

PHENOLOGY OF *Chelidurella acanthopygia* (Dermaptera: Forficulidae) NYMPHAL INSTARS IN OAK-HORNBEAM FORESTS OF THE MALÉ KARPATY MTS AND TRNAVSKÁ PAHORKATINA HILLS (SW SLOVAKIA)

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Abstract

Országh I.: Phenology of *Chelidurella acanthopygia* (Dermaptera: Forficulidae) nymphal instars in oak-hornbeam forests of the Malé Karpaty Mts and Trnavská pahorkatina hills (SW Slovakia). *Ekológia* (Bratislava), Vol. 24, Supplement 2/2005, p. 152–160.

In the Malé Karpaty Mts as well as nearby Trnavská pahorkatina hills the phenology of *Chelidurella acanthopygia* nymphal instars was studied in the period of 1999–2002. Abundance of the species varied between 1–33 ind.m⁻² at the study sites. The first specimens, adults of both sexes from the previous year shortly after their overwintering appeared in the samples already in March. The first nymphal instar (N1) was sampled from the second decade of April till the end of the second decade in June. Interval of their existence took approximately 70 days. The second instar (N2) appeared from May (2nd decade) to the end of July in the period of more than 80 days. The third instar (N3) was recorded in the period of more than 75 days from June (beginning of the 2nd half) to the 1st week of September. The fourth instar (N4) was present from the beginning of July to September (1st decade) (period of more than 70 days). The first new generation adults (females and males) appeared at the end of summer (August). After winter they will form a new parental generation for the next year. The obtained data on the instars N1–N4 and length of their existence in the Malé Karpaty Mts declare that the ontogenesis of *C. acanthopygia* from the 1st nymphal instar to imago takes 100–120 days.

Key words: *Chelidurella acanthopygia*, Dermaptera, nymphal instars, phenology, Malé Karpaty Mts, SW Slovakia

Introduction

In the Malé Karpaty Mts the earwig *Chelidurella acanthopygia* (G é n é, 1832) belongs to common inhabitants of fallen leaf litter in oak-hornbeam forests as a part of epigeic macrofauna. It participates on formation of herbal detritus. From the trophic point of view it is classified as a decomposer (Turček, 1974). According to Franke (1985) *C.*

acanthopygia represents an omnivorous species with a preference to animal food. Its ontogenesis includes 4 nymphal instars. In the Malé Karpaty Mts it has one generation annually and overwinters as an adult.

The available data declare that its occurrence as well as quantity at a site is determined by temperature, humidity and depth of leaf litter, quantity of decaying wood, presence of bigger-sized stones on substrate. It avoids open landscape and prefers forested areas. There are no detailed studies on correlation between its occurrence and chemical variables of soil as well as undergrowth.

It has been recorded in most W and C Europe, some countries of S and SE Europe, Scandinavia and Baltic region. In E Europe its distribution area includes even W Ukraine (Bey-Bienko, 1936; Albouy, Caussanel, 1990). In Slovakia there are some records on this species already from the end of the 19th century (Petrogalli, 1890; Petricskó, 1892). There are just sporadic data published on its distribution in the Malé Karpaty Mts. From the village of Sološnica in the western part of the Malé Karpaty Mts and from the village of Dobrá Voda in the northern part of the mountains the earwig *Chelidurella acanthopygia* was mentioned by Kočárek, Galvagni (2000). The records from Devínska Kobyla (the southern margin of the Malé Karpaty Mts) were published by Lukáš (2003) and Fedor (2005). Straka (2005) collected *Chelidurella acanthopygia* in the Biele Karpaty Mts (Javorník – Vršatecké Podhradie; Krivoklát) and Strážovské vrchy Mts (Mitická step – Trenčianske Mitice).

Study area

With a total area of 65,504 ha the Malé Karpaty Mts are situated in the western part of Slovakia from Bratislava towards the town of Nové Mesto nad Váhom on NE within the length of 100 km. The altitude varies between 132 m a.s.l. (by the Danube river) and 768 m a.s.l. (Mount Záruby). The main range grows to the altitude of 450–650 m a.s.l. The Malokarpatský kras karst represents a specific area of approximately 180 km².

The Malé Karpaty Mts belong to the gently warm climatic zone with an average annual temperature of 7–9 °C, which declines under 8 °C at the altitudes of 400 m a.s.l. The vegetation period (with the average daily temperature of 10 °C) usually takes 180 days, respectively 160 days at higher altitudes. Precipitation reaches 650–900 mm in the mountains, 600–650 mm in the lowland.

The area of the Malé Karpaty Mts belongs to the Subcarpathian district of the deciduous forest province. The eastern side has been influenced by the Steppe province (Pannonian district) as plenty of thermophilous species infiltrate onto S and SE slopes. Dominant forest stands have been considerably replaced by vineyards on the SE and SW slopes, by pastures and farmland on north. From the hypsometric point of view the area is inhabited by colinous and submountainous elements forming the communities in forests, woody steppes and rocky habitats.

Study sites

All the sites are situated on forested area. The plots of Cajla (CA); Vinosady (VI); Fúgelka (FU); Lošonec–lom quarry (LL); Lošonský háj grove (LH); Naháč–Kukovačník (NA); Naháč–Katarínka 1, young forest (NK1) and Naháč–Katarínka 2, old forest (NK2) are located in the zone of oak-hornbeam forests on the SE slopes of the Malé Karpaty Mts. The sites of Lindava (LI) and Horný háj grove (HH) spread out on the boundary of the Malé Karpaty Mts and Trnavská pahorkatina hills. The study sites are situated at the altitude of 240–350 m a.s.l. on acid soils (pH varies between 3.8–5.0) with the only exception of Lošonec–lom quarry (LL) and Naháč–Katarínka 2, old forest (NK2) laying on weakly acid to almost neutral soil (pH 6.5–6.7). The air distance between the first site Cajla (CA) and the most northern one – Naháč–Katarínka 1, young forest (NK1) is measured as approximately 30 km.

The map with the study sites and the more detailed pedological and botanical characteristics of the study sites as well as the climatic conditions in the period of 1999–2002 have been included in the paper by Zlinská et al. (2005).

Material and methods

The collections of the earwig *Chelidurella acanthopygia* (Dermaptera) date back to the years of 1999–2002 at 10 study sites in monthly intervals from March to October (resp. to November). In the total of 285 samples 205 were positive on the earwig *C. acanthopygia*. Generally 1,484 specimens were collected. The Table 1 presents number of nymphs (N1 – N4), and adults obtained at the study sites during the whole period. The material has been deposited at the Department of Zoology, Faculty of Natural Sciences, Comenius University in Bratislava.

Table 1. Number of *Chelidurella acanthopygia* specimens collected during 1999–2002 at the study sites.

	CA	VI	FU	LI	HH	LH	LL	NA	NK 1	NK 2	Total
N1	0	18	0	4	4	7	0	1	9	12	55
N2	12	42	43	77	49	41	11	49	64	35	423
N3	51	40	20	17	48	20	11	17	27	39	290
N4	22	26	5	37	26	29	5	27	37	32	246
F	35	10	17	30	29	25	11	37	47	21	262
M	21	9	13	27	26	30	11	16	35	20	208
Total	141	145	98	192	182	152	49	147	219	159	1484
PS	21	21	18	17	20	23	12	23	27	23	205

Explications: Abbreviations of study sites (CA → NK 2) see text; N 1 → N 4 – first → fourth nymphal instar; F – female; M – male; PS – Number of positive samples with *Chelidurella acanthopygia*

To sample the square method was used. The leaf litter was sieved on the area of 1 m² (16 squares of 25x25 cm). The samples were transported in textile bags into a laboratory. The earwigs were extracted in the Moczarski-Winkler's selectors (Holdhaus, 1910; Balogh, 1958), and stored in 75% ethyl alcohol. *C. acanthopygia* was sampled at all the study sites.

The nymphal instars (N1, N2, N3, N4) were identified according to 5 characters: width of the head in its widest section behind compound eyes; length of the head, distance from the front margin of compound eyes to the rear margin of the head (vertex); width of pronotum; length of pronotum (Fig. 1) and number of antennal segments. All character values and numbers of the measured specimens are presented in the Table 2.

Table 2. Width and length of head and pronotum in mm and number of antennal segments of *Chelidurella acanthopygia*.

		N1	N2	N3	N4	F	M
WH	1	0.79 – 0.90	0.98 – 1.14	1.24 – 1.37	1.48 – 1.72	1.77 – 2.12	1.74 – 2.04
	2	0.88 ± 0.03	1.05 ± 0.04	1.31 ± 0.03	1.58 ± 0.06	1.97 ± 0.09	1.91 ± 0.07
	3	n = 39	n = 36	n = 32	n = 35	n = 25	n = 36
LH	1	0.40 – 0.53	0.48 – 0.66	0.69 – 0.85	0.85 – 1.06	1.11 – 1.35	1.00 – 1.35
	2	0.45 ± 0.04	0.57 ± 0.04	0.76 ± 0.04	0.96 ± 0.05	1.20 ± 0.06	1.17 ± 0.08
	3	n = 39	n = 36	n = 32	n = 35	n = 25	n = 36
WP	1	0.69 – 0.79	0.82 – 1.03	1.16 – 1.35	1.48 – 1.69	1.74 – 2.22	1.67 – 2.04
	2	0.75 ± 0.03	0.94 ± 0.04	1.24 ± 0.05	1.58 ± 0.06	1.99 ± 0.11	1.85 ± 0.09
	3	n = 39	n = 36	n = 32	n = 35	n = 25	n = 36
LP	1	0.42 – 0.53	0.53 – 0.71	0.77 – 0.92	0.98 – 1.27	1.40 – 1.70	1.27 – 1.59
	2	0.45 ± 0.03	0.61 ± 0.04	0.85 ± 0.05	1.15 ± 0.06	1.54 ± 0.09	1.42 ± 0.07
	3	n = 39	n = 36	n = 32	n = 35	n = 25	n = 36
AS		8	10	11	12	13	13

Explications: WH – width of head; LH – length of head; WP – width of pronotum; LP – length of pronotum; 1 – range (mm); 2 – average ± SD (mm); 3 – number of earwigs measured (n); AS – number of antennal segments; N 1 → N 4 – first → fourth nymphal instar; F – female; M – male

All the measurements were realised by the stereomicroscope Stemi 2000 C (Carl Zeiss) with the help of eyepiece micrometer (WPL 16x, Carl Zeiss). The measured earwigs were enlightened by 6-point ringlight (Schott KL electronic 1500, Carl Zeiss), which provides the snap without shadows.

Results and discussion

In the research period the earwig *Chelidurella acanthopygia* usually regularly occurred in the fallen leaf horizon samples in oak-hornbeam forests of the Malé Karpaty Mts and Trnavská pahorkatina hills. At the study sites its abundance varied between 1 and 33 ind.m⁻², in most of the samples there were 9–18 specimens recorded from the area of 1 m². The similar values (3–36 ind.m⁻²) from the beech forest in N Germany were published by Irmeler and Hingst (1993).

The study site Lošonec–lom quarry has been regularly impacted by limestone dust from the nearby quarry. This fact has probably reflected in the neutral value (pH = 6.74) of the upper soil horizon. The earwig *C. acanthopygia* occurred at the site sporadically, its abundance varied between 1 ind.m⁻² and 6 ind.m⁻². Exceptionally the sample from June 6, 2000 contained 4 ♀ and 6 ♂. In most of the study sites (pH = 3.90–5.00 in the upper soil horizon) the quantitative structure of the earwig was richer.

First nymphal instar (N1)

The first nymphal instar of *Chelidurella acanthopygia* occurred in the Malé Karpaty Mts from April (2nd decade) to June (end of the 2nd decade) (Table 3). The first specimens appeared in the sample from April 12, 2000 at the site NK1, the last ones in the sample from June 21, 1999 at the sites LH, NK1 and NK2. The first nymphal instar was present in the period of 70 days. Later N1 wasn't recorded at any of the study sites in the period of 1999–2002. Kočárek (1998) found N1 even at the end of June in Litovelské Pomoraví, Czech Republic. In Germany Franke (1985), recorded N1 on S from Karlsruhe in May, in Denmark Nielsen (1991) app. 25 km on NE from the town of Århus in July (the highest quantity), in June and August (lower quantity). The N1 specimens from the Malé Karpaty Mts are well distinguished in comparison with older nymphs (characters presented in Table 2). Due to their small size (body length 5.5–6.5 mm including cerci) are not visible enough. They are weakly sclerotised, some of the collected specimens were damaged at sieving.

Table 3. Occurrence of adults and nymphal instars of *Chelidurella acanthopygia* in Malé Karpaty Mts and Trnavská pahorkatina hills.

	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
F March 8 – June 3	XXX	XXXX	XXXX	X					
M March 8 – April 26	XXX	XXXX							
N1 April 12 – June 21		XXX	XXXX	XXX					
N2 May 9 – August 1			XXX	XXXX	XXXX	X			
N3 June 18 – September 5				XX	XXXX	XXXX	X		
N4 July 1 – September 11					XXXX	XXXX	XX		
F August 28 – November 28						X	XXXX	XXXX	XXXX
M August 15 – November 28						XX	XXXX	XXXX	XXXX

Explications: F – female; M – male; N1 → N4 – nymphal instar; the 2nd column includes the 1st and last date of collection; X – projects one quarter on the month; XXXX – projects the whole month

Second nymphal instar (N2)

The second nymphal instar occurred from the second decade of May to the end of July, for more than 80 days – the longest period of all the instars. The first N2 specimens appeared in the sample from May 9, 2001 in Vinosady (VI), the last ones were recorded at the site of Fúgelka in August 1, 2001. In the Czech Republic Kočárek (1998) recorded N2 at the end of June, in July and at the beginning of August 1995, in Germany Franke

(1985) in June, in Denmark Nielsen (1991) in July and August. The relevant characters are presented in the Table 2. In comparison with N1, N2 has 10 antennal segments.

Third nymphal instar (N3)

The 3rd nymphal instar is well-sclerotised. Alive specimens are brown to dark brown, being stored in alcohol they are gently pale. The first N3 specimens appeared in the samples in June (at the beginning of the 2nd half), on the 18th of June 2002 at the site NK2, the last ones were recorded in September 5, 2000 at LH. The period of their existence takes more than 75 days. In the Czech Republic N3 nymphs were observed from the end of June to the first decade of September (Kočárek, 1998), in Germany at the end of July and beginning of August (Franke, 1985), in Denmark (Nielsen, 1991) in most of the year, particularly in July, August and September. The relevant characters are presented in the Table 2.

Fourth nymphal instar (N4)

The 4th instar is formed by specimens with 12-segment antennae, immature cerci and character values included in the Table 2. The first specimens were collected in July 1, 1999 at the site VI, the last ones in September 9, 2001 at the sites CA, VI, FU, LI and HH. The whole existence period of the 4th instar takes more than 70 days. In the Czech Republic the specimens of were recorded in August and September (Kočárek, 1998), in Germany in the second half of August (Franke, 1985), in Denmark in most of the year, particularly in February, August and September (Nielsen, 1991).

Adults (females and males)

Adults occurred from the first sample at the beginning of the vegetation period (March). Females were recorded till June (1st decade), males till the end of April. Those were the overwintered specimens from the previous year. At the end of summer the first new generation females and males appeared in August. After wintertime they will become the parental generation for the next year.

For the whole period of 1999–2002 adults were recorded in July only in 3 cases: July 1, 1999 (♀) in Lindava, July 6, 2000 (♀, ♂) in Lošonec–lom quarry and July 16, 2002 in Naháč–Katarínka I (♀). Most probably these are the specimens from the previous year, which spent wintertime as nymphs. A possibility to overwinter in a nymphal instar (N3, N4) of *Chelidurella* sp. has been mentioned by Kočárek et al. (2005).

Conclusion

Phenology of *Chelidurella acanthopygia* nymphal instars was studied at several sites in the Malé Karpaty Mts (Cajla, Vinosady, Fúgelka, Lošonský háj grove, Lošonec–lom quarry, Naháč–Kukovačnick, Naháč–Katarínka 1 and Naháč–Katarínka 2) as well as in the Trnavská pahorkatina hills (Lindava and Horný háj) in the zone of oak-hornbeam forests.

Being based on the material of 1,484 specimens of nymphs (N1–N4) and adults (♀, ♂) the chronological sequence of the *C. acanthopygia* ontogenesis was completed (Table 3). The whole development from the 1st instar to imago takes 100–120 days. In the Malé Karpaty Mts the earwig has one generation annually. It spends wintertime in a stage of imago. Few specimens overwinter in nymphal stage. Within the whole study period of 1999–2002 the imagines were recorded only in 3 July samples. The specimens probably survived winter as nymphs.

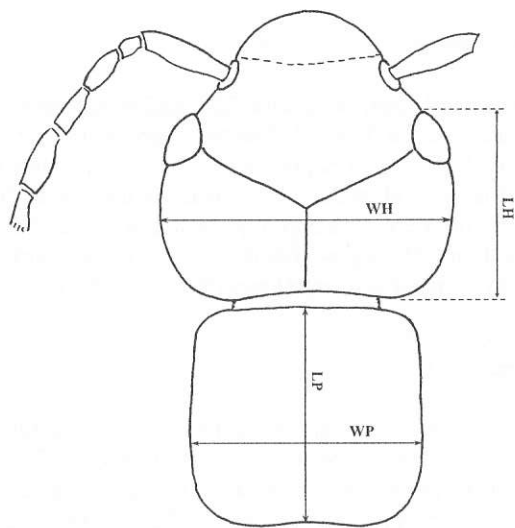


Fig. 1. *Chelidurella acanthopygia* – head with pronotum. LH – length of the head; WH – maximum width of the head; LP – length of the pronotum; WP – maximum width of the pronotum.

The paper projects diagnostic characters (Table 2), which allow quite exact identification of nymphal instars. The diagnostic characters include width and length of head and pronotum as well as number of antennal segments (Fig. 1). All the measured specimens (203) with their character values are presented in Table 2.

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V období rokov 1999–2002 sme v Malých Karpatoch a neďalekej Trnavskej pahorkatine sledovali fenológiu larválnych instarov ucholaka *Chelidurella acanthopygia*. Abundancia druhu sa na sledovaných plochách pohybovala v rozmedzí hodnôt 1–33 jedincov na m². Prvé jedince, imága oboch pohlaví, z predchádzajúceho roku sa po prezimovaní objavili vo vzorkách už v marci. Prvé nymfálne instary (N1) boli zbierané od druhej dekády apríla do konca druhej dekády júna. Obdobie ich výskytu trvalo približne 70 dní. Jedince druhého instaru (N2) sa objavovali od mája (2. dekáda) do konca júla s obdobím výskytu viac ako 80 dní. Tretí instar (N3) bol zaznamenaný počas obdobia viac ako 75 dní od júna (začiatok 2. polovice) do 1. týždňa septembra. Štvrtý instar (N4) bol prítomný od začiatku júla do septembra (1. dekáda) s obdobím výskytu viac ako 70 dní. Nová generácia dospelých jedincov (samice a samce) sa objavila na konci leta (august). Táto po prezimovaní utvorí v nasledujúcom roku novú rodičovskú generáciu. Získané údaje o instaroch N1 až N4 a dĺžke obdobia ich výskytu v Malých Karpatoch potvrdzujú, že vývin *Chelidurella acanthopygia* od prvého nymfálneho instaru po imago trvá 100–120 dní.

BUG ASSEMBLAGES IN EPIGEON OF OAK-HORNBEAM FORESTS IN SW SLOVAKIA

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Abstract

Hradil K.: Bug assemblages in epigeon of oak-hornbeam forests in SW Slovakia. *Ekológia* (Bratislava), Vol. 24, Supplement 2/2005, p. 161–178.

The study contains results of four-year research on epigeic Heteroptera fauna at 8 terrestrial sites of the Malé Karpaty Mts and 2 sites of the Trnavská pahorkatina hills. The bugs were collected during the period of 1999–2002 using a square method and sifting. The 399 obtained specimens belong to 46 species of 17 families. The evaluation of the Heteroptera taxocoenoses was based on their quantitative structure, being expressed by the average abundance values per 1 m², and on their qualitative aspects with emphasis on the constancy and dominance values. The RDA analysis showed that of the 15 tested variables the E₃ cover is the most significant factor. *Legnotus limbosus* and *Eurygaster maura* may be classified as eudominant species, *Plinthisus brevipennis*, *Megalonotus sabulicola*, *M. chiragra*, *Peritrechus nubilus* and *Raglius alboacuminatus* as dominant and subdominant elements. The occurrence of *Myrmedobia exilis* is faunistically interesting.

Key words: bugs, Heteroptera, epigeic assemblages, oak-hornbeam forests, SW Slovakia, ecology, human impacts

Introduction

Bugs live on soil surface, occasionally hypogeically and form a quantitatively as well as qualitatively significant component of zoocoenoses. Predominantly they are phytophagous, feeding on seeds and fruits and often sucking on roots, stalks or lower leaves. Plenty of species specialize on bryophytes, or even lichens on the basis of trunks. Predation or necrophagy may appear less frequently. Some species live in soil or epigeon permanently, the others just temporally. They often survive unsuitable climatic conditions or wintertime in a leaf litter horizon.

Species structure and abundance in epigeic assemblages of bugs sensitively reflect changes in humidity, ruderalisation as well as an increase of shadowiness. At open