Dalechampii oak (*Quercus dalechampii* Ten.), an important host plant for folivorous lepidoptera larvae

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Abstract

*Dalechampii oak (*Quercus dalechampii *Ten.), an important host plant for folivorous lepidoptera larvae.*— We conducted a structured analysis of lepidoptera larvae taxocenoses living in leaf bearing crowns of Dalechampii oak (*Quercus dalechampii* Ten.) in nine study plots in the Malé Karpaty Mountains (Central Europe). The differences between lepidoptera taxocenoses in individual oak stands were analyzed. A total of 96 species and 2,140 individuals were found. Species abundance peaked in May, while number of species and species diversity reached the highest values from April to May and from April to June, respectively. Abundance showed two notable peaks in flush feeders and in late summer feeders. Lepidoptera taxocenosis in the study plot Horný háj (isolated forest, high density of ants) differed significantly from all other taxocenoses according to Sörensen's index of species similarity, species diversity, analysis of similarity on the basis of permutation and pairwise tests (ANOSIM), seasonal variability of species composition, and NMDS ordination.

Key words: Moths, Caterpillars, *Q. dalechampii*, Malé Karpaty Mountains, SW Slovakia.

Resumen

*El roble de dalechampii (*Quercus dalechampii *Ten.), una importante planta hospedadora de las larvas de lepidópteros filófagos.*— Llevamos a cabo un análisis estructurado de las taxocenosis de larvas de lepidópteros que viven en las copas del roble de dalechampii (Quercus dalechampii Ten.) en nueve parcelas del estudio en los Pequeños Cárpatos (Europa central). Se analizaron las diferencias entre las taxocenosis de lepidópteros de cada roble. Se hallaron 96 especies y 2.140 individuos. La abundancia de especies alcanzó su valor más elevado en mayo, mientras que el número y la diversidad de especies fueron máximos desde abril hasta mayo y desde abril hasta junio, respectivamente. La abundancia mostró dos máximos notables en las larvas que se alimentan durante la brotación y las que se alimentan al final del verano. La taxocenosis de los lepidópteros en la parcela del estudio Horný háj (un bosque aislado con una elevada densidad de hormigas) difirió significativamente de las demás taxocenosis según el índice de Sörensen para la similitud de las especies, la diversidad de las especies, el análisis de la similitud sobre la base de las pruebas de permutación y las pruebas de pares (ANOSIM), la variabilidad estacional de la composición de especies y el escalamiento multidimensional no métrico (NMDS por sus siglas en inglés).

Palabras clave: Polillas, Orugas, *Q. dalechampii*, Pequeños Cárpatos, Eslovaquia sudoccidental.

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Introduction

Oaks belong to the woody plants that host the richest insect assemblages in Central Europe (Patočka et al., 1999). Lepidoptera larvae have been shown to be the most important group of oak defoliators (Patočka et al., 1962, 1999). About 250 lepidoptera species are known to damage the assimilation tissue of oaks in Central Europe (Patočka et al., 1999; Reiprich, 2001).

Lepidoptera fauna on some oak species in Central Europe have been relatively well studied (Patočka et al., 1962, 1999; Csóka, 1990–1991, 1998a, 1998b; Kulfan, 1990, 1997; Kulfan, 1992; Kulfan et al., 1997, 2006; Kulfan & Degma, 1999; Turčáni et al., 2009, 2010; Parák et al., 2012, etc.). Taxocenoses of lepidoptera caterpillars on three oak species from Slovakia and the Czech Republic (*Quercus robur*, *Q. petraea* and *Q. cerris*) have been used to explain why there are so many species of herbivorous insects in tropical rainforests (Novotny et al., 2006).

However, the lepidoptera fauna related to *Q. dalechampii* growths has been poorly explored in Europe. A total of nine lepidoptera miner species from families Nepticulidae, Tischeriidae and Gracillariidae have been recorded on *Q. dalechampii* in southern Slovakia (Arboretum Čifáre) (Skuhravý et al., 1998). Kollár (2007) mentions the species *Phyllonorycter roboris* (lepidoptera miner) as a pest of *Q. dalechampii* in Slovakia. Stolnicu (2007) studied lepidoptera leaf–miners on *Q. dalechampii* in Romania. Kulfan (2012) partially studied economically most important pest species on *Q. dalechampii* in Central Europe.

Dalechampii oak (*Quercus dalechampii* Ten.) is one of the most common oaks in Europe and is naturally distributed in Western Italy, Sicily, Greece, Albania, Montenegro, Macedonia, Bosnia & Herzegovenia, Serbia, Slovenia, Austria, Hungary, Slovakia, Romania, and Bulgaria.

The main aims of the present study were: (i) to analyze the structure taxocenoses, alpha diversity and representation of trophic groups and seasonal guilds of lepidoptera en bloc on Dalechampii oak; (ii) to complete data concerning biodiversity of lepidoptera species feeding on oaks in Central Europe; and (iii) to highlight the differences among the individual study plots representing various types of oak forests, with emphasis on fragmentation, forest age and crown canopy.

Material and methods

Material was collected by the beating method into a tray of 1 m diameter (one quantitative sample = beating from 25 branches) on nine selected plots at regular 2–weekly intervals from April to October 2000–2002. Samples were taken from branches at a height of about 1–2.5 m above ground with varying exposure to cardinal points. Larvae were identified using the keys by Gerasimov (1952), Patočka (1954, 1980) and Patočka et al. (1999). Seasonal guilds of lepidoptera caterpillars were established according to Turčáni et al. (2009).

The complete linkage clustering in combination with Sörensen's index and Wishart's similarity ratio was used to classify the taxocenoses. Visualization of dendrograms was done by computer program Syn–tax, Version 5.0 (Podani, 1993). Diversity of taxocenoses was characterised using Pielou's index of equitability, Shannon–Wiener's index of total species diversity, and Simpson's index of dominance (Poole, 1974; Ludwig & Reynolds, 1988). Shannon–Wiener diversity indices were compared using the *t*–test (Poole, 1974). Ordination was carried out with non–metric multidimensional scaling (NMDS) using the Bray–Curtis dissimilarity coefficient. One–way analysis of similarities (ANOSIM) was used to identify difference in species variability of the lepidoptera taxocenosis in the study plots during the year. Hierarchical (nested) ANOVA was used to examine spatial (locality) and temporal (sampling months) variation in the distribution of the total abundance, number of species, taxa and species diversity of lepidoptera. The model contained factors (terms) representing the effects of locality and sampling date nested in locality. Multiple sample comparisons were used to identify significant differences in the number of individuals, number of species and species diversity between localities and sampling months. The hypothesis that occurrences of three types of feeding specialization are randomly distributed throughout the vegetation season was tested according to Poole & Rathcke (1979). Differences of means and dispersion of species numbers in feedings groups were analyzed by Tukey's pairwise comparison and Levene's test in ANOVA, respectively. Analyses of variance and Tukey's pairwise comparison were used to identify differences between the number of species and the number of individuals in seasonal gilds. The nomenclature and systematic classification of the lepidoptera species were used according to Laštůvka & Liška (2011). The trophic groups of lepidoptera larvae were established according to Brown & Hyman (1986). The map (fig. 1) and pedological and phytocoenological characteristics of the investigated area are given in detail by Zlinská et al. (2005).

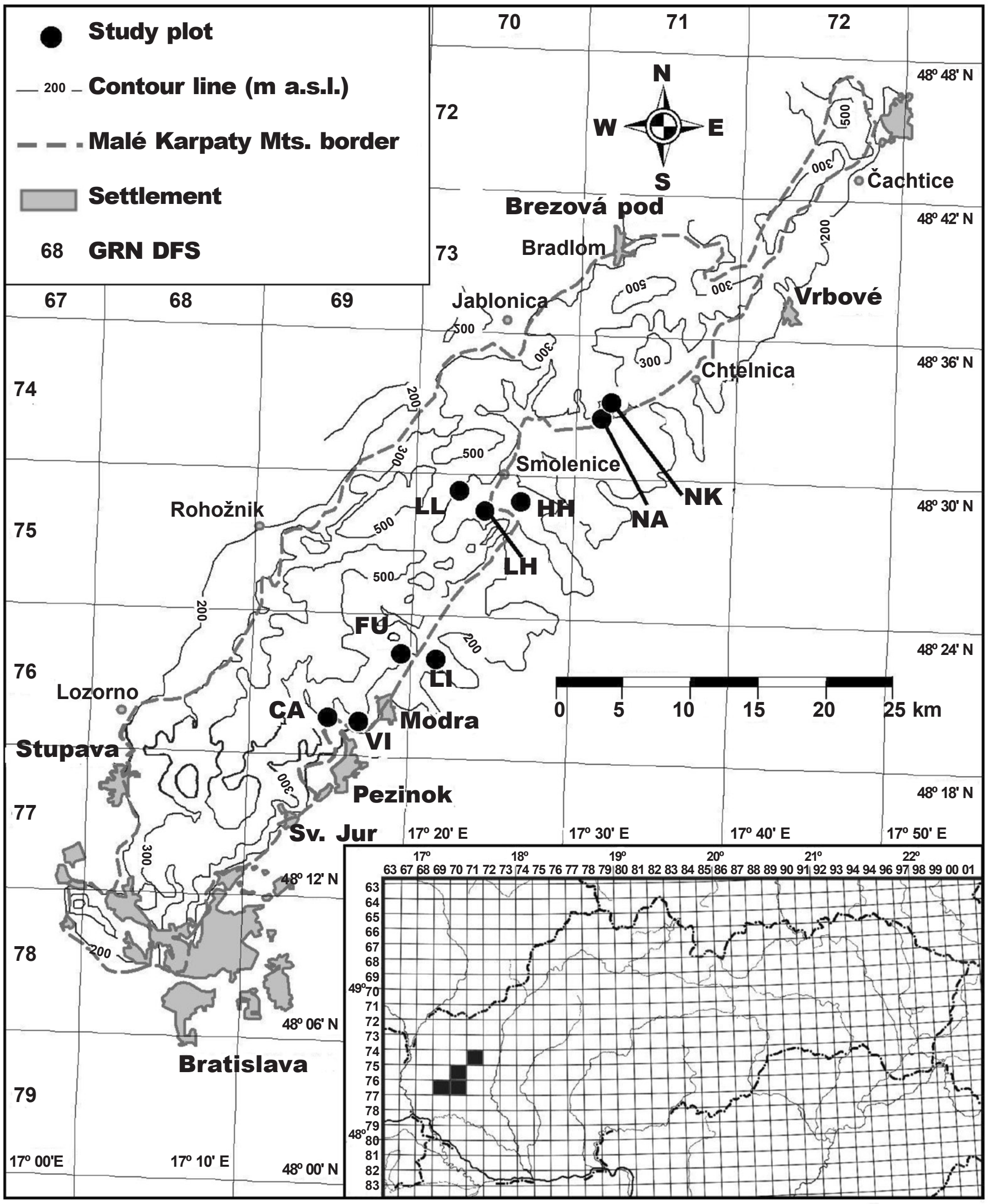
Voucher specimens (in ethanol) are deposited at the Faculty of Natural Sciences, Comenius University, Bratislava, Slovakia.

Study area

The lepidoptera larval stages on *Quercus dalechampii* were studied in the territories of the Protected Landscape Area of Malé Karpaty and Trnavská pahorkatina hills situated in the centre of Europe in the western part of Slovakia.The vast majority of the plots are located in the southern to northern part of the Malé Karpaty Mountains (Mts.) at altitudes of 240–350 m a.s.l. and an average annual temperature of 8–9°C. Study plots in Trnavská pahorkatina hilly land are situated near the Malé Karpaty Mts. at an altitude of 240 m. The annual precipitation in both territories is about 650–800 mm.

Study plots (abbreviation of study plot in parentheses used in the text):

Vinosady (VI), 48º 19' N, 17° 17' E, 280 m a.s.l.: a 60–80–year–old forest at the foot of the Kamenica



GRN DFS: Grid references number of the Databank of Slovak fauna

Map design:
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Fig. 1. Study area with location of the study plots.

Fig. 1. Área del estudio con la ubicación de las parcelas del estudio.

hill, NW and W oriented, with drier subxerophilous meadows and shrub complexes. Besides *Quercus dalechampii*, the tree stratum consists of *Q. cerris* and *Acer campestre*.

Cajla (CA), 48º 20' N, 17° 16' E, 260–280 m a.s.l.: an 80–100–year–old forest at the foot of the Malá cajlanská homola hill, S oriented and neighbouring meadows and vineyards on S and E, from N and W closed forest complexes. *Quercus dalechampii* and *Carpinus betulus* predominate in the tree layer.

Fúgelka (FU), 48º 22' N, 17° 19' E, 350 m a.s.l.: an 80–100–year–old forest near the Dubová village, S oriented. Besides *Quercus dalechampii*, the tree stratum consists of *Acer pseudoplatanus*.

Lindava (LI) (Nature Reserve), 48º 22' N, 17° 22' E, 240 m a.s.l.: an 80–100 (120)–year–old forest near the village of Píla. *Quercus dalechampii* and *Q. cerris* predominate in the tree layer.

Horný háj (HH), 48º 29' N, 17° 27' E, 240 m a.s.l.: a larger complex of an island forest 60–80–years old near the village of Horné Orešany, surrounded by fields and vineyards, W and SW oriented. *Quercus cerris, Q. dalechampii, Carpinus betulus* and *Fraxinus excelsior* predominate in the tree layer.

Lošonec–lom quarry (LL), 48º 29' N, 17º 23' E, 340 m a. s. l.: an 80–100–year–old forest SW oriented, neighbouring with mesophilous meadows and pastures. The tree layer consists of *Quercus dalechampii, Q. cerris* and *Carpinus betulus*. The leaf litter, herbage undergrowth and trees are strongly covered with calcareous dust from a nearby quarry.

Lošonský háj (LH) (Nature Reserve), 48º 28' N, 17º 24' E, 260 m a.s.l.: an 80–100–year–old oak–hornbeam forest NE oriented, surrounded by closed forest complexes. *Quercus dalechampii*, *Q. cerris* and *Carpinus betulus* predominate in the tree stratum.

Naháč–Kukovačník (NA), 48º 32' N, 17º 31' E, 300 m a.s.l.: a small forest island, approximately 40–60–year–old surrounded by fields and pastures, NE oriented. *Quercus dalechampii, Q. cerris* and *Carpinus betulus* predominate in the tree layer.

Naháč–Katarínka (NK) (Nature Reserve), 48° 33' N, 17º 33' E, 340 m a.s.l.: a 40–60–year–old forest NW oriented, surrounded by closed forest ecosystems. *Quercus dalechampii* and *Carpinus betulus* predominate in the canopy.

Only abbreviations of the study plots are used in the following text.

The study plots LI and HH are situated in Trnavská pahorkatina hills and the others are in the Malé Karpaty Mts.

Results

From 2000–2002, a total of 2,140 Lepidoptera larvae were collected in nine study plots with *Quercus dalechampii*. They represented 96 species from 17 families (appendix 1). The families Geometridae, Noctuidae and Tortricidae encompassed the highest number of species found (27, 23, and 13, respectively) (appendix 1). The lowest number of species (18 species) were found in HH (appendix 1). Six species (*Coleophora siccifolia*, *Lomographa temerata*, *Peribatodes rhomboidaria*, *Acronicta auricoma*, *Orthosia opima* and *Amata phegea*) were found on oaks for the first time in Slovakia (cf. Hrubý, 1964; Patočka et al., 1999). *A. phegea* is one of six species presenting first records of lepidoptera larvae feeding on oaks. This species probably entered the oak crown from the surrounding low vegetation because it has not been found previously on trees according to the literature (Reiprich, 2001).

The most abundant families were Geometridae and Noctuidae (appendix 1, table 1). The families Tortricidae and Erebidae achieved relatively high dominance, mainly due to the species *Aleimma loeflingiana* (Tortricidae) and *Lymantria dispar* (Erebidae) (appendix 1, table 1). Species with dominance higher than 10% were *Lymantria dispar* in HH, *Operophtera brumata* in CA (calamitous oak pests), *Cosmia trapezina* in LI, *Aleimma loeflingiana* in FU (an important pest of oaks) and *Cyclophora linearia* in HH (cf. Patočka et al., 1999; appendix 1).

Table 1. Family dominance (%) of lepidoptera larvae on *Quercus dalechampii* in the Malé Karpaty Mountains in 2000–2002 (based on total number of individuals).

Tabla 1. Dominancia por familia (%) de las larvas de lepidópteros que se encontraron en Quercus dalechampii *en los Pequeños Cárpatos entre los años 2000 y 2002 (con respecto al número total de individuos).*

Family / year	2000	2001	2002	Total
Psychidae	0.00	0.17	0.00	0.05
Bucculatricidae	0.00	0.00	0.43	0.19
Gracillariidae	0.17	0.00	0.00	0.05
Ypsolophidae	2.48	2.15	1.29	1.87
Chimabachidae	2.74	1.49	1.12	1.73
Peleopodidae	8.85	1.65	1.25	3.46
Coleophoridae	8.77	3.63	4.09	5.28
Gelechiidae	0.17	0.83	0.22	0.37
Tortricidae	6.79	19.64	9.68	11.68
Lycaenidae	0.33	0.33	0.43	0.37
Pyralidae	1.82	0.50	1.29	1.21
Drepanidae	0.33	0.33	0.11	0.23
Geometridae	32.62	39.11	42.58	38.79
Notodontidae	5.46	0.17	0.22	1.68
Erebidae	7.95	5.94	9.04	7.85
Nolidae	3.48	1.98	1.72	2.29
Noctuidae	18.05	22.11	26.56	22.90
No individuals	604	606	930	2,140

The species *Lymantria dispar*, *Cyclophora linearia*, *Pseudoips prasinana* and *Carcina quercana* reached the highest dominance on the species poorest study plot HH when compared with other plots (appendix 1).

Characteristic species of the plot LL covered with calcareous dust are as follows: *Tortrix viridana*, *Conobathra tumidana*, *Aleimma loeflingiana*, *Agriopis leucophaearia* and *Alsophila aceraria*. Three lepidoptera species, *Archips podana*, *Eudemis profundana* and *Apocheima hispidaria* (appendix 1), were found only in this plot but abundance was low.

Lepidoptera species *Agriopis marginaria*, *Cosmia trapezina*, *Orthosia cruda* and *Lymantria dispar* (appendix 1) were typical of the lighter, sparser and younger oak stands (study plots NK, LI, CA, VI).

The vast majority of Lepidoptera belonged to the monovoltine species with main occurrence in spring. Further oligophagous species (*Cyclophora linearia* and *Ennomos erosaria*) and polyphagous species (*Parectropis similaria* and *Colocasia coryli*) belonged to the bivoltine species. *Watsonalla binaria* proved to be trivoltine species (appendix 1).

Most species found belonged to the trophic group of generalists (64 species). Narrow oligophages (18 species) feeding on oaks are considered to be typical oak species. Only six species belonged to wider oligophages.

The value of Shannon–Wiener´s diversity index of the richest lepidoptera taxocenosis (NK, $H' = 3.428$) and the poorest taxocenosis (HH, $H' = 2.505$) was statistically significantly different from other taxocenoses (T–test, $P < 0.05$) (table 2). A detailed algorithm is given by Poole (1974). The richest taxocenosis NK includes 462 individuals representing 52 species; of these, seven species dominate at least 5%. The poorest taxocenosis HH includes only 44 individuals belonging to 18 species; 4 of these species dominate over 5% (appendix 1).

Poor qualitative–quantitative taxocenosis of lepidoptera larvae on island forest HH is also expressed by Simpson's index of dominance ($c = 0.126$) where dominance is concentrated in a small number of species (appendix 1). In other taxocenoses, dominance is spread to more co–dominant species (Simpson's index of dominance values from 0.044 to 0.086). The value of equitability was highest at FU, NK and NA (table 2).

A dendrogram based on the qualitative representation (Sörensen's index, complete linkage) separated the lepidoptera taxocenosis on the study plot HH (isolated forest, high density of ants, the lowest diversity of species) (fig. 2). Based on a qualitative–quantitative similarity (Wishart's similarity ratio, complete linkage), the hierarchical classification divided the lepidoptera taxocenoses into two clusters connected on the relatively low level of similarity (fig. 3). The first cluster consisted of the taxocenoses HH and NA (island forests) with the lowest figures for abundance and individuals (44 and 133, respectively). The second cluster had two subclusters and included other taxocenoses. The first subcluster contained the taxocenoses from the denser and older plots (LL. Study plot affected by calcium dust deposition and with higher canopy cover of shrub story; LH. Lot with higher canopy cover of wood species crowns; and FU. Plot with higher canopy cover of both shrub story and wood species crowns). The second subcluster may be formed from the taxocenoses on lighter and younger plots (NK, LI, CA and VI)

The NMDS showed plot HH was set apart from all the other study plots (fig. 4). The study plot NA was also separated (although less marked so) as confirmed by Wishart's index.

Table 2. Species diversity test and basic characteristics of caterpillar taxocenoses at study plots in 2000–2002: *H'*. Shannon's index of species diversity; *e*. Pielou's index of equitability; *c*. Simpson's index of dominance. (*T*–test values of *H'* are under the diagonal and degrees of freedom are above it; the testing process is detailed in Materials and methods; significance levels: *** $P < 0.001$; ** $0.001 < P < 0.01$; * = $0.01 < P < 0.05$; ns = $0.05 < P$ (non–significant); for abbreviations of the study plots see Material and methods).

Tabla 2. Prueba de la diversidad de especies y características básicas de las taxocenosis de orugas en las parcelas del estudio entre los años 2000 y 2002. H'. *Índice de Shannon para la diversidad de especies;* e. *Índice de Pielou para la equidad;* c. *Índice de Simpson para la dominancia. (Los valores de* H' *de la prueba* t *se encuentran debajo de la diagonal y los grados de libertad, encima; el proceso de la prueba se detalla en el apartado Material and methods; niveles de significación: **** P < 0,001; ** 0,001 < P < 0,01; * = 0,01 < P < 0,05; ns = 0,05 < P *(no significativo); para consultar las abreviaturas de las parcelas del estudio, ver Material and methods).*

		VI	CA	FU	LI	HH	LL	LH	NA	NK
	e	0.851	0.801	0.872	0.809	0.867	0.838	0.849	0.867	0.868
	c	0.066	0.086	0.063	0.063	0.126	0.067	0.063	0.066	0.044
	H'	3.097	3.065	3.101	3.212	2.505	3.091	3.194	3.197	3.428
VI	3.1	0	541.083	349.481	636.538	55.534	445.853	356.73	228.02	670.81
CA	3.07	0.343ns	0	421.247	582.174	65.467	495.143	431.18	294.16	477.82
FU	3.1	0.048ns	0.346ns	0	396.331	64.992	372.919	350.76	265.84	289.7
LI	3.21	1.356ns	1.495ns	1.127ns	0	59.702	491.438	402.8	259.76	603.69
HH	2.51	3.549***	3.218**	3.429**	4.162***	0	63.662	68.671	78.673	51.015
LL	3.09	0.071ns	0.246ns	0.106ns	1.263ns	3.387**	0	386.06	272.78	381.14
LH	3.19	0.99ns	1.174ns	0.842ns	0.182ns	3.901***	0.957ns	0	284.73	299.12
NA	3.2	0.908ns	1.092ns	0.792ns	0.131ns	3.764***	0.894ns	0.029ns	0	192.36
NK	3.43	4.681***	4.198***	3.784***	2.773**	5.653**	4.013***	2.567**	2.201*	0

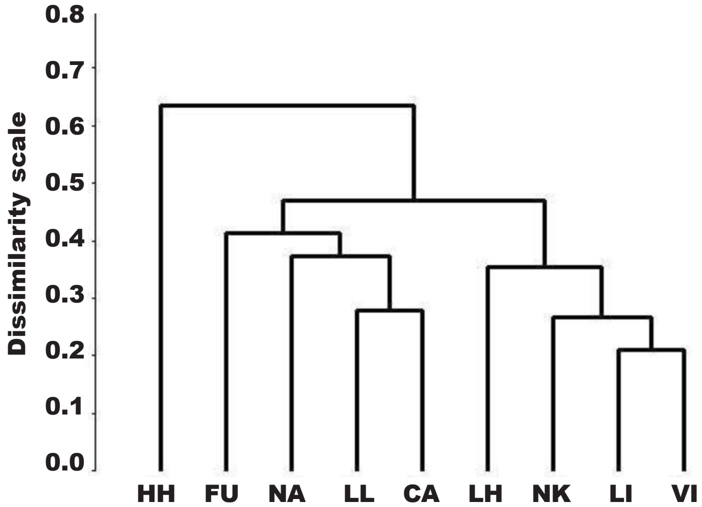

Fig. 2. Classification of lepidoptera taxocenoses on individual study plots according to species presence/absence (Sörensen's index).

Fig. 2. Clasificación de las taxocenosis de lepidópteros en cada una de las parcelas del estudio en función de la presencia o ausencia de las especies (índice de Sörensen).

Table 3 shows the overall result of the permutation test and pairwise ANOSIMs between all pairs of groups (provided as post–hoc test). Significant comparisons (at $P < 0.05$) are shown in bold.

Analysis of similarity based on seasonal variability of species composition distinguished two significant different lepidoptera taxocenoses. The lepidoptera taxocenosis of the HH had significantly lower abundance and number of species than the taxocenoses of the other eight study plots (table 4).

Generally, lepidoptera larvae were weakly represented in HH because of the occurrence of numerous

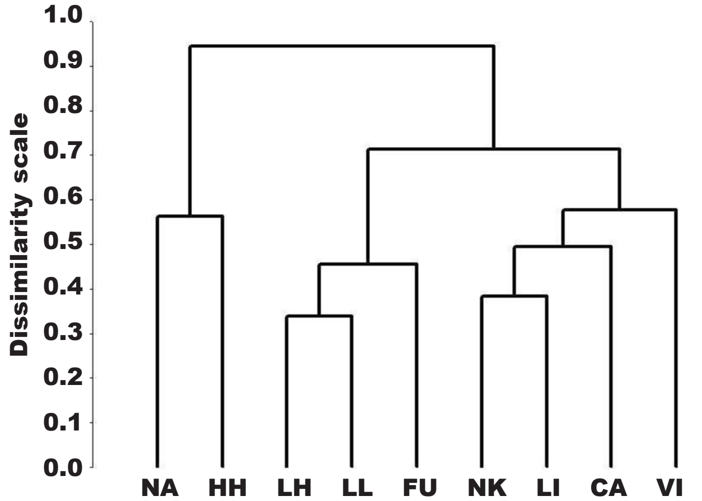

Fig. 3. Classification of lepidoptera taxocenoses on individual plots according to qualitative–quantitative similarity (Wishart's index).

Fig. 3. Clasificación de las taxocenosis de lepidópteros en cada una de las parcelas del estudio en función de la similitud cualitativa y cuantitativa (índice de Wishart).

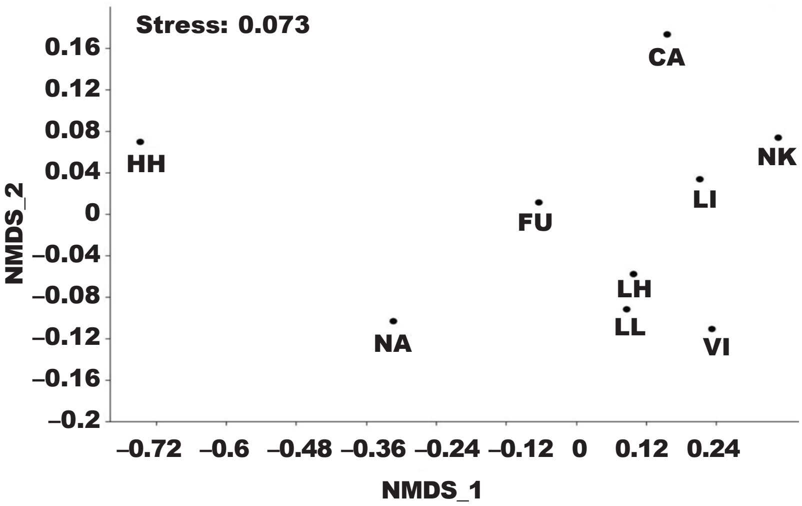

Fig. 4. Nonmetric multidimensional (NMDS) scaling plot based on Bray–Curtis similarities for species abundance data from nine study plots. (For abbreviations of the study plots see Material and methods.)

Fig. 4. Gráfico del escalamiento multidimensional no métrico (NMDS) de las similitudes de Bray–Curtis a partir de los datos sobre la abundancia de las especies obtenidos en nueve parcelas del estudio (para consultar las abreviaturas de las parcelas del estudio, véase el apartado Material and methods).

colonies of ants as predators of lepidoptera larvae in this plot (appendix 1).

The seasonal effect was reflected in all three examined parameters of the taxocenosis (table 4). The species abundance peaked in May, while number of species and species diversity reached the highest values from April to May and from April to June, respectively (fig. 5).

Figure 6 shows the number of species and the number of individuals in seasonal guilds. The number of species and the abundance showed two clear peaks in flush feeders and in late summer feeders. The number of flush feeder species was significantly higher than the number of species in other seasonal guilds (table 5).

Table 3. Results of analysis of similarity (ANOSIM): permutation number: 1,000; mean rank within: 5,047; mean rank between: 5,241; $R = 0.037$, $P < 0.01$. (For abbreviations of the study plots see Material and methods.)

Tabla 3. Resultados del análisis de similitud (ANOSIM): número de permutaciones: 1.000; rango medio dentro: 5.047; rango medio entre: 5.241; R *= 0,037;* P *< 0,01. (Para las abreviaturas de las parcelas del estudio, véase el apartado Material and methods).*

	VI	CA	LI	LL	NA	NK	HH	FU	LH
VI	–	0.16	0.39	0.73	0.15	0.23	**0.02**	0.06	0.18
CA		–	0.58	0.67	0.77	0.46	**0.01**	0.68	0.21
LI			–	0.68	0.15	0.32	**0.01**	0.73	0.17
LL				–	0.38	0.62	**0.02**	0.83	0.33
NA					–	0.48	**0.01**	0.18	0.22
NK						–	**0**	0.3	0.3
HH							–	0.09	0.11
FU								–	0.3
LH									–

Table 4. Comparison of abundance, species number and species diversity in spatial and temporal scaling of studied lepidoptera taxocenoses in the hierarchical (nested) analysis of variance (ANOVA): * $P < 0.05$, ** $P < 0.01$; SSq. Sum of squares; MSq. Mean squares; SS. Sampling site; SD. Sampling date.

*Tabla 4. Comparación de la abundancia, el número de especies y la diversidad de especies en las escalas espacial y temporal de las taxocenosis estudiadas de lepidópteros en el análisis jerárquico (anidado) de la varianza (ANOVA): * P < 0,05, ** P < 0,01; SSq. Suma de los cuadrados; MSq. Media de los cuadrados; SS. Lugar de muestreo; SD. Fecha de muestreo.*

	SSq	df	MSq	*F*–statistic	*P*–value	Mann–Whitney pairwise comparison
Abundance						
SS	13336.73	8	1667.09	4.29614	$P < 0.01$	HH < CA, VI, FU, LI, NK, NA, LI*
SD	61095.30	54	1131.39	3.51589	$P < 0.01$	June–October < April–May*
Number of species taxa						
SS	268.798	8	33.600	3.0216	$P < 0.01$	HH < CA, VI, FU, LI, NK, NA, LI*
SD	4419.608	54	81.845	7.3602	$P < 0.01$	June–October < April–May*
Species diversity						
SS	6.50334	8	0.81292	1.2961	$P = 0.2571$	– –
SD	86.24383	54	1.59711	4.9800	$P < 0.01$	August–October < April–June**

The occurrence in time of lepidoptera species with two types of feeding specialization (generalists, narrow oligophagous) was non–randomly distributed throughout the season (table 6). The number of species in these feeding groups peaked in May. On the other hand, species in the wider oligophagous feeding groups exploited time in a random way.

Discussion

Taxocenoses of lepidoptera larvae observed on *Quercus dalechampii* in Malé Karpaty Mts. can be compared with taxocenoses on *Q. cerris* that were studied under similar conditions. A comparison shows similarities and differences (cf. Kulfan et al., 2006). Species richness was higher on *Q. dalechampii* (96 species on *Q. dalechampii* compared to 58 species on *Q. cerris*). The lowest number of species in both types of taxocenoses was found in the study plot HH. *Lymantria dispar* and *Operophtera brumata* belonged to the most abundant species both on *Q. dalechampii* and on *Q. cerris*. In the study plot HH, *L. dispar* reached a higher dominance on *Q. cerris* than on *Q. dalechampii* (cf. Kulfan et al., 2006). Regarding cumulative dominance, the families Ypsolophidae, Pyralidae and Drepanidae predominated on *Q. cerris*. On the contrary, the families Peleopodidae and Chimabachidae were noticeably more common on *Q. dalechampii* (cf. table 1, Kulfan et al., 2006).

In general, when compared with other areas of Slovakia, the abundance of lepidoptera larvae found on *Q. dalechampii* corresponds to the latent phase of the gradation cycle on oaks. No marked outbreaks of folivorous lepidoptera larvae have been observed on oaks in Slovakia since 1990 (cf. Kulfan, 1990, 1998, 2002; Kulfan, 1992; Kulfan et al., 1997, 2006).

The values of species diversity of lepidoptera taxocenoses on *Q. dalechampii* are characterized by a greater variance than the values of diversity of taxocenoses on *Q. petraea* in the Malé Karpaty Mts. Diversity of lepidoptera taxocenoses on *Q. petraea* reached annual values ranging from 3.042 to 3.296 (Kulfan, 1990). The smallest diversity of lepidoptera taxocenoses on oaks in the Malé Karpaty Mts.was found on *Q. cerris* and it achieved a value of 2.230 (Kulfan et al., 2006) for the three–year period.

As a rule, there is notable spring peak in abundance of lepidoptera caterpillars on oaks in Central Europe (Kulfan, 1992; Kulfan, 1983, 1990; Parák et al., 2012, etc.). This was also confirmed by the research on *Q. dalechampii.* Other peaks in caterpillar abundance on *Q. dalechampii* were not found throughout the growing season. Two peaks in the number of lepidoptera caterpillars during the season with prevalence in spring time were found on some oak species in Central Europe (Kulfan, 1992; Kulfan, 1983, 1990). The abundance of lepidoptera taxocenoses on *Q. petraea* throughout the growing season in the Malé Karpaty Mts in Slovakia has been found to have a very marked peak in spring (May–June) and a less noticeable peak in autumn (September). However, it is interesting that the autumn peak of total abundance of lepidoptera caterpillars on *Q. petraea* in the old oak stand in 1978 was more noticeable when compared to the spring peak (cf. Kulfan, 1983).

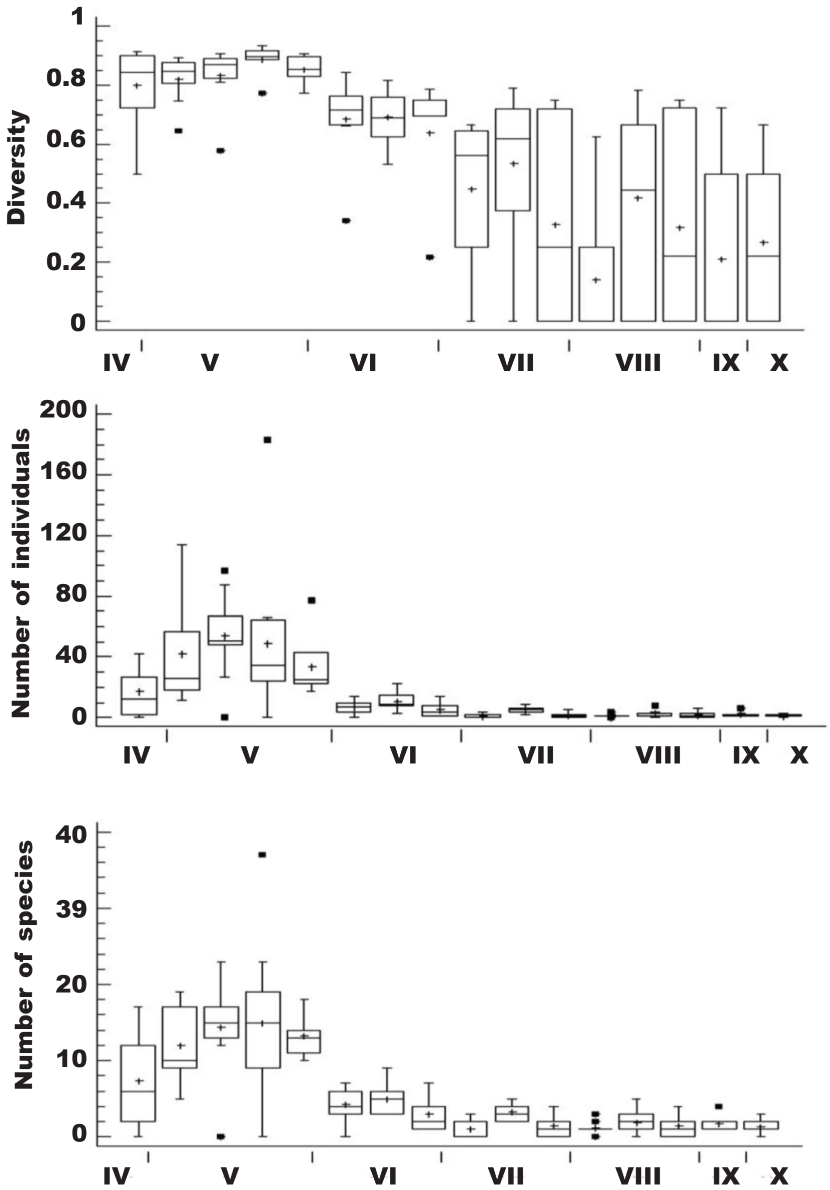

Fig. 5. Box plots showing the monthly variation of diversity, abundance and number of species of lepidoptera taxocenosis: IV–X. Months of presence of lepidopteran caterpillars during the season.

Fig. 5. Diagramas de caja en los que se muestra la variación mensual de la diversidad, la abundancia y el número de especies de la taxocenosis de los lepidópteros: IV–X. Meses de presencia de las orugas de lepidópteros durante la estación.

This was probably caused by unfavorable weather conditions in spring.

Yoshida (1985) in northern Japan presented the highest abundance of lepidoptera caterpillars on oaks in summer. This difference compared to our results may be caused by different climate, because the frosts in May in northern Japan have a large impact on leaf phenology, which is associated with the development of the spring taxocenoses of caterpillars. In oak forest on Mont Holomontas (Mediterranean area, Greece) even three peaks in insect abundance (consisting mainly of lepidoptera larvae) on six oak species were found (Kalapanida & Petrakis, 2012).

Not only the species abundance but also the species richness and diversity of lepidoptera species on *Q. dalechampii* culminated in the vernal aspect. The marked increase of species diversity of lepidoptera taxocenoses on *Q. dalechampii* was in spring. A similar

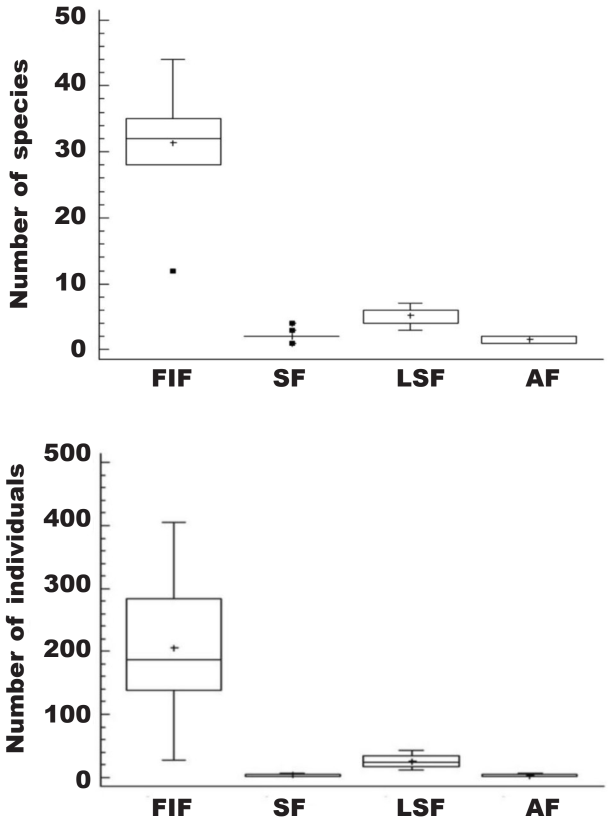

Fig. 6. Box plots showing the effects of seasonality on species number and abundance of lepidoptera taxocenosis: FIF. Flush feeders; SF. Summer feeders; LSF. Late summer feeders; AF. Autumn feeders.

Fig. 6. Diagramas de caja en los que se muestra los efectos de la estacionalidad en el número de especies y en la abundancia de la taxocenosis de los lepidópteros: FIF. Se alimentan durante la brotación; S. Se alimentan en verano; LSF. Se alimentan al final del verano; AF. Se alimentan en otoño.

Table 5. Results of one–way ANOVA on differences between seasonal guilds in the number of species taxa and number of individuals. The post hoc multiple sample comparison test (Tukey's pairwise comparison) for differences in mean number of species taxa and number of individuals between seasonal guilds: * $P < 0.05$, ** $P < 0.01$; FIF. Flush feeders; LSF. Late spring feeders; SF. Summer feeders; AF. Autumn feeders.

*Tabla 5. Resultados de la ANOVA simple de las diferencias existentes entre los gremios estacionales en cuanto el número de taxones y el número de individuos. La prueba múltiple de comparación a posteriori de Tukey (comparación por pares de Tukey) de las diferencias en el número medio de taxones y el número de individuos entre gremios estacionales: * P < 0,05; ** P < 0,01; FIF. Se alimentan durante la brotación; LSF. Se alimentan al final de la primavera; SF. Se alimentan en verano; AF. Se alimentan en otoño.*

	F–statistic	df	*P*–value	Tukey's pairwise comparison
Number of species in seasonal guilds	85.49	35	$P < 0.01$	SF, LSF, AF < FIF**
Number of individuals in seasonal guilds	25.44	35	$P < 0.01$	SF, LSF, AF < FIF** SF, AF < LSF**

Table 6. Results obtained from the Poole–Rathcke method used to segregate the moths in time. The null hypothesis (H1) states that the dispersion is not significantly different from random and the second null hypothesis (H2) that the two means and dispersions are not significantly different: N. Number of species; OV. Observed variance; EV. Expected variance; DR. Dispersion ratio; RD. Random dispersion (significance of H1); HM. Homogeneity of means; HD. Homogeneity of dispersion (significance of H2). (* $P < 0.05$, ** $P < 0.01$, ns. Non–significant)

Tabla 6. Resultados obtenidos con el método de Poole–Rathcke empleado para segregar las polillas en el tiempo. La hipótesis nula (H1) afirma que la dispersión no es significativamente distinta de la aleatoria y la segunda hipótesis nula (H2), que las dos medias y las dos dispersiones no son significativamente diferentes: N. Número de especies; OV. Varianza observada; EV. Varianza esperada; DR. Razón de la dispersión; RD. Dispersión aleatoria (significación de H1); HM. Homogeneidad de las medias; HD. Homogeneidad de la dispersión (significación de H2). (P < 0,05; ** P < 0,01; ns. No significativa).*

	N	OV	EV	DR	RD
Feeding specialization					
Generalists	64	9.87	0.19	51.94736842	**
Narrow oligophagous	18	18.7	0.27	69.25925926	**
Wider oligophagous	6	15.33	0.82	18.69512195	ns

	HM	HD
Feeding specialization compared		
Generalist/narrow oligophagous	Q = 8.54 $P < 0.01$	W = 2.14 $P = 0.15$
Generalist/wider oligophagous	Q = 8.74 $P < 0.01$	W = 13.55 $P < 0.01$
Narrow oligophagous/wider oligophagous	Q = 0.19 $P = 0.98$	W = 14.92 $P < 0.01$

course of diversity was observed on four oak species in the Borská nížina Lowland in Slovakia. (Kulfan & Degma, 1999).

Southwood et al. (2005) found distinct seasonal patterns in species richness of the arthropod fauna on four oak species in the U.K. In terms of species richness, the values showed a general trend peaking in summer and early autumn, but biomass peaked in May on the native oak species, mainly due to lepidoptera larvae.

A relatively steady decrease in the individuals from early spring to autumn is well known from the '*Quercus* type' of host tree (Niemelä & Haukioja, 1982). These authors suggested that this effect was due to a decline in available resources. Feeny (1970) and Kamata & Igarashi (1996) stated that tougher leaves with a higher tannin concentration contributed to the lower richness of Lepidoptera later during the growing season. A negative correlation between some specialist oak feeders and condensed tannins in the canopy of *Quercus alba* and understorey of *Q. velutina* was found (Forkner et al., 2004). Their results generally indicated a negative response from both specialists and generalists to condensed tannins.

A higher number of flush feeders in spring compared to the number of species in other seasonal guilds on *Q. dalechampii* was also found on three oak species in Borská nížina lowland (western Slovakia, Central Europe), where the greatest proportion of flush feeders was found on *Q. robur* (cf. Turčáni et al., 2009).

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Appendix 1. The list of the lepidoptera species recorded in the nine study plots in the Malé Karpaty Mountains on *Quercus dalechampii* with dominance (%), months of occurrence of larvae (MO), trophic group (TG: S2. Narrow oligophagous; S3. Wider oligophagous species; G. Generalists; U. Unknown), and larval trophic specialization and seasonal guilds (SG: FIF. Flush feeders; LSF. Late spring feeders; SF. Summer feeders; AF. Autumn feeders). (For abbreviations of study plots see Material and methods.)

Families and species	VI	CA	FU	LI
Psychidae				
Sterrhopterix fusca (Haworth, 1809)	0.0	0.0	0.0	0.3
Bucculatricidae				
Bucculatrix ulmella Zeller, 1848	0.0	0.0	0.0	0.0
Gracillariidae				
Phyllonorycter sp.	0.0	0.0	0.6	0.0
Ypsolophidae				
Ypsolopha alpella (Denis et Schiffermüller, 1775)	1.8	0.0	0.0	0.9
Ypsolopha parenthesella (Linnaeus, 1761)	0.0	0.0	0.0	0.0
Ypsolopha ustella (Clerck, 1759)	0.3	1.1	0.0	0.3
Chimabachidae				
Diurnea fagella (Denis et Schiffermüller, 1775)	0.0	0.7	0.6	0.0
Diurnea lipsiella (Denis et Schiffermüller, 1775)	0.6	2.8	1.2	0.6
Peleopodidae				
Carcina quercana (Fabricius, 1775)	0.6	2.8	3.0	4.6
Coleophoridae				
Coleophora ibipennella Zeller, 1849	0.0	0.0	0.0	0.3
Coleophora kuehnella (Goeze, 1783)	0.0	0.0	0.0	0.0
Coleophora lutipennella (Zeller, 1838)	0.6	4.2	6.6	4.6
Coleophora siccifolia Stainton, 1856	0.0	0.0	0.0	0.3
Gelechiidae				
Anacampsis timidella (Wocke, 1887)	0.0	0.0	0.6	0.0
Carpatolechia decorella (Haworth, 1812)	0.0	0.4	0.0	0.0
Psoricoptera gibbosella (Zeller, 1839)	0.0	0.0	0.0	0.3
Stenolechia gemmella (Linnaeus, 1758)	0.0	0.4	0.0	0.0
Tortricidae				
Aleimma loeflingiana (Linnaeus, 1758)	7.7	0.0	12.0	3.4
Archips crataegana (Hübner, 1799)	0.6	0.0	0.0	0.3
Archips podana (Scopoli, 1763)	0.0	0.0	0.0	0.0
Eudemis profundana (Denis et Schiffermüller, 1775)	0.0	0.0	0.0	0.0
Pammene albuginana (Guenée, 1845)	0.0	0.0	0.0	0.0
Pandemis cerasana (Hübner, 1786)	0.0	0.7	2.4	0.0
Pandemis corylana (Fabricius, 1794)	0.0	0.4	0.0	0.3
Pandemis heparana (Denis et Schiffermüller, 1775)	0.0	0.4	0.0	0.3
Ptycholoma lecheana (Linnaeus, 1758)	0.0	0.0	0.0	0.3
Spilonota ocellana (Denis et Schiffermüller, 1775)	0.0	2.1	0.6	0.0
Tortricodes alternella (Denis et Schiffermüller, 1775)	1.8	1.4	3.6	0.9
Tortrix viridana (Linnaeus, 1758)	4.9	0.7	1.2	0.3
Zeiraphera isertana (Fabricius, 1794)	1.8	0.4	1.8	0.3

Apéndice 1. Lista de las especies de lepidópteros registradas en Q. dalechampii *en las nueve parcelas del estudio ubicadas en los Pequeños Cárpatos con la dominancia (%), los meses de presencia de las larvas (MO), el grupo trófico (TG: S2. Oligófagas estrictas; S3. Especies oligófagas más amplias; G. Generalistas; U. Desconocido) y la especialización trófica de las larvas y los gremios estacionales (SG: FIF. Se alimentan durante la brotación; LSF. Se alimentan al final de la primavera; SF. Se alimentan en verano; AF. Se alimentan en otoño). (Para las abreviaturas de las parcelas del estudio, véase el apartado Material and methods).*

HH	LL	LH	NA	NK	MO	TG	SG
0.0	0.0	0.0	0.0	0.0	5	G	FIF
0.0	0.0	0.0	1.5	0.4	6	G	LSF
0.0	0.0	0.0	0.0	0.0	7	U	SF
2.3	0.0	1.1	3.0	2.0	5–6	S2	FIF
0.0	0.0	1.1	0.0	0.0	5	G	FIF
2.3	0.9	1.1	0.8	0.4	5–6	G	FIF
4.5	0.5	0.0	3.8	0.4	6–9	G	SF
0.0	0.5	1.1	0.8	3.9	5–8	G	FIF
6.8	3.2	1.6	2.3	3.5	5–8	G	LSF
0.0	0.0	0.0	0.0	0.0	5	G	FIF
0.0	0.0	0.0	0.0	0.2	5	S2	FIF
0.0	6.0	2.7	3.8	5.0	4–6	S2	FIF
0.0	0.0	0.0	0.0	5.2	4–5	G	FIF
0.0	0.0	0.0	0.0	0.0	5	S2	FIF
0.0	0.0	0.0	0.0	0.0	5	G	FIF
2.3	0.0	0.5	0.0	0.0	5	G	FIF
0.0	0.0	1.1	0.0	0.0	5–6	S2	FIF
0.0	9.7	5.4	10.5	0.0	4–5	S2	FIF
0.0	0.0	1.1	0.0	0.4	5–6	G	FIF
0.0	0.5	0.0	0.0	0.0	5	G	FIF
0.0	0.5	0.0	0.0	0.0	5	S2	FIF
0.0	0.0	0.0	0.0	0.2	5	S2	FIF
0.0	0.0	3.8	1.5	0.7	5–7	G	FIF
0.0	0.5	0.0	0.0	0.0	5	G	FIF
0.0	1.4	0.5	0.0	0.7	5–6	G	FIF
0.0	0.0	0.0	0.8	0.2	5	G	FIF
0.0	0.0	0.0	0.0	0.0	5	G	FIF
4.5	1.4	1.1	1.5	0.9	5	G	FIF
0.0	9.3	0.0	2.3	1.3	4–5	S2	FIF
0.0	0.0	1.1	0.0	0.9	4–5	S2	FIF

Appendix 1. (Cont.)

Families and species	VI	CA	FU	LI
Lycaenidae				
Favonius quercus (Linnaeus, 1758)	0.3	0.0	1.2	0.3
Pyralidae				
Acrobasis repandana (Fabricius, 1798)	0.0	0.0	0.0	0.0
Acrobasis tumidana (Denis et Schiffermüller, 1775)	0.0	0.0	0.0	0.0
Phycita roborella (Denis et Schiffermüller, 1775)	0.9	0.4	0.0	0.9
Drepanidae				
Watsonalla binaria (Hufnagel, 1767)	0.0	0.4	0.6	0.0
Geometridae				
Agriopis aurantiaria (Hübner, 1799)	2.5	0.7	0.6	0.6
Agriopis leucophaearia (Denis et Schiffermüller, 1775)	3.1	1.4	1.8	6.8
Agriopis marginaria (Fabricius, 1776)	3.4	4.2	3.6	8.0
Alcis repandata (Linnaeus, 1758)	0.0	0.0	0.0	0.0
Alsophila aceraria (Denis et Schiffermüller, 1775)	0.3	0.4	0.0	1.5
Alsophila aescularia (Denis et Schiffermüller, 1775)	4.9	2.1	0.6	1.8
Apocheima hispidaria (Denis et Schiffermüller, 1775)	0.0	0.0	0.0	0.0
Biston betularia (Linnaeus, 1758)	0.0	0.4	1.2	0.0
Biston strataria (Hufnagel, 1767)	0.0	0.0	0.0	0.0
Campaea margaritaria (Linnaeus, 1761)	1.8	0.0	0.0	0.3
Colotois pennaria (Linnaeus, 1761)	1.5	0.4	0.0	1.8
Cyclophora linearia (Hübner, 1799)	0.3	3.2	8.4	2.5
Cyclophora punctaria (Linnaeus, 1758)	0.0	0.4	0.0	0.0
Ennomos autumnaria (Werneburg, 1859)	0.0	0.4	0.0	0.0
Ennomos erosaria (Denis et Schiffermüller, 1775)	0.9	0.0	0.6	0.3
Ennomos quercinaria (Hufnagel, 1767)	0.0	0.4	0.0	0.0
Epirrita dilutata (Denis et Schiffermüller, 1775)	1.2	7.7	1.2	0.9
Erannis defoliaria (Clerck, 1759)	1.8	2.1	0.0	0.6
Hypomecis punctinalis (Scopoli, 1763)	0.6	0.0	0.0	0.3
Lomographa temerata (Denis et Schiffermüller, 1775)	0.0	1.1	0.0	0.6
Lycia hirtaria (Clerck, 1759)	0.0	0.0	0.0	0.3
Operophtera brumata (Linnaeus, 1758)	11.4	22.9	10.2	8.0
Parectropis similaria (Hufnagel, 1767)	0.0	0.0	0.0	0.0
Peribatodes rhomboidaria (Denis et Schiffermüller, 1775)	0.0	0.0	0.0	0.0
Phigalia pilosaria (Denis et Schiffermüller, 1775)	0.0	0.0	0.0	0.0
Selenia lunularia (Hübner, 1788)	0.0	0.0	0.0	0.3
Selenia tetralunaria (Hufnagel, 1767)	0.0	0.0	0.0	0.0
Notodontidae				
Drymonia ruficornis (Hufnagel, 1766)	0.3	0.0	2.4	0.3
Phalera bucephala (Linnaeus, 1758)	0.0	0.0	0.0	0.0
Spatalia argentina (Denis et Schiffermüller, 1775)	0.0	0.0	0.0	0.0
Thaumetopoea processionea (Linnaeus, 1758)	0.0	0.0	0.0	0.6

HH	LL	LH	NA	NK	MO	TG	SG
0.0	0.0	0.5	0.0	0.6	5	S2	FIF
0.0	0.0	0.0	0.8	0.0	5	S2	FIF
0.0	2.3	1.6	0.0	0.7	5	S2	FIF
0.0	0.5	1.1	0.0	0.9	4–5, 9	S2	FIF
0.0	0.9	0.0	0.8	0.0	6, 8, 10	S3	AF
0.0	3.7	2.2	0.8	1.3	4–6	G	FIF
2.3	7.9	7.1	1.5	8.5	4–5	S3	FIF
2.3	0.9	7.6	1.5	5.7	4–5	G	FIF
0.0	0.0	0.5	0.0	0.0	9	G	AF
0.0	2.8	0.5	0.8	0.7	4–5	G	FIF
0.0	5.6	5.4	3.0	3.1	4–6	G	FIF
0.0	0.5	0.0	0.0	0.0	5	G	FIF
2.3	0.9	0.0	0.0	0.0	8–10	G	AF
0.0	0.0	0.5	0.0	0.0	5	G	FIF
0.0	1.4	2.2	3.8	1.3	4–9, 11	G	LSF
0.0	0.0	1.6	1.5	3.3	4–5	G	FIF
11.4	3.2	3.3	8.3	2.8	6–10	S3	LSF
0.0	0.0	0.5	0.0	0.0	6–7	S3	LSF
0.0	0.9	0.0	1.5	0.0	5–7	G	LSF
0.0	0.0	0.0	0.0	0.0	5,9	S3	FIF
0.0	0.0	0.5	0.0	0.0	5–6	G	FIF
2.3	0.5	0.5	2.3	1.5	4–5	G	FIF
0.0	0.5	0.0	0.0	0.7	4–5	G	FIF
0.0	0.0	0.0	0.0	1.3	6–9	G	AF
0.0	0.0	0.0	0.0	0.4	7–8	G	SF
0.0	0.0	0.0	0.0	0.4	5	G	FIF
4.5	15.7	15.8	5.3	9.2	4–5	G	FIF
0.0	0.9	0.0	0.0	0.0	7, 10	G	AF
0.0	0.0	0.0	0.8	0.0	11	G	AF
0.0	0.0	0.0	0.0	0.2	5	G	FIF
0.0	0.0	0.0	0.0	0.0	6	G	LSF
0.0	0.0	0.5	0.0	0.0	6	G	LSF
0.0	0.0	0.0	0.0	0.9	5	S2	FIF
4.5	0.0	0.0	0.0	0.0	7	G	SF
0.0	0.0	0.5	0.0	0.2	6–7	G	SF
0.0	0.0	0.0	0.0	4.4	5–6	S2	FIF

Appendix 1. (Cont.)

Families and species	VI	CA	FU	LI
Erebidae				
Amata phegea (Linnaeus, 1758)	0.0	0.4	0.0	0.0
Calliteara pudibunda (Linnaeus, 1758)	1.2	0.0	0.0	0.9
Lymantria dispar (Linnaeus, 1758)	16.3	1.8	3.0	11.4
Orgyia antiqua (Linnaeus, 1758)	0.0	0.0	0.0	0.0
Nolidae				
Bena bicolorana (Fuessly, 1775)	0.3	0.4	0.0	0.3
Nycteola revayana (Scopoli, 1772)	0.0	0.0	0.6	0.0
Pseudoips prasinana (Linnaeus, 1758)	1.2	4.2	3.0	2.8
Noctuidae				
Acronicta auricoma (Denis et Schiffermüller, 1775)	0.0	0.7	0.0	0.3
Agrochola helvola (Linnaeus, 1758)	0.0	0.0	0.0	0.0
Amphipyra pyramidea (Linnaeus, 1758)	0.0	0.0	0.6	1.5
Colocasia coryli (Linnaeus, 1758)	0.0	0.4	0.0	0.0
Cosmia pyralina (Denis et Schiffermüller, 1775)	5.2	2.5	0.0	0.0
Cosmia trapezina (Linnaeus, 1758)	5.5	12.0	12.0	14.5
Dichonia convergens (Denis et Schiffermüller, 1775)	2.8	0.7	1.8	0.6
Dryobotodes eremita (Fabricius, 1775)	0.0	0.0	4.2	0.0
Eupsilia transversa (Hufnagel, 1766)	0.6	2.8	1.2	0.3
Lithophane ornitopus (Hufnagel 1766)	0.6	2.1	3.0	0.9
Moma alpium (Osbeck, 1778)	0.0	0.0	0.0	0.0
Noctuidae species 1	0.0	0.0	0.0	0.0
Noctuidae species 2	0.0	0.0	0.0	0.0
Noctuidae species 3	0.0	0.0	0.0	0.0
Noctuidae species 4	0.0	0.0	0.0	0.9
Noctuidae species 5	0.0	0.0	0.0	0.3
Noctuidae species 6	0.0	0.0	0.0	0.0
Noctuidae species 7	2.2	0.0	0.0	0.0
Orthosia cerasi (Fabricius, 1775)	5.5	2.1	0.0	3.4
Orthosia cruda (Denis et Schiffermüller, 1775)	2.2	1.1	1.8	2.5
Orthosia gothica (Linnaeus, 1758)	0.0	2.1	0.0	0.6
Orthosia incerta (Hufnagel, 1776)	0.0	0.4	0.0	0.0
Orthosia opima (Hübner, 1809)	0.0	0.0	2.4	3.4
No individuals	325	284	167	325
No species/taxons	38	46	35	53

HH	LL	LH	NA	NK	MO	TG	SG
2.3	0.0	0.0	0.0	0.0	4–5	G	FIF
0.0	0.0	0.0	0.8	0.0	6–8	G	SF
29.5	0.0	2.2	18.0	3.5	4–7	G	FIF
0.0	0.0	0.0	0.0	0.2	6	G	LSF
0.0	0.0	0.0	0.8	0.0	4, 8	S2	FIF
0.0	0.0	0.0	0.0	0.0	5	S3	FIF
6.8	0.9	1.1	1.5	1.1	6–10	G	LSF
0.0	0.0	0.0	0.0	0.0	5–6	G	LSF
0.0	0.0	0.5	0.0	0.0	5	G	FIF
0.0	0.0	0.5	0.0	0.2	5	G	FIF
0.0	0.5	0.0	0.8	0.0	6, 8	G	LSF
4.5	0.5	0.0	0.0	1.5	4–5	G	FIF
0.0	5.6	9.8	0.0	5.9	4–5	G	FIF
0.0	0.5	0.0	3.0	1.3	4–5	G	FIF
0.0	0.5	0.0	0.8	0.0	5	S2	FIF
4.5	2.3	0.5	3.0	0.7	4–6	G	FIF
0.0	0.9	0.5	2.3	0.2	4–6	G	FIF
0.0	0.5	0.0	0.8	0.4	7–8	G	SF
0.0	0.0	0.0	0.8	0.0	5	U	FIF
0.0	0.0	0.0	0.8	0.0	5	U	FIF
0.0	0.0	0.0	1.5	0.0	5	U	FIF
0.0	0.0	0.0	0.0	0.0	4	U	FIF
0.0	0.0	0.0	0.0	0.0	4	U	FIF
0.0	0.0	1.6	0.0	0.0	9	U	AF
0.0	0.0	0.0	0.0	0.0	4	U	FIF
0.0	3.2	6.5	0.0	1.1	4–7	G	FIF
0.0	1.4	0.0	0.0	7.0	4–6	G	FIF
0.0	0.0	0.0	0.8	0.4	5–6	G	FIF
0.0	0.0	0.0	0.0	0.0	5	G	FIF
0.0	0.0	0.5	0.0	2.8	4–6	G	FIF
44	216	184	133	462			
18	40	43	40	52			