

THE FINDINGS OF MEHELÝ'S HORSESHOE BAT (CHIROPTERA) IN THE LAST CENTURY IN CROATIA WERE MISTAKES IN IDENTIFICATION

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Personal notes discovered in the papers of Croatian mammalogist Professor Beatrica Đulić were used to assess the reliability of the identification of the findings of *Rhinolophus mehelyi* Matschie, 1900, in Croatia from 1952 to 1968. Because no voucher specimens exist, analysis of the original description of caught specimens, measurements from Đulić's field notebook, together with published data (ĐULIĆ, 1959, 1961), were compared with recent data on two morphologically similar species from the same genus. It is established that there is no evidence to confirm the finding of *R. mehelyi* in Croatia: in all cases, dubious specimens belonged, with a high degree of certainty, to another species, *R. euryale*. The reason for the wrong determination was insufficient knowledge of the variability of the two morphologically similar species in the years when the findings were published.

Key words: *Rhinolophus mehelyi*, Croatia, finding validation

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Bilješke koje su nađene u ostavštini hrvatskog mamaloga prof. dr. Beatrica Đulić pomogle su da se rasvijetli vjerodostojnost nalaza vrste *Rhinolophus mehelyi* Matschie, 1900 u Hrvatskoj u razdoblju od 1952 do 1968 godine. Kako dokazni primjerci ove vrste nisu sačuvani, analizom originalnog opisa nađenih primjeraka i njihovih mjera zapisanih u terenskoj bilježnici kao i onih publiciranih (ĐULIĆ, 1959, 1961), te usporedbom s danas poznatim karakteristikama dvije slične vrste istog roda utvrđeno je da nema dokaza da se radilo o nalazima *R. mehelyi* u Hrvatskoj, nego da su sporni primjerci s velikom sigurnošću pripadali vrsti *R. euryale*. Razlog krive determinacije je bilo nedovoljno poznavanje varijabilnosti ovih morfološki sličnih vrsta u doba publikacije nalaza.

Ključne riječi: *Rhinolophus mehelyi*, Hrvatska, validacija nalaza

INTRODUCTION

Findings of the Mediterranean cryptic species *Rhinolophus mehelyi* (Matschie, 1901) in Croatia were published only in the early papers of the late Croatian mammalogist Beatrica Đulić (ĐULIĆ, 1953a, 1953b, 1959, 1960, 1961) and in one professional report (HENEBERG *et al.*, 1968). From 1994, this species was given on the Red List of Croatian Mammals as a Rare Species (ĐULIĆ, 1994). In the present mammal collections, there are no voucher specimens, but the findings in Croatia have been presented in the current distribution map of the species range in Europe (GAISLER, 2001), and in the Atlas of European Mammals as data without evidence to suggest that it has become extinct (KRYŠTUFEK in MITCHELL-JONES *et al.*, 1999). Finally, the species is on the official list of Croatian mammals considered as being regionally extinct (TVRTKOVIĆ & PAVLINIĆ, 2006). In the meantime,

Professor Đulić's personal notes have been discovered: her first field book (1952 – 1956), and the manuscripts of her first congress report in 1953 (ĐULIĆ 1953b), with more data about the first finding of this species in Croatia, which have been used to check the reliability of the identification.

In 1950, as a junior assistant in the Institute of Biology of the Yugoslav Academy of Science and Arts in Zagreb, Beatrica Đulić had a special interest in bats. Nobody in Zagreb at the Faculty of Science, in the museum or in the Biological Institute was involved in bats or small mammals, and she was self-educated in mammalogy. The literature about bats at this time in Zagreb was poor, and there were only a few books and papers about them in the local Zoological Museum, where a small collection of bats, mostly from the Zagreb vicinity, was deposited. The most informative book for bat taxonomy and distinction between species was the Catalogue of the Mammals of Western Europe by Gerrit Miller (MILLER, 1912) in the Collection of the British Museum. In the Zoological Museum library she found a faunistic paper by zoologist Stanko Karaman, who published information on the bats from the Zagreb museum collection (KARAMAN, 1929), together with some findings of his own investigations in caves near Zagreb. Karaman noted only the possibility that, of the examined *R. euryale* from the Zagreb museum collection sample (n=35), some specimens with larger forearms were probably *R. mehelyi*, but he left them under the name *R. euryale*. The list of bats and the localities given by Karaman were Đulić's starting point for her fieldwork.

Đulić's self-supported fieldwork started in January 1952 with the first sampling of bats in Veternica Cave near Zagreb. Her first bats were two specimens of *Rhinolophus hipposideros*, found on 14.01.1952. During her second visit to Veternica (15.05.1952), at the entrance of the cave, she found eight *R. euryale*-like specimens. In her unpublished manuscript (Fig. 1, Tab. 1), it was noted that the three (largest) males had external measurements within the known variability of *R. mehelyi* as published by MILLER (1912). The upper saddle process from the noseleaf cutaneous outgrowths looked to her slightly different from that in the other five, smaller, *R. euryale* from the cave. The tip of the upper saddle process was „smaller than in the lower process” and „the subside margin between the upper and lower saddle process [was] concave”, probably not too deep as in the smaller *R. euryale*. Concerning the lancet she noted only that it „was concave”, probably more so than in the drawing of the lancet in *R. euryale* from MILLER (2012: p.138). Đulić concluded that she had found a true *R. mehelyi* together with *R. euryale*. The finding of *R. mehelyi* was published firstly in *Speleolog*, the specialist journal of the local Speleological Club (ĐULIĆ, 1953a) and in her congress lecture abstract as a new bat species for Yugoslavia (ĐULIĆ, 1953b), without reports with supporting data.

In the first overview of Croatian bat fauna, ĐULIĆ (1959) added for *R. mehelyi* two new localities (Mandalina Cave near Šibenik: two specimens in 1954, and Donja Cerovačka Cave near Gračac: one specimen in 1956), and presented external measurements for four specimens and some skull measurements for one specimen (ĐULIĆ, 1959: Tab. 14), both without any designation of localities. With the help of data from unpublished manuscripts and her first field book, in which there are data for Mandalina Cave, we are sure that in the Table there were external measurements of specimens from Veternica Cave and Donja Cerovačka Cave (Tab. 1), but the locality for the specimen with skull measurements remains unresolved. Her last locality was Močiljska Cave near Dubrovnik in 1959 (ĐULIĆ, 1961), from which she presented external measurements of two males and six females designated with her collection numbers (11–18/1). All these data were from the wintering period (November – December). The last finding of *R. mehelyi* in Croatia

in June 1968 was published by HENEGER *et al.* (1968), who mentioned a colony of 5–10 specimens of *R. mehelyi* in Zatonska Sea-cave (= Rafova Cave in PAVLINIĆ *et al.*, 2010) near Zaton Mali in the vicinity of Dubrovnik. From this small summer colony, five specimens were killed for pathohistological and serological investigations. In the list of references from the sources offering help in identification, there was only one paper of ĐULIĆ (1959).

During intensive fieldwork for the first distribution atlas of Croatian bats from the European Habitat Directive, a bat-team from the Croatian Natural History Museum in Zagreb visited several times all the localities with historical indications for *R. mehelyi*, but only *R. euryale* was found, and never *R. mehelyi* (TVRTKOVIĆ & PAVLINIĆ, 2006, PAVLINIĆ *et al.*, 2010).

SHORT ANALYSIS OF PUBLISHED AND UNPUBLISHED DATA

The main differences between two morphologically similar species, *Rhinolophus mehelyi* and *R. euryale*, apart from the mostly darker colour around the eyes, lie in the noseleaf structures, lancet and upper saddle process, and in the antitragal lobe (GAISLER, 2001, DIETZ & VON HELVERSEN, 2004) (Tab. 1). The differences in the size of the body and the skull shape (e.g. forearm length) are mostly different in the median values; in *R. mehelyi* the values are greater, in *R. euryale* lesser, but all the measurements have a lesser or higher overlapping in dimensions. Only the bivariate plot of the zygomatic width against the upper tooth-row length (C-M³) separates both species faultlessly (FELTEN *et al.*, 1977).

In the middle of the last century, in 1952, when Beatrica Đulić, after graduating from the Faculty of Science in Zagreb, started her research into bats, knowledge about the variability of the Mediterranean species *R. mehelyi* was scarce, because only limited samples of specimens had been investigated. MILLER (1912), in an analysis of a small sample (n = 55), found three main differences in the external features between *R. euryale* and *R. mehelyi*: in (1) the length of forearms; (2) the length and ratio of the fourth finger phalanges; and in (3) the different feature of the lancet (Tab. 2). These characteristics are presented in his Key to the European Forms of *Rhinolophus*:

MILLER (1912): Key to the European forms of *Rhinolophus* (part of external morphology only):

- Size smaller, forearm 44.6 – 49 mm;
- gradation between phalanges of fourth finger abrupt (ratio from first to second about 38);
- point of lancet gradually narrowed, never linear; *R. euryale*
- Size larger, forearm 48.6 – 51.4 mm;
- gradation between phalanges of fourth finger less abrupt (ratio about 44);
- point of lancet linear; *R. mehelyi*

The first two features from specimens caught in Veternica Cave are the same as Miller's *R. mehelyi* (Tab. 1. and Tab. 2). But after SCHOBER & GRIMMBERGER (1988), GAISLER (2001) and DIETZ & VON HELVERSEN (2004), these forearm values can be seen to overlap with the values of *R. euryale* (Tab. 2). The length and ratio of the fourth finger phalanges are no longer useful for determination after an insight into a larger sample (FELTEN *et al.*, 1977). For the lancet, Đulić had no picture for comparison, and her description of the lancet (Fig. 1) was too slight (only „lancet concave”), but in *R. euryale* the lancet is com-

Tab. 1. Main external characteristics of *Rhinolophus mehelyi* from Croatia (1953–1961) and in prof. Đulić's manuscripts (1953), and the same characteristics for *R. mehelyi* from MILLER (1912), GAISLER (2001) and DIETZ & VON HELVERSEN (2004)

Rhinolophus mehelyi	"CROATIAN SPECIMENS" Đulić manuscript 1953 ĐULIĆ 1953–1961*	MILLER 1912 – key – diagnosis* – external characters description**	GAISLER 2001 – diagnosis – description*	DIETZ & VON HELVERSEN 2004 – key
differences in size:	*forearms 48–51,2 (n=12)	forearms 48,6–51,4 mm	forearms 48–55,5 mm	forearms 48,2–54,8 mm
noseleaf differences: lancet	margins concave;	point of lancet linear; *abruptly narrowed to a linear tip; **very abruptly narrowed above middle to a distinctly linear tip; no pictures!	abruptly narrowed in upper part to a distinctly thin tip;	abruptly narrowed above the middle to a distinctly linear tip;
upper saddle process	tip smaller than in lower process;	no comments no pictures	relatively blunt and only slightly longer than the lower process;	relatively blunt in profile and only slightly longer than the lower process;
subside margin between upper and lower saddle process	concave but not to deep as in <i>R. euryale</i> ;	no comments no pictures	no comments (only slightly concave on Abb. 20, p.92)	no comments (very deep concave on photo 42, p.20)
ear differences: antitragal lobe	no comments	**relatively broad and low; (scarcely half as height as conch, its width slightly greater than height);	*only in description: great and from posterior auricle separate with one strong notch;	not half as high as the conch, its width is greater than the height, it is strongly indented close to the connection to the ear
wing differences: fourth finger: phalanges length	*P4.1/P4.2 = 38,5–47,6 %	first phalanx decidedly more than one-third as long as second;	*only in description cited Felten et al. 1977: to large overlap in a large sample!	no comments, only presented minimal and maximal values of both phalanges;

Tab. 2. Measurements of Croatian specimens of horseshoe bats identified and published as *Rhinolophus mehelyi* by B. ĐULIĆ (1953, 1955, 1959, 1960, 1961) and data from MILLER (1912), FELTEN *et al.* (1977), SCHÖBER & GRIMMBERGER (1998), GÄISLER (2001) and DIETZ & VON HELVERSEN (2004) for *R. euryale* and *R. mehelyi*. VE = Vaternica cave near Zagreb, Croatia (ĐULIĆ 1959); DCE = Donja Cerovačka cave near Gračac, Croatia (ĐULIĆ, 1959); MO = Močiljska cave near Dubrovnik, Croatia (ĐULIĆ, 1961). HB = Head and body length; T = Tail length; FA = Forearm length; P4.1 = fourth finger first phalanx length; P4.2 = fourth finger second phalanx length.

	Miller 1912	VE1 15. May 1952	VE2 15. May 1952	VE3 15. May 1952	DCE 29. Nov 1956	MO1 29. Dec 1959	MO2 06. Dec 1959	MO3 06. Dec 1959	MO4 06. Dec 1959	MO5 06. Dec 1959	MO6 06. Dec 1959	MO7 06. Dec 1959	MO8 06. Dec 1959	Schober & Grimm. 1998	Dietz & v.H.2004 Gaisler 2001* Felten <i>et al.</i> 1977**	Dietz & v.H.2004 Gaisler 2001* Felten <i>et al.</i> 1977**
	<i>R. mehelyi</i>													<i>R. euryale</i>	<i>R. mehelyi</i>	
HB	51-64	♂	59,5	♂	♂	♀	♀	♀	♀	♀	♀	♂	♂			
T	23-27,6	26	27	27,5	28,5	-	28	29	28	27	27,5	31	26	22-30	20,6-36,6*	
FA	48,6-51,4	50,5	50	51,2	50	49	48,5	50	48,5	48	48	48	49	43-51	48,2-54,8 48-55,5*	
P4.1	7,2-8,0	7,5	7,8	8,0	8,2	8,0	6,8	7,0	6,8	7,0	7,0	7,0	6,6-8,5	5,7-8,2 6,2-8,0**	6,5-9,3	
P4.2	17,4-19,0	17,6	18,2	18,8	17,2	17,8	17,5	18,5	17,5	18,0	18,0	17,8	17,9-19,1	16,4-18,1 16,5-20,0**	17,4-21,5	
ratio P4.1/ P4.2	41,4-44,4	42,6	42,8	42,6	47,6	44,9	38,9	37,8	38,9	38,9	38,9	39,3	38,5		37,7-45,9**	
	n = 12													n=133**	n=180**	

Rhinolophus mehelyi Matschie

Da Rh. mehelyi Karaman se nije mogao odlučiti, sudući po dužini krila da li da neke primjerke vrste Rh. euryale stavi u XU vrstu Rh. mehelyi. ~~XXXXXXXXXXXX~~
~~XXXXXXXXXXXX~~XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX1952XXXXXXXXXXXX primjerka Za opis ove vrste raspolagala sam vrlo oskudnom literaturom. U špilji Veternici uhvaćena su polovicom svibnja 1952 3 primjerka, za koje bi se moglo po nosnom nastavku i mjerama zaključiti da pripadaju vrsti Rh. mehelyi. Na nosnom nastavku kod ove vrste rubovi lancete su konkavni, a na sedlu gornji šiljak je manji od onog kod Rh. euryale i pada lagano prema donjem šiljku, a udubina između njih nije tako velika ~~XXXX~~ kao kod Rh. euryale. (2)

Ovaj nalaz u Veternici bio bi ujedno i prvi podatak o toj vrsti za našu zemlju.

Fig. 1. Excerpt from unpublished extended manuscript „Contribution to knowledge of bat fauna in Zagreb vicinity” of Beatrica Đulić, junior assistant in Institute of Biology JAZU, Zagreb, for presentation on I. Congress of Yugoslavian Biologists, Zagreb 12.-15.07.1953; first (older) version.

Nalazište:		Pecina Mandalina, 29. XI. 1954		Pecina pećnati, 11. XI. 1954	
Spol:		♂ prep.	♂ prep.	♀ prep.	♂ prep.
Prmj:	Vrsta:	Rh. mehe-lyi	Rh. mehe-lyi	Rh. euryale	Rh. euryale
glava i tijelo - s led. str.		6,8	6,5	5,62	5,3
----- s lab. str.					
tijelo - s led. str.					
----- s strb. str.					
tijelo bez glave - s led. str.					
----- s strb. str.					
Rep - trbušno-leadne strana		3,85	3,9	3,1	3,25
Nadlaktica - trbušno-leadne str.					
Podlaktica - trbušna strana			4,6		
	leadna strana	4,4		4,2	4,63
Noga - - - - - gor. dio		2,16	1,9	1,4	1,71
	dolj. dio	1,86(2,2)	2,08(2,9)	1,9(2,26)	1,9(2,2)

Fig. 2. Excerpt from first field-book („Measurements of bats, 1952 – 1956”) of Beatrica Đulić, junior assistant in Institute of Biology JAZU, Zagreb. External measurements of *Rhinolophus mehelyi* from Mandalina cave (Pecina Mandalina) from 29.11.1954. Glava i tijelo (Head and body), Rep (Tail), Podlaktica (Forearm) = 4,4; 4,6 cm, Noga (Hind foot).

monly slightly concave too: this is for example visible from a drawing on p.138 in MILLER (1912). Đulić was sure that she had discovered other new specific differences in the saddle process (Fig. 1, Tab. 1). But, after seeing these features in many *R. euryale* in the field, we know that these differences in the saddle process are nothing but variability within the *R. euryale*, and any similarity with *R. mehelyi* in her description is excluded

(compare with the saddle description in GAISLER 2001 and DIETZ & VON HELVERSEN 2004). Her mistake lay in never sending voucher specimens of this supposedly new species for Yugoslavia at this time to one of the European chiropterologists, with whom she had good contacts, to check her determination (for example Benedetto Lanza in Bologna, or Heinz Felten in Frankfurt am Main).

From Tab. 2 it can be seen that all external measurements of the 12 Croatian „mehelyi” specimens (Veternica Cave, Donja Cerovačka Cave, Močiljska Cave) are within the variability of *R. euryale*. For two specimens from Mandalina Cave (ĐULIĆ, 1959, 1960), for which there are only the measurements recorded in ĐULIĆ’s field book, the forearm lengths were 44 and 46 mm (Fig. 2), smaller than the known minimal values for *R. mehelyi* (Tab. 2). In ĐULIĆ (1959), there are some measurements of one skull (without locality), but, unfortunately, without any values for the only usefully informative „zygomatic breadth” or „upper tooth row (C-M³)”, they are not helpful either. In her collection in the Zoological Department of the Faculty of Science in Zagreb we found only the skulls of *R. mehelyi* from Romania (Gura Dobroge I, date 19.09.1966, from an unknown collector, Coll. no. 2106-9, 2011-12), probably voucher specimens from published chromosomes of this species (ĐULIĆ & SOLDATOVIĆ, 1969). Identification of the last Croatian „*R. mehelyi*” finding in 1968 (HENEBERG *et al.*, 1968) from Josip Bakić (Zatonska Sea-cave) was performed only with the value of the measurements published in ĐULIĆ (1959), because he never had in his hand any other publication giving information on the determination of this species (J. Bakić, personal information).

Finally we have: (1) an unclear lancet description, (2) saddle processes like *R. euryale*, (3) external measurements in the overlap zone of *R. euryale* and *R. mehelyi*, but from the same localities together with an undoubted *R. euryale* (Veternica Cave and other localities near Zagreb, Močiljska Cave). The only possible conclusion is that we have no genuinely documented evidence for the finding of the species *Rhinolophus mehelyi* in Croatia; in all cases, the dubious specimens were with a high degree of certainty just larger *R. euryale* specimens. All published information regarding findings of *R. mehelyi* in Croatia resulted from misidentification.

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Documentation of *Rhinolophus „mehelyi „* in Croatia

- *WL67 Zagreb: Borčec, cave, 18.03.1902, in sample of 3 *R. euryale* 1 bat FA=50 mm, leg. V. Slabnik, HPM135, 137, 147 (KARAMAN 1929: as *R.euryale*, with suspect to *R.mehelyi*?);
- *WL67 Zagreb: Podsused – Stenjevec, 27.03.1902, in sample of 20 *R. euryale* 1 ♂ + 3 ♀♀ FA= 49,5; 49,7; 50 mm, HPM (KARAMAN 1929: as *R.euryale*, with suspect to *R.mehelyi*?);
- *WL64 Pisarovina, church loft, 29.03.1902, in sample of 14 *R. euryale* 1 ♂ + 3 ♀♀, FA= 49,5: 50 mm, leg. V. Slabnik, HPM, only note in old documentation (KARAMAN 1929: as *R.euryale*, with suspect to *R. mehelyi*?);
- WL67 Medvednica Mt.: Veternica cave, 16.05.1952, in sample of 8 *R. euryale* 3 ♂♂, leg. et det. Beatrica Gjulić (ĐULIĆ 1953a, 1953b, 1959, 1994);
- WK70 Donja Cerovačka pećina, in the cave 1200 m from the entrance, 29.11.1956, 1 ♂, leg. et det. Beatrica Gjulić (DJULIĆ 1959, 1994);
- WJ95 Šibenik: Mandalina, marine cave, 29.11.1954, 2 ♂♂, (FA = 44!; 46!) leg. et det. Beatrica Gjulić (DJULIĆ 1959, 1960, 1994);
- BN63 Dubrovnik: Močiljska cave, 06.12.1959, 33 bats in hibernation with *R. blasii*, 2 ♂♂ + 6 ♀♀ leg. et det. Beatrica Đulić, Coll. no. 11/1 – 18/1, but not found in collection (ĐULIĆ 1961, 1994);
- BN53 Zaton Mali: Rafova cave (= Zatonaska pećina), 06.1968, from colony of 5 –10 bats, 5 specimens leg. et det. Josip Bakić (HENEBERG *et al.* 1968);