

FIRST RECORD OF THE BUSH-CRICKET *ISOPHYA HARZI* (ORTHOPTERA: PHANEROPTERIDAE) OUTSIDE ITS *LOCUS* *TYPICUS*

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Abstract. During the period 2008-2012, the bush-cricket *Isophya harzi* Kis, 1960 has been the subject of several collecting trips in Cozia Mountains, where it was believed to be endemic, in order to study its acoustic behaviour. However, on a recent trip to Piatra Craiului Mountains, to study its Orthoptera fauna, *I. harzi* was surprisingly found in clearings and mountain steppe slopes covered with tall subalpine vegetation from Northern and Western areas. Bioacoustic analysis and some ecological notes are presented in the paper.

Résumé. La sauterelle *Isophya harzi* Kis, 1960 a été l'objet de plusieurs voyages de collecte dans les Montagnes de Cozia, pendant 2008-2012, afin d'étudier son comportement acoustique. Lors d'une étude récente sur la faune des Orthoptères des montagnes Piatra Craiului, *I. harzi* a été trouvée avec surprise dans les clairières et sur les pentes couvertes de steppes subalpines dans les régions nord et ouest de la montagne. L'analyse bioacoustique et quelques notes écologiques sont présentées.

Key words: *Isophya harzi*, distribution, Romania, bioacoustics.

INTRODUCTION

Genus *Isophya* Brunner von Wattenwyl is one of the largest of Palaearctic Orthoptera, with about 90 species known so far (Eades et al., 2012). Many of these bush-crickets have small distributional area, some of them being considered endemic species, characterized by limited mobility and usually confined to specific topographic requirements (Sevgili et al., 2006; Chobanov, 2009). They are usually found in small, isolated populations with a low density. Partly due to their preference to feed on dicotyledonous plants, they have a strict habitat preference (Bauer & Kenyeres, 2006). The study of this genus in the Carpathians can help elucidate some of the zoogeographical processes occurring after the last ice age (Kenyeres et al., 2009).

Isophya harzi Kis, 1960, one of the few Orthoptera species listed on both IUCN Red List of Threatened Species and Annex II from Habitats Directive, occurs in the Southern Carpathians, Romania. Up to this study, it was supposed to be endemic to a small area from Cozia Mountains, from where it was described in 1960 by Béla Kis. Kenyeres et al. (2009) postulate that this species is a recently isolated endemism and survived the last glaciation in situ. The species' song has been described recently by Orci et al. (2010), thus helping the clarification of its taxonomic status and allowing an easier identification of specimens directly on the field. Our finding of the species in Piatra Craiului Mountains, more than 65 km away in a straight line, supports the importance of knowing the species distribution in its conservation efforts. Its presence in other mountains from Southern Carpathians is very likely, because of similarities in habitat conditions.

MATERIAL AND METHODS

During several expeditions in Cozia Mountains in the period 2008-2012 and one trip in Piatra Craiului Mountains in July 2012, several specimens of *Isophya harzi* were caught alive in order to study their acoustic behaviour. Males and females



Fig. 1 - *Isophya harzi*: a, habitat; b, ♂; c, ♀ (Piatra Craiului Mts., 29.07.2012; photos: I. Șt. Iorgu).

have been recorded indoors, using the digital recorder EDIROL R-09HR and directly in the field, using the same recorder and the external microphone EDIROL CS-15R attached. Photos and tegmina movements while producing sounds were recorded with a Canon DSLR EOS 600D and a Canon 100 mm 2.8 1:1 macro lens. Song terminology follows Heller et al. (2004) and Orci et al. (2010). Sound analysis was performed with Audacity 2.0.2.

RESULTS AND DISCUSSIONS

Order Orthoptera
Suborder Ensifera
Family Phaneropteridae

Isophya harzi Kis, 1960
(Figs 1 a-c; 2 a-f; 3 a-g)

Examined material. 6 ♂♂, 4 ♀♀, 19.08.2008, Cozia Mts., 45°18.86'N, 24°20.76'E, 1380 m, leg. I. Şt. Iorgu & E. I. Iorgu; 6 ♂♂, 4 ♀♀, 01.08.2009, Cozia Mts., 45°19.06'N, 24°20.31'E, 1580 m, leg. I. Şt. Iorgu; 10 ♂♂, 7 ♀♀, 17.08.2010, Cozia Mts., 45°19.04'N, 24°20.42'E, 1590 m, leg. I. Şt. Iorgu & E. I. Iorgu; 8 ♂♂, 6 ♀♀, 29.07.2012, Piatra Craiului Mts., 45°33.49'N, 25°14.40'E, 1380 m, leg. I. Şt. Iorgu & A. I. Tatu; 2 ♂♂, 1 ♀, 29.07.2012, Piatra Craiului Mts., 45°33.19'N, 25°14.68'E, 1930 m, leg. I. Şt. Iorgu; 3 ♂♂, 29.07.2012, Piatra Craiului Mts., 45°31.89'N, 25°11.76'E, 1420 m, leg. I. Şt. Iorgu; 2 ♂♂, 2 ♀♀, 30.07.2012, Cozia Mts., 45°18.82'N, 24°22.62'E, 1030 m, leg. I. Şt. Iorgu.

Audio recordings. 3 ♂♂, 01.08.2009, Cozia Mts., air temperature 26°C; 7 ♂♂, 3 ♀♀, 17.08.2010, Cozia Mts., air temperature 25°C; 4 ♂♂, 29.07.2012, Piatra Craiului Mts., air temperature 19°C; 2 ♂♂, 30.07.2012, Cozia Mts., air temperature 19°C.

Bioacoustics. The bush-cricket *Isophya harzi* stridulates at dusk and during the night. Male calling song consists of temporal variable groups of syllables (for more details see Orci et al., 2010). A group is well defined in structure, two types

Table 1
Song characteristics of *Isophya harzi* (n = number of recorded males, t = temperature).

Male song		Min.	Max.	Mean	SD	n	t (°C)
Short ("A") syllable	Syllable duration (ms)	75	168	121.64	28.36	16	19–26
	Number of impulses	23	55	40.5	9.67		
	Delay of after-clicks (ms)	40	90	64	16.97		
	Number of after-clicks			0–2			
	Syllable duration (when producing after-clicks)	75	258	156.42	77.01		
Gap between consecutive short ("A") syllables (ms)		122	298	175.78	48.25		
Gap between short ("A") and long ("B") syllables (ms)		367	789	527.4	126.18		
Long ("B") syllable	Syllable duration (ms)	94	216	154.7	43.54		
	Number of impulses	37	59	46.5	8.38		
	Delay of after-clicks (ms)	75	202	142.3	47.19		
	Number of after-clicks			0–2			
	Syllable duration (when producing after-clicks)	94	418	223.3	114.78		
Syllable group total duration (ms)		617	6168	2254.8	1954.04		
Gap between consecutive syllable groups (ms)		191	303	249.8	40.28		

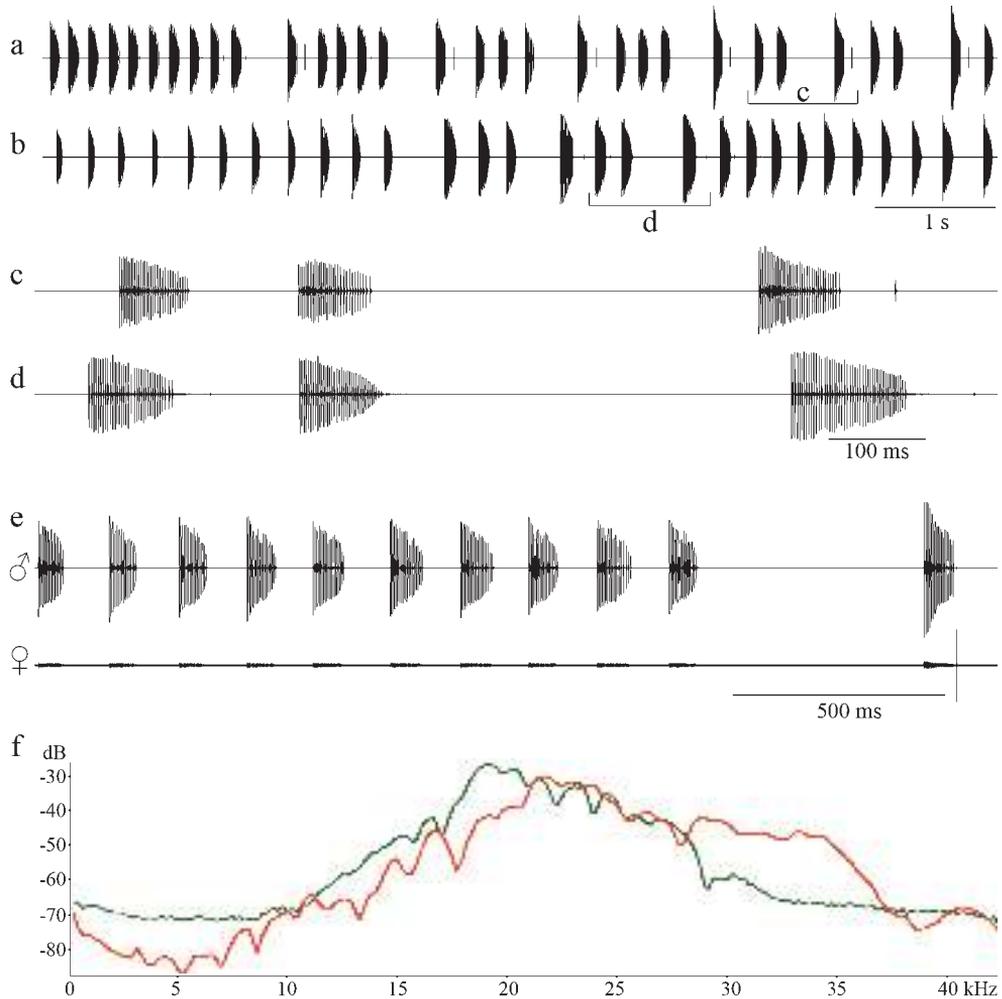


Fig. 2 - Sound analysis in *Isophya harzi*: a, oscillogram - male calling song, Piatra Craiului Mts., temperature 19°C; b, oscillogram - male calling song, Cozia Mts., temperature 19°C; c, d, oscillogram - detailed group of syllables: first two syllables short ("A"), last one long ("B"); e, oscillogram - male - female acoustic duet, Cozia Mts., temperature 25°C; f, spectrum - red, Piatra Craiului Mts.; green, Cozia Mts.

of syllables being produced: a sequence of 1-36 short ("A"-type) syllables (usually 2-6), followed by a long syllable ("B"-type). Very interesting is that the gap between successive "A" and "B" syllable is longer than the gap between "B" and consecutive "A" syllable, creating the false impression that the group actually begins with "B" syllable. The groups of syllables are produced in sequences, from 2 to more than 20 syllables being produced without gaps longer than 303 ms between consecutive ones. Usually, the last group in a sequence lacks the ending long syllable (Fig. 2 a, b). The "A"-type syllables are formed of 23-55 impulses lasting for 75-168 ms, sometimes after-clicks being produced after 40-90 ms. The "B"-type syllable consists of 37-59

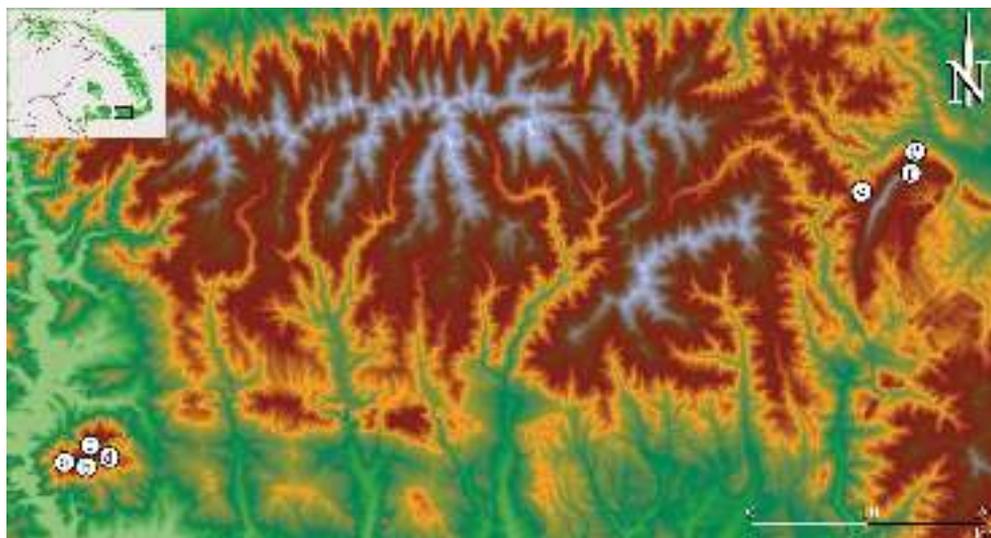


Fig. 3 - Distribution map of *Isophya harzi* in Romania: a, Cozia Mts. (45°19.06'N, 24°20.31'E); b, Cozia Mts. (45°18.86'N, 24°20.76'E); c, Cozia Mts. (45°19.04'N, 24°20.42'E); d, Cozia Mts. (45°18.82'N, 24°22.62'E); e, Piatra Craiului Mts. (45°31.89'N, 25°11.76'E); f, Piatra Craiului Mts. (45°33.19'N, 25°14.68'E); g, Piatra Craiului Mts. (45°33.49'N, 25°14.40'E).

impulses and lasts for 94-216 ms. The after-clicks, if present after “B” syllables, are produced after 75-202 ms (Fig. 2 c, d). When willing to mate with the singing male, female replies with a short song formed of isolated impulses and produced only after the beginning of male “B” syllable, sometimes overlapping with male syllable main body (Fig. 2 e). This proves that male groups begin with the series of “A” syllables and end with “B” syllable, as females reply usually to a (ending) trigger element, in this case the long syllable (Orci et al., 2010). The song frequency ranges from 10 kHz up to 30-40 kHz, with the highest peak recorded at about 19-22 kHz (Fig. 2 f).

Ecology and distribution. This bush-cricket inhabits sunny mesophytic forest ecotones and growth clearings, subalpine grasslands, abundant in *Rubus*, *Urtica*, *Rumex*, *Veratrum*, *Aconitum*, *Vaccinium* etc. It is distributed over a wide range of altitudes, from 1000-1600 m altitude in Cozia Mountains and from 1400 m up to more than 1900 m in Piatra Craiului. It may well be that *Isophya harzi*'s distribution area includes more mountain massifs between Olt and Prahova river valleys, as this area is still in need of a thorough research (Fig. 3). In the course of time, new protected areas (European Commission Habitats Directive Sites of Community Importance) may be designated on the presence of this particular bush-cricket in the Southern Carpathians and checklists should be updated in already nominated Sites of Community Importance.

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PRIMA SEMNALARE A COSAȘULUI *ISOPHYA HARZI* (ORTHOPTERA:
PHANEROPTERIDAE) ÎN AFARA *LOCUS TYPICUS*

REZUMAT

Cosașul *Isophya harzi* Kis, 1960 a fost subiectul mai multor excursii de colectare în Munții Cozia, în perioada 2008-2012, pentru a-i studia comportamentul acustic. În timpul unui studiu recent în Munții Piatra Craiului, *I. harzi* a fost găsită în mod surprinzător în poienile și zonele cu vegetație subalpină de pe stâncăriile abrupte din nordul și vestul masivului. În lucrare sunt prezentate analiza bioacusticii și câteva date ecologice.

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