were caught and 66 carabid species were recorded (Table 2). 30 species are new records for the Austrian part of the National Park, where in total 124 carabid species (+1 tiger beetle, Cicindelidae) are known so far (WAITZBAUER et al. 2010, NÁRODNÍ PARK PODYJÍ 2011, MARKUT 2012, MARKUT et al. 2011, 2012). This is approximately one third of the East-Austrian carabid fauna. In Národní Park Podyjí twice as much carabid species have been recorded continually since 1991, namely 243 species (NÁRODNÍ PARK PODYJÍ 2011). Nevertheless, 5 species are new records for the whole international park (*Agonum emarginatum*, *Harpalus luteicornis*, *Olisthopus sturmii*, *Parophonus maculicornis*, *Pterostichus ovoideus*).

Only 10 out of the 66 recorded species occur on both types of open habitats (dry grassland vs. extensive meadows) so the two types are clearly separated from each other (Table 2, Figure 1). 30% of all sampled Carabid species are xerothermic specialists and only few sites show a characteristic xerothermic coenosis (Figure 2). 12 species (=18%) of all sampled species are forest species and occur especially on dry sampling sites.

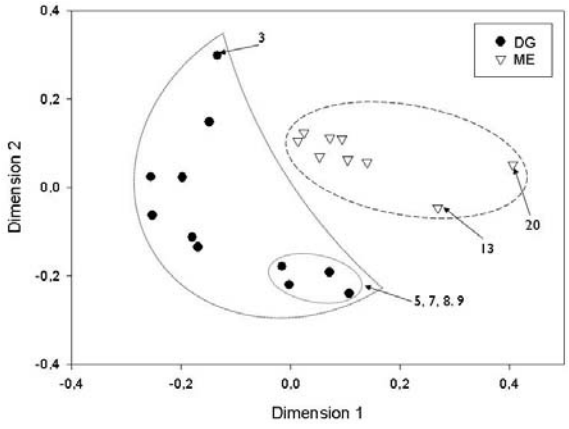

Figure 1: Non-metric multidimensional scaling of dry grassland (DG) and meadow sites (ME) with presence/ absence data. © T. Markut

Table 2: Species list of carabid beetles in open habitats. New records for the Austrian part are marked by bold letters, new records for the whole International Park are marked by *.

species	number of individuals	number of sites	occurs only at DG	occurs only at ME	occurs at DG as well as ME
Abax ovalis (Duftschmid, 1812)	2	1	x		
Abax parallelepipedus (Piller & Mitterpacher, 1783)	11	8			x
Abax parallelus (Duftschmid, 1812)	2	2		*x*	
Agonum emarginatum* (Gyllenhal, 1827)	2	2		*x*	
Agonum viduum (Panzer, 1797)	2	1		*x*	
Amara aenea (Degeer, 1774)	2	2		*x*	
Amara convexior Stephens, 1828	7	4		*x*	
Amara equestris (Duftschmid, 1812)	2	2			x
Amara eurynota (Panzer, 1797)	1	1		*x*	
Amara familiaris (Duftschmid, 1812)	4	4			x
Amara lunicollis Schiödte, 1837	37	6			x
Amara nitida Sturm, 1825	3	1	x		
Amara ovata (Fabricius, 1792)	2	2		*x*	
Amara plebeja (Gyllenhal, 1810)	2	2		*x*	
Amara similata (Gyllenhal, 1810)	2	2		*x*	
Amara tibialis (Paykull, 1798)	2	2		*x*	
Asaphidion flavipes (Linné, 1761)	2	1		*x*	
Badister bullatus (Schrank, 1798)	1	1		*x*	
Bembidion mannerheimii Sahlberg, 1827	5	3		*x*	
Bradycellus caucasicus (Chaudoir, 1846)	1	1		*x*	
Calathus cinctus Motschulsky, 1850	3	1	x		
Calathus fuscipes (Goeze, 1777)	25	3			x
Calathus melanocephalus (Linné, 1758)	14	3		*x*	
Carabus auronitens Fabricius, 1792	2	2		*x*	
Carabus cancellatus Illiger, 1798	2	1		*x*	
Carabus convexus Fabricius, 1775	2	2	x		
Carabus coriaceus Linné, 1758	1	1	x		
Carabus hortensis Linné, 1758	3	3	x		
Carabus intricatus Linné, 1761	6	5	x		
Carabus scheidleri Panzer, 1799	140	7			x
Carabus violaceus Linné, 1758	11	5			x
Dyschirius globosus (Herbst, 1784)	21	4		*x*	
Epaphius secalis (Paykull, 1790)	12	4		*x*	
Harpalus griseus (Panzer, 1796)	1	1		*x*	
Harpalus luteicornis* (Duftschmid, 1812)	2	2		*x*	
Harpalus pumilus Sturm, 1818	6	1	x		
Harpalus rubripes (Duftschmid, 1812)	8	5			x
Harpalus rufipalpis Sturm, 1818	5	2	x		
Harpalus rufipes (De Geer, 1774)	13	5		*x*	
Harpalus signaticornis (Duftschmid, 1812)	2	2	x		
Harpalus tardus (Panzer, 1796)	18	4	x		
Leistus ferrugineus Linné, 1758	2	2		*x*	
Microlestes minutulus (Goeze, 1777)	2	2		*x*	
Molops elatus (Fabricius, 1801)	13	3	x		
Nebria brevicollis (Fabricius, 1792)	1	1		*x*	
Notiophilus rufipes Curtis, 1829	2	2	x		
Olisthopus sturmii* (Duftschmid, 1812)	3	2			x
Ophonus azureus (Fabricius, 1775)	1	1	x		
Ophonus laticollis Mannerheim, 1825	1	1		*x*	
Oxypselaphus obscurus (Herbst, 1784)	2	1		*x*	
Panagaeus bipustulatus (Fabricius, 1775)	2	1		*x*	
Parophonus maculicornis* (Duftschmid, 1812)	1	1		*x*	
Patrobus atrorufus (Stroem, 1768)	2	1		*x*	
Philorhizus crucifer (Lucas, 1846)	1	1		*x*	
Poecilus cupreus (Linné, 1758)	52	9			x
Poecilus lepidus (Leske, 1785)	2	2		*x*	
Pterostichus melanarius (Illiger, 1798)	45	6		*x*	
Pterostichus niger (Schaller, 1783)	27	4		*x*	
Pterostichus ovoideus* (Sturm, 1824)	4	3		*x*	
Pterostichus strenuus (Panzer, 1796)	5	2		*x*	
Pterostichus vernalis (Panzer, 1796)	2	2		*x*	
Syntomus foveatus (Geoffroy, 1785)	3	2	x		
Syntomus pallipes (Dejean, 1825)	4	2	x		
Syntomus truncatellus (Linné, 1761)	7	3		*x*	
Synuchus vivalis (Illiger, 1798)	10	5		*x*	
Tachyta nana (Gyllenhal, 1810)	1	1	x		

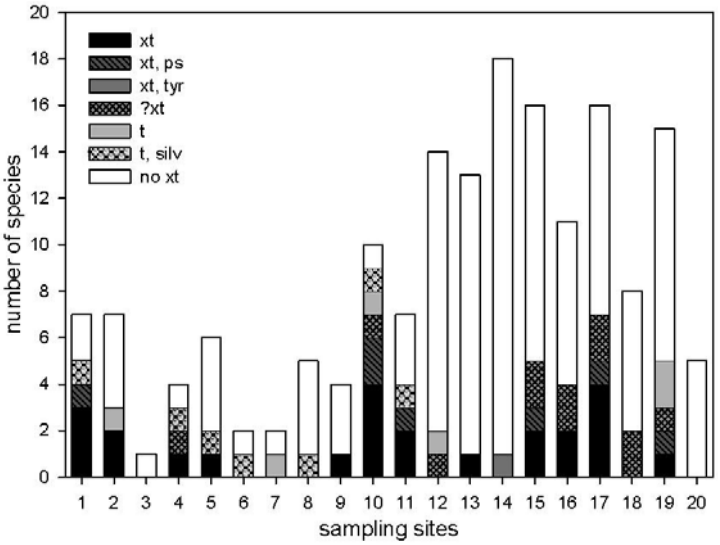

Figure 2: Xero-thermophilous preferences (after MÜLLER-MOTZFELD 2004a). t....thermophilous; xt....xero-thermophilous; ps....psammophilous; silv....silvicolous; tyr....tyrphophilous; ?....preference not sure; no tx...no xero-thermophilous preference. © T. Markut

Discussion and Conclusion

Dry grasslands, semi-natural grasslands and extensive meadows are habitats of high conservation value. In Austria the loss of dry grasslands and rock-steppes is very high (GEPP 1984) and in Europe the extent and connectivity of extensive grassland dramatically decreases (ex. g. DE VRIES et al. 2002, TSCHARNTKE et al. 2002, MAGURA & KÖDÖBÖCZ 2007). Such open biotopes of high conservation value are not substitutable with other open habitats like agricultural areas, because the composition of carabid communities differ greatly although absolute species numbers are may be equal (ex. g. TABOADA et al. 2011, TSCHARNTKE et al. 2002, SIEREN & FISCHER 2002). In consequence of habitat loss many threatened species are xerothermic species.

In the National Park Thaya Valley some rare species with additionally limited geographical distribution and mostly thermophilous preferences were recorded (ex. *Olisthopus sturmii*, *Harpalus signaticornis*, *H. pumilus*, *Amara equestris*, *A. tibialis*, *Calathus cinctus*) and some sampling sites show typical dry grassland species composition (site 1, 10). High species numbers reach the meadows near the river Thaya because of the interesting coincidence of thermophilous species and hygrophilous species at the same site (site 15, 17). Concerning environmental management of carabid beetles TABOADA et al. 2011 recommend to prioritise evaluation of assemblage composition over simple species richness, to consider a diverse set of grassland patches with variable spatial arrangements and to encourage appropriate traditional extensive farming (see also IRMLER & HOERNES 2003, GUTIÉRREZ et al. 2004, BATÁRY et al. 2007).

Ensuring habitat heterogeneity for stenotopic species, the habitat must be minimum-sized (ex. g. MAGURA & KÖDÖBÖCZ 2007, DE VRIES & DE BOER 1990). The minimum size for carabid beetles depends on geographical location, structure and the age of the fragments. Many small scaled and few larger-scaled open habitats in the Thaya valley theoretically meet the optimal requirements for durable occurrence of specialised species (TSCHARNKE et al. 2002) although the habitats are extremely small scaled in the National Park. Temporal variation of carabid species compositions, degree of fragmentation and connectivity of open habitats within the International Park as well as the surrounding landscape in Austria and Czech Republic are open questions. Research on connectivity or disjunction of fragmented habitats is of peculiar scientific interest, not only for a better understanding of the occurrence or absence of carabid species but also for distribution of other arthropods or even vertebrates.

References

BATÁRY, P., BÁLDI, A., GYŐZŐ, S., PODLUSSÁNY, A., ROZNER, I. & S. ERDŐS 2007. Responses of grassland specialist and generalist beetles to management and landscape complexity. Diversity and Distributions 13: 196-202.

DE VRIES, H.H. & P.J. DEN BOER 1990. Survival of populations of Agonum ericeti in relation to fragmentation of habitats. Netherland Journal of Zoology 40: 484-498

DE VRIES, M.F., POSCHLOD, P. & J.H. WILLEMS 2002. Challenges for the conservation of calcareous grasslands in northwestern Europe: integrating the requirements of flora and fauna. Biological Conservation 104: 265-273.

GAC – Gesellschaft für Angewandte Carabidologie e.V. 2009. Lebensraumpräferenzen der Laufkäfer Deutschlands - Wissensbasierter Katalog. Angewandte Carabidologie: Supplement V. 45pp.

GEPP, J. 1984. Rote Listen gefährdeter Tiere Österreichs. Grüne Reihe des Bundesministeriums für Gesundheit und Umweltschutz. 243pp.

Geologische Bundesanstalt Wien (eds.) 2004. Geologische Karte der Nationalparks Thayatal und Podyjí.

GUTIÉRREZ, D., MENÉNDEZ, R. & M. MÉNDEZ 2004. Habitat-based conservation priorities for carabid beetles within the Picos de Europa National Park, northern Spain. Biological Conservation 115: 379-393.

HARL, J. 2010. Untersuchungen zur Ameisenfauna (Hymenoptera, Formicidae) des Nationalparks Thayatal. Wissenschaftliche Mitteilungen aus dem Niederösterreichischen Landesmuseum 21: 345-360.

HOLOVSKY, E. 2011. Phänologie und Abundanzen der EPT-Taxa (Insecta: Ephemeroptera, Plecoptera, Trichoptera) im Kajabach (Nationalpark Thayatal, Niederösterreich). Master Thesis, University of Vienna.

HURKA, K. 1996. Carabidae of the Czech and Slovak Republics. Kavourek, Zlin.

IRMLER, U. & U. HOERNES 2003. Assignment and evaluation of ground beetle (Coleoptera: Carabidae) assemblages to sites on different scales in a grassland landscape. Biodiversity and Conseravation 12: 1405-1419

KUNZ, G. 2010. Erste Zikadenerhebungen im Nationalpark Thayatal. Wiss. Wissenschaftliche Mitteilungen aus dem Niederösterreichischen Landesmuseum 21: 283-302.

MAGURA, T. & V. KÖDÖBÖCZ 2007. Carabid assamblages in fragmented sandy grasslands. Agriculture, Ecosystems and Environment 119: 396-400.

MARGGI, W.A. 1992 Faunistik der Sandlaufkäfer und der Laufkäfer der Schweiz (Cicindelidae & Carabidae) Coleoptera. Teil 1, Documenta Faunistica Helvetiae Bd13.

MARKUT, T., MILASOWSZKY, N. & M. HEPNER 2011. Laufkäfer und Spinnen auf Trockenrasen und Wiesen im Nationalpark Thayatal. Unpunlished final report to the National Park Thayatal. 137pp. Vienna.

MARKUT, T. 2012 Der Umlaufberg im Thayatal - ein Berg voller Leben. Abhandlungen Zool.-Bot. Ges. Österreich 38: 169–213.

MARKUT, T., MILASOWSZKY, N. & M. HEPNER 2012. Spinnen (Araneae) und Laufkäfer (Coleoptera, Carabidae) ausgewählter Offenlandflächen im Nationalpark Thayatal – vorläufige Ergebnisse. Thayensia (Znojmo) 9: 105-114.

MÜLLER-MOTZFELD, G. 2004a. Xerotherme Laufkäfer in Deutschland – Verbreitung und Gefährdung. Angewandt Carabidologie Supplement III: 27-44.

MÜLLER-MOTZFELD, G. (eds.) 2004b. Die Käfer Mitteleuropas. Volume 2, Adephaga 1, Carabidae (Laufkäfer). Elsevier, München.

NEUMAYER, J. 2010. Aculeate Hymenopteren (ohne Ameisen) des Nationalparks Thayatal. – Wissenschaftliche Mitteilungen des Niederösterreichischen Landesmuseum 21: 325-344.

Národní park Podyjí 2011. Pers. Comm. to Stejskal R. / Národní Park Podyjí (1.3.2011)

RABITSCH, W. 2005. Die Wanzenfauna im Nationalpark Thayatal. Beiträge zur Entomofaunistik 6: 87-106.

REISCHÜTZ, A. 2010. Ersterhebung der Landschneckendiversität des Nationalparks Thayatal. Wissenschaftliche Mitteilungen des Niederösterreichischen Landesmuseum 21: 265-281.

SIEREN, E. & F.P. FISCHER 2002. Evaluation of measures for enlargement, renaturation and development of a dry grassland biotope by analysing differences in the carabid fauna (Coleoptera). Acta Oecologica 23: 1-12.

STEJSKAL, R. 2011. Biological records localization map of the Podyjí/Thayatal National Parks. Thayensia 8: 315-322. Znojmo ISSN 1212-3560.

TABOADA, A., KOTZE, J., SALGADO, J. M. & R. TARREGA 2011. The value of semi-natural grasslands for the conservation of carabid beetles in long-term managed forested landscapes. J. insect Conserv 15: 573-590.

TSCHARNKE, T., STEFFAN-DEWENTER, I., KRUESS, A. & C. THIES 2002. Contribution of small habitat fragments to conservation of insect communities of grassland-cropland landscapes. cological Applications 12: 354-363.

WAITZBAUER, W. 2006. Biodiversitätsforschung im Nationalpark Thayatal – Teilbereich Faunistik (ausgewählte Evertebraten). In: Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (Hrsg.): Forschung im Nationalpark 2005/2006. pp. 84-86.

WAITZBAUER, W., VIDIC, A. & W. PRUNNER 2010. Bestandesaufnahme der Laufkäferfauna in den Waldgesellschaften des Nationalparks Thayatal (Niederösterreich). Wissenschaftliche Mitteilungen aus dem Niederösterreichischen Landesmuseum 21: 303-324.

WRBKA, T., THURNER, B. & I. SCHMITZBERGER 2001a. Vegetationskundliche Untersuchung der Trockenstandorte im Nationalpark Thayatal. CVL-Reports. Vienna, University of Vienna, Department of Conservation, Vegetation- and Landscape Ecology. 144 pp.

WRBKA, T., THURNER, B. & I. SCHMITZBERGER 2001b. Vegetationskundliche Untersuchung der Wiesen und Wiesenbrachen im Nationalpark Thayatal. CVL-Reports. Vienna, University of Vienna, Department of Conservation, Vegetation- and Landscape Ecology. 156 pp.

WRBKA, T. 2006a. Biodiversitätsforschung im Nationalpark Thayatal – Teilbereich Waldvegetation. In: Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (eds.): Forschung im Nationalpark 2005/2006. pp. 82-84.

WRBKA, T., ZMELIK, K., DURCHHALTER, M., WILLNER, W., RENETZEDER, C., KROMMER, V., MARCHSTEINER, L. & A. STOCKER-KISS 2006b. Biodiversitätsforschung im Nationalpark Thayatal Teilbereich Waldvegetation. Endbericht im Auftrag der Nationalpark Thayatal GmbH. CVL-Reports. Vienna, University of Vienna, Department of Conservation, Vegetation- and Landscape Ecology. 132 pp.

WRBKA, T., ZMELIK, K., SCHMITZBERGER, I. & B. THURNER 2010. Die Vegetation der Wälder, Wiesen und Trockenrasen des Nationalparks Thayatal – ein erster Überblick. Wissenschaftliche Mitteilungen aus dem Niederösterreichischen Landesmuseum 21: 67-134.

WURTH-WAITZBAUER, C. & R. PEKNY 2010. Populationsökologische Untersuchung des Edelkrebsbestandes (*Astacus astacus*) im Nationalpark Thayatal. Wissenschaftliche Mitteilungen aus dem Niederösterreichischen Landesmuseum 21: 19-34.

WURTH-WAITZBAUER, C. & C. ÜBL 2010. 10 Jahre wissenschaftliche Forschung im Nationalpark Thayatal. – Wissenschaftliche Mitteilungen aus dem Niederösterreichischen Landesmuseum 21: 19-34.

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