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PLECOTUS MICRODONTUS (MAMMALIA, VESPERTILIONIDAE), A NEW BAT SPECIES FROM AUSTRIA

FRIEDERIKE SPITZENBERGER[1], ELISABETH HARING[1] & NIKOLA TVRTKOVIĆ[2]

[1]Naturhistorisches Museum Wien, Burgring 7, A-1014 Wien, Austria

[2]Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia

Spitzenberger, F., Haring, E. & Tvrtković, N.: *Plecotus microdontus* (Mammalia: Vespertilionidae), a new bat species from Austria. Nat. Croat., Vol. 11, No. 1., 1–18, 2002, Zagreb.

SPITZENBERGER *et al*. (2001) reported the existence of more than two different genetic clades within long-eared bats in Austria. A genetic analysis of one specimen from the Dalmatian island of Lastovo (Croatia), close to the locus typicus of *Plecotus kolombatovici*, and an additional morphological analysis of specimens from some other Dalmatian islands revealed the fact that in contrast to the previous interpretation, clade 2 in SPITZENBERGER *et al*. (2001) does not represent *P. kolombatovici*, which is a separate species related to *P. austriacus*. Clade 2 has to be considered a new species, *P. microdontus* n. sp., which is the sister group of *P. auritus*. It is distinguishable in external, skull and teeth characters from other European *Plecotus* species. It is known from the Alps between Liguria and Slovenia.

Key words: Vespertilionidae, *Plecotus*, new species, mitochondrial DNA, morphological characters, Austria

Spitzenberger, F., Haring, E. & Tvrtković, N.: *Plecotus microdontus* (Mammalia: Vespertilionidae), nova vrsta šišmiša iz Austrije. Nat. Croat., Vol. 11, No. 1., 1–18, 2002, Zagreb.

SPITZENBERGER *et al*. (2001) su objavili da u Austriji postoji više od dvije genetički različite grupe dugouhih šišmiša. Genetička analiza jednog primjerka šišmiša ove skupine s dalmatinskog otoka Lastova (Hrvatska) koji je neposredno uz locus typicus vrste *Plecotus kolombatovici*, te dodatna morfološka analiza primjeraka s drugih dalmatinskih otoka, pokazali su suprotno prethodnom objašnjenju da grupa 2 u SPITZENBERGER *et al*. (2001) ne predstavlja vrstu *P. kolombatovici*, koja je odijeljena vrsta srodna s *P. austriacus*. Za navedenu grupu 2 iz tog rada smatramo da predstavlja za znanost novu vrstu, *P. microdontus* n. sp., koja pripada grupi *P. auritus*. Ona se od ostalih europskih vrsta roda *Plecotus* razlikuje u vanjskoj morfologiji, značajkama lubanje i zubiju. Poznata je iz Alpa u području između Ligurije i Slovenije.

Ključne riječi: Vespertilionidae, *Plecotus*, nova vrsta, mitohondrijalna DNK, morfološke značajke, Austrija

INTRODUCTION

In recent times several authors studied species diversity within the genus *Plecotus* in Europe. Based on mitochondrial DNA-sequences of European vespertilionid bats KIEFER *et al*. (2000) reported the existence of four genetically highly divergent groups. Nevertheless, the dendrogram in MAYER & HELVERSEN (2001) based on the ND2 sequence contained only three clades within *Plecotus*. They were assigned to *P. auritus*, *P. austriacus* and *P. austriacus kolombatovici* from Croatia and Greece. While the genetic distance between the brown and the grey long-eared bat was very high, *austriacus* and *kolombatovici* were less well differentiated. Our genetic analysis (SPITZENBERGER *et al*., 2001) also revealed the existence of three lineages (depicted as clades 1–3 in Fig. 1). Using uni- and multilateral analyses of cranial measurements these lineages were classified as representing *P. austriacus* (clade 1), *P. auritus* (clade 3), and *P. kolombatovici* (clade 2).

Only when a freshly collected plecotine bat from the Dalmatian island Lastovo became available for a genetic analysis did it appear that the allocation of clade 2 in our former paper to *P. kolombatovici* was wrong. The result of the sequence analysis of the Dalmatian bat indicates that clade 2 is not identical with *kolombatovici* but represents a yet undescribed species. Genetic distances in the mitochondrial control region (CR) between this new species and *P. auritus*, the next related species in the dendrogram, ranges from 14.0–17.5% (SPITZENBERGER *et al*., 2001).

The aim of this paper is to describe the taxon representing clade 2 as a new species and to compare its morphological features with those of *P. auritus*, *austriacus*, and also of *kolombatovici*, which it resembles closely in size and skull proportions. The author of the new species is F. Spitzenberger.

MATERIAL AND METHODS

Genetic analysis

The specimen of *P. kolombatovici* (NMW 62004, in the dendrogram: Plekol-1) was collected in June 2001 on the Dalmatian island of Lastovo. DNA extraction from fresh tissue, PCR amplification, cloning and sequencing were performed as described previously (SPITZENBERGER *et al*., 2001). PCR primers for the tRNA-Pro and tRNA-Phe genes (Pro+, Phe-; HARING *et al*., 2000) were used to amplify the complete mitochondrial control region (CR). For sequence analysis and dendrogram calculation a section of the 3´-end of the CR described previously (SPITZENBERGER *et al*., 2001) was used. The neighbour-joining dendrogram based on (p-distances) (NJ; SAITOU & NEI, 1987) was calculated with the software package PAUP (test version 4.0b3a; SWOFFORD, 2001) using *Myotis bechsteinii* as outgroup. The sequence determined in the course of the present study is registered under the following GenBank accession numbers (AF 49826).

Morphological analysis

Specimens examined:

New species: Austria, n = 27; Eastern Tyrol: Panzendorf 1 ♀ (1 skin +1 skull) 22.7.1977 (NMW 33344); Lienz 2 ♂, 6 ♀♀ (8 skins + 7 skulls) 5. 6. 1974 (NMW 57512), 19. 5. 1980 (NMW 34853-59); Tristach 2 ♀♀ (2 alc. + 2 skulls) 7. 5.1977 (NMW 36983- 84); Hopfgarten 1 ♂ (1 skin + 1 skull) 26. 8. 1984 (NMW 42563); Anras 1 ♀ (1 skin + 1 skull) 25. 8. 1984 (NMW 42565). Northern Tyrol: Weerberg 5 indet. (5 skulls + 4 skel.) 1991 (NMW 42270-73), 1993 (NMW 51139); Ried im Oberinntal 1 indet. (1 skull) 28. 7. 1988 (NMW 50466). Salzburg: Mauterndorf 1 ♂ (1 skull) 25. 8. 1992 (NMW 56150). Carinthia: Globasnitz 1 ♂ (1 skin + 1 skull) 23. 6. 1985 (NMW 42564); Dellach/Drautal 1 ♀ (1 skull + 1 skel.) 28. 8. 1984 (NMW 50467); Rennweg 1 indet. (1 skull + 1 skel.) 8. 8.1987 (NMW 50468); Obervellach 1 ♂ (1 skull + 1 skel.) 21. 8. 1989 (NMW 50469); Moosburg 1 ♂ (1 skull + 1 skel.) 11. 9. 1989 (NMW 50470); Hermagor-Presseger See 1 indet. (1 skull + 1 skel.) 6. 9. 1978 (NMW 55994); Wernberg 1 ♂ (1 alc. + 1 skull) 31. 8. 1997 (NMW 57249).

Comparative material:

New species: Slovenia, n = 1: Zgornje Jezersko 1 ♂ (1 alc. + 1 skull) 31. 8. 1984 (NMW 55502); Italy, n = 2: San Remo, Liguria 1 indet. (1 alc. + 1 skull) 7. 7. 1972 (NMW 15005); San Leonardo, Val Passiria, Trentino 1 ♀ (1 alc. + 1 skull) 27. 7. 1908 (NMW 29877).

94 *P. auritus* and 105 *P. austriacus* from Austria as in SPITZENBERGER *et al*. (2001).

Plecotus kolombatovici: Dalmatia, Croatia, n = 6: Lastovo 2 ♀♀ (2 alc. + 2 skulls) 15. 6. 2001 (CNHM 6113, NMW 62004); Sušac 1 ♂ (1 alc. + 1 skull) 11. 5. 1997 (CNHM 6010); Mrčara 1 ♂ (1 alc. + 1 skull) 14. 6. 2001 (CNHM 6114); Sv. Andrija 1 ♂ (1 alc. + 1 skull) 8. 6. 1996 (CNHM 6001); »Dalmatia« 1 ♂ (1 alc. + 1 skull) ? 1900 (NMW 29860).

P. austriacus kolombatovici Đulić, 1980 was described from the Dalmatian island of Korčula (near the island of Lastovo). The type as well as further material of this taxon, listed in ĐULIĆ (1980) as being deposited in the Department of Zoology, University of Zagreb (head Prof. Dr. M. Kerovec), could not be made available for this investigation.

Measurements of the canines and first upper incisors were taken with an accuracy of 0.001 mm using a binocular (Leica, Wild M 8 with a Mitutoyo plane table). Body and skull measurements of *P. auritus*, *austriacus*, and the new species were taken from SPITZENBERGER *et al*. (2001). Of *P. kolombatovici* these measurements were taken using the same methods as described in SPITZENBERGER *et al*. (l. c.).

To stain the baculum we followed standard methods (cf. ANDERSON, 1960): The dried phallus was removed from a study skin and cleared in 3% KOH for 7 hours. Then several drops of alcoholic Alizarin Red-S solution were added, the amount of it being increased again on the second day. The well stained baculum was then isolated and passed through increasing concentrations of glycerine to be finally stored

in pure glycerine. For measuring and taking pictures the baculum was put on a slide with a drop of glycerine.

RESULTS

Genetic analysis

The complete CR sequence of the Dalmatian *P. kolombatovici* specimen (Plekol-1) was determined. As it is the case with the CRs of other *Plecotus* species, Plekol-1 contains several repetitive sections which are not comparable between taxa. For interspecific sequence comparisons, the 210-bp section of the 3´-end was integrated into the alignment of the sequences analysed previously (SPITZENBERGER *et al.*, 2001). Fig. 1 shows the NJ dendrogram calculated from this alignment. The new sequence (Plekol-1) clearly clusters with the Turkish specimen (Plesp-TR), forming the sister group of the *P. austriacus* clade (clade 1). All main nodes are supported by high bootstrap values.

This result indicates that the taxon that was previously assigned to *P. kolombatovici* (SPITZENBERGER *et al.*, 2001) should be considered another as yet undescribed species that represents the sister group of *P. auritus*.

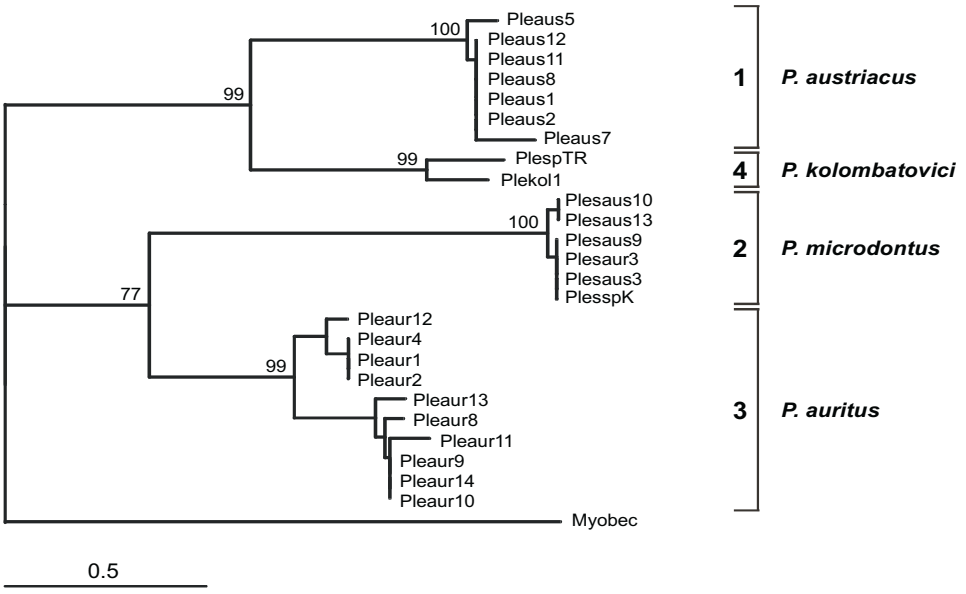

Fig. 1. Neighbour-joining tree based on partial CR sequences of *Plecotus* spp. Bootstrap values (%, 1000 replicates) are given at the major nodes. Clades 1–3 correspond to clades in SPITZENBERGER *et al.* (2001). Abbreviations of specimens are the same as in this previous study.

In contrast to the previous interpretation, *P. kolombatovici* (clade 4) is more closely related to *P. austriacus* (clade 1). The mean distance between *P. austriacus* and *P. kolombatovici* measures 12.1% in this section of the CR. High distances (at least 11%) between these two taxa, which were considered to be in the range of interspecific differences, were also found in another mitochondrial gene, the ND1 gene, by MAYER & HELVERSEN (2001). The distances between the CR sequences of *P. auritus* and the new species (14.0–17.5) and between *P. austriacus* and *P. auritus* and the new species respectively (20.3–30.2) are even higher (SPITZENBERGER *et al*., 2001). This clear differentiation justifies specific rank for these four *Plecotus* taxa.

Plecotus microdontus n. sp. Spitzenberger

Holotype: NMW 34857, ♂, 19. May 1980; collected by Kurt Bauer and Barbara Herzig. Skin and skull (left bulla tympani missing); genetically analysed; baculum prepared.

Measurements: Hbl 49.9, T 48.0, Ear 34.0, weight 6.4g, FA^{+} 39.6, Gsl 16.7, Ccl 14.7, Cbl 15.2, Bh^{+} 7.4, Bb 8.1, Mb 9.0, Zb 8.4, Iob 3.5, C-C 3.6, M^3-M^3 5.9, C-M^3 5.4, Cl 1.8, I^1l 0.9, DBt 4.5, M 10.4, C-M_3 5.8, Corh 2.8 mm.

Type locality: Lienz, Eastern Tyrol, Austria; 688 m above sea level.

Paratypes: NMW 34853-34856, 34858-34859, 6 ♀♀, 19.May 1980, K. Bauer and B. Herzig; NMW 57512, ♂, 5. June 1974, M. Eder; Lienz, Austria.

Diagnosis

External characters generally as in *P. auritus*, but forearm longer, thumb and thumb claw shorter, dorsal fur darker and more greyish than in *P. auritus*. Anterior part of the muzzle bulging and almost naked (Fig. 2). A hard triangular pad that is extended towards the chin exists in the central part of the lower lip (Fig. 7).

Fig. 2. Face of *Plecotus microdontus*, n. sp.

Tab. 1. Body and skull measurements of *Plecotus auritus* from Austria.

	male					female				
	mean	s	min	max	n	mean	s	min	max	n
Hbl	48.76	3.36	42.00	55.00	40	50.42	3.93	42.00	59.00	36
T	42.75	2.99	36.00	50.00	40	43.83	3.59	33.00	49.50	36
Ear	36.71	2.09	31.80	40.40	34	35.51	2.61	26.20	40.00	34
Weight	6.53	1.35	4.00	9.00	29	7.70	1.54	5.00	10.80	18
FA+	39.71	1.25	35.10	41.80	42	40.04	1.39	35.10	43.20	46
FA-	38.84	1.34	34.60	40.90	24	39.08	1.30	34.10	41.60	45
Gsl	16.52	0.26	15.83	17.02	46	16.56	0.32	15.71	17.13	48
Ccl	14.33	0.25	13.77	14.84	45	14.39	0.29	13.79	14.84	46
Cbl	14.90	0.27	14.33	15.55	46	14.99	0.28	14.48	15.49	46
Bh^+	7.36	0.16	7.11	7.79	41	7.36	0.16	6.92	7.66	41
Bb	8.40	0.17	7.98	8.74	44	8.37	0.19	8.05	8.78	46
Mb	8.90	0.26	7.55	9.21	42	8.85	0.20	8.39	9.33	43
Zb	8.68	0.18	8.31	8.98	38	8.60	0.20	8.19	9.09	45
Iob	3.63	0.11	3.40	3.86	45	3.60	0.11	3.37	3.89	48
C-C	3.76	0.12	3.35	3.98	44	3.75	0.14	3.29	3.99	47
M^3-M^3	6.24	0.20	5.68	6.65	43	6.25	0.25	5.56	6.67	47
C-M^3	5.33	0.10	5.10	5.52	44	5.33	0.16	4.85	5.61	48
Cl	1.62	0.10	1.47	1.77	9	1.67	0.14	1.43	1.85	9
I^1l	0.96	0.06	0.86	1.03	9	1.00	0.07	0.87	1.09	9
DBt	4.08	0.11	3.85	4.41	43	4.04	0.10	3.82	4.17	43
M	10.55	0.19	10.22	10.93	44	10.58	0.24	10.02	11.07	48
C-M_3	5.71	0.13	5.44	5.99	46	5.74	0.14	5.42	6.00	48
Corh	2.88	0.14	2.63	3.20	45	2.91	0.10	2.68	3.15	47

Skulls of Austrian specimens of *P. microdontus*, *austriacus*, and *auritus* can be distinguished by using the following canonical discriminant functions

$$X = -0.07278*Ccl + 0.05374*C\text{-}M^3 + 0.13652*M + 0.18976*C\text{-}M_3 + 0.48842*dBt \text{ and}$$

$$Y = -0.11727*Ccl + 0.16848*C\text{-}M^3 + 0.27054*M + 0.08229*C\text{-}M_3 - 0.53452*dBt$$

(SPITZENBERGER *et al.*, 2001). As the skull measurements used for computing the discriminant functions are very similar in *P. microdontus* and *kolombatovici*, these two species must be separated by using the relations between length of I^1 and length of canine (Fig. 3).

Derivatio nominis: The species name *microdontus* refers to the fact that the length of the first upper incisor in relation to the length of the upper canine of *P. microdontus* is smaller than in the other three species (Fig. 3).

Distribution: The known distribution comprises the Alps from Liguria (Italy) in the west to Trentino Alto Adige and Slovenia in the east. The species is known in Austria from North and East Tyrol, Carinthia and Salzburg (SPITZENBERGER *et al.*, 2001).

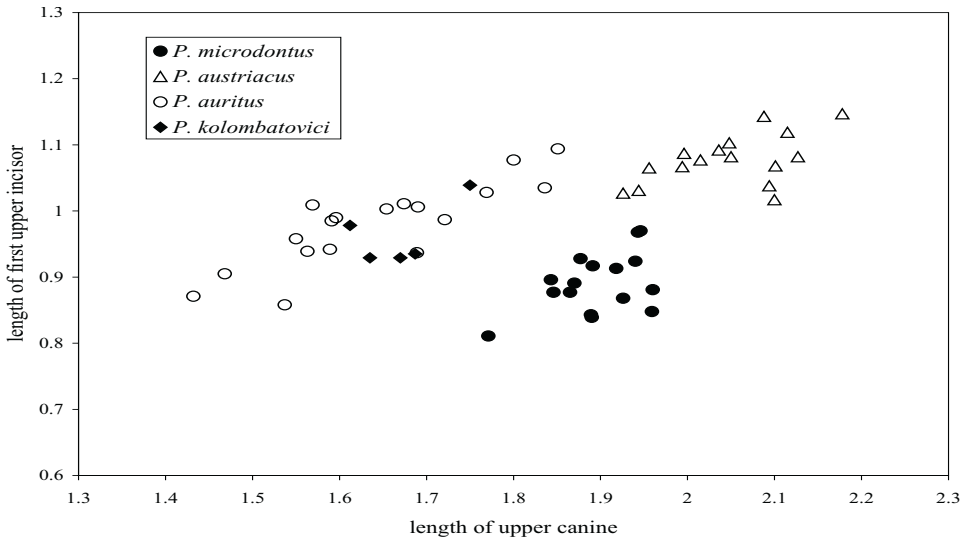

Fig. 3. Correlation between length of upper canine and length of I^1in *Plecotus auritus*, *P. microdontus*, and *P. austriacus* from Austria and *P. kolombatovici* from Dalmatia, Croatia.

Description

External characters

Fur: Dorsal side of *P. microdontus* greyish brown, base of hairs dark brown, darker than in *P. auritus.* Ventral side light grey.

Forearm (FA^+) of *P. microdontus* in its mean length (Tab. 2) exceeds the values of *auritus* and *austriacus* and is absolutely longer than in *kolombatovici* (Tab. 1, 3, 4).

The length of the ear of *P. microdontus* is more or less equal in size to *P. auritus* and *austriacus* (Tab. 2), but on average smaller than in *kolombatovici* (Tab. 3).

Thumb, thumb claw (Fig. 4), **toes and toe claws** (Fig. 5) of *P. microdontus* resemble in length and proportions those of *P. auritus*, but are shorter in *P. microdontus* than in the brown long-eared bat. These characters separate *P. microdontus* from *kolombatovici* and *austriacus*, in which these features are distinctly shorter.

Feet of *P. microdontus* are sparsely haired with long vibrissae like in *P. auritus*. In *P. kolombatovici* and *P. austriacus* these vibrissae are missing (Fig. 5).

Facial part of the head. STRELKOV (1988) recommended features on the muzzle as distinguishing characters between *P. auritus* and *austriacus*. In *P. microdontus* the anterior part of the muzzle is considerably bulging, forming a sparsely haired arch around the nostrils (Fig. 2) which is pink in living animals. In this character *P. microdontus* resembles *P. auritus*, but it is more pronounced in *P. microdontus* than in the brown long-eared bat (Fig. 6). The protuberances above the upper eyelid and

Tab. 2. Body- and skull measurements of *Plecotus microdontus* n. sp. from Austria

	male						female				
	mean	s	min	max	n	p	mean	s	min	max	n
Hbl	49.90	2.84	46.00	55.00	7		51.47	2.73	47.00	55.20	11
T	47.03	3.91	41.00	53.00	6		49.55	2.57	45.00	53.40	11
Ear	35.96	1.71	34.00	38.30	5		36.17	1.47	34.00	38.30	11
Weight	7.40	1.17	6.00	9.00	6		7.94	1.21	6.40	10.20	8
FA+	40.59	0.59	39.60	41.50	7	**	41.91	0.86	40.50	43.50	11
FA-	39.60	0.64	38.80	40.70	6	**	41.10	1.00	39.40	42.60	10
Gsl	17.07	0.21	16.70	17.37	7	**	17.46	0.22	17.08	17.86	11
Ccl	14.79	0.08	14.68	14.91	7	***	15.19	0.19	14.90	15.63	11
Cbl	15.47	0.13	15.24	15.61	7	***	15.94	0.19	15.70	16.41	11
Bh^+	7.61	0.10	7.43	7.77	7		7.72	0.11	7.51	7.94	10
Bb	8.33	0.16	8.08	8.51	7		8.46	0.16	8.25	8.76	11
Mb	9.05	0.15	8.80	9.24	7	**	9.25	0.09	9.10	9.40	11
Zb	8.66	0.15	8.37	8.84	7	**	8.90	0.12	8.75	9.14	10
Iob	3.68	0.11	3.50	3.85	7		3.63	0.07	3.54	3.76	11
C-C	3.68	0.10	3.50	3.85	7	**	3.82	0.10	3.66	3.99	11
M^3-M^3	6.17	0.16	5.92	6.42	7		6.29	0.13	6.00	6.49	11
C-M^3	5.47	0.07	5.36	5.55	7	**	5.62	0.09	5.49	5.74	11
Cl	1.87	0.05	1.77	1.95	7		1.93	0.04	1.85	1.99	11
I^1l	0.89	0.05	0.81	0.97	7		0.89	0.04	0.84	0.97	9
DBt	4.47	0.06	4.40	4.58	7		4.56	0.10	4.43	4.73	11
M	10.71	0.18	10.44	10.87	7	**	10.97	0.15	10.74	11.23	11
C-M_3	5.93	0.07	5.82	6.00	7	*	6.04	0.11	5.83	6.16	11
Corh	2.94	0.09	2.83	3.08	7		3.00	0.08	2.90	3.16	11

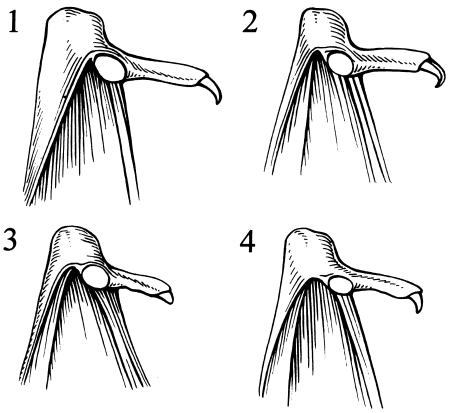

Fig. 4. Thumb and thumb claw of *Plecotus auritus* (1), *P. microdontus* (2), and *P. austriacus* (4) from Austria, and of *P. kolombatovici* (3) from Dalmatia, Croatia

Tab. 3. Body- and skull measurements of *Plecotus kolombatovici* from Dalmatia

	male				female	
	NMW 29860	CNHM 6001	CNHM 6010	CNHM 6114	NMW 62004	CNHM 6113
Hbl	47.00					
T	43.00					
Ear	34.10	30.70	29.70	33.00	31.20	
Weight	7.00					
FA+	37.50	39.30	36.20	37.30	38.90	
FA-	36.30	38.40	35.50	36.30	37.80	
Gsl	16.75	16.33	16.47	16.66	16.79	16.77
Ccl	14.80	14.22	14.40	14.50	14.77	14.70
Cbl	15.41	14.76	15.05	15.21	15.25	15.33
Bh^{+}	7.73	7.58	7.99	7.81	7.90	7.82
Bb	8.74	8.27	7.86	8.49	8.74	8.71
Mb	8.79	8.83	8.66	6.95	9.02	9.14
Zb	8.54	8.35	8.12	8.51	8.73	8.68
Iob	3.31	3.36	3.36	3.31	3.37	3.48
C-C	3.63	3.46	3.58	3.55	3.94	3.65
M^3-M^3	6.05	5.70	5.74	6.05	6.08	6.10
C-M^3	5.42	5.16	5.25	5.29	5.37	5.39
Cl		1.69	1.75	1.61	1.64	1.67
I^1l	1.04	0.94	1.04	0.98	0.93	0.93
DBt	4.45	4.27	4.33	4.28	4.38	4.54
M	10.42	10.21	10.23	10.54	10.73	10.75
C-M_3	5.82	5.53	5.60	5.72	5.83	5.86

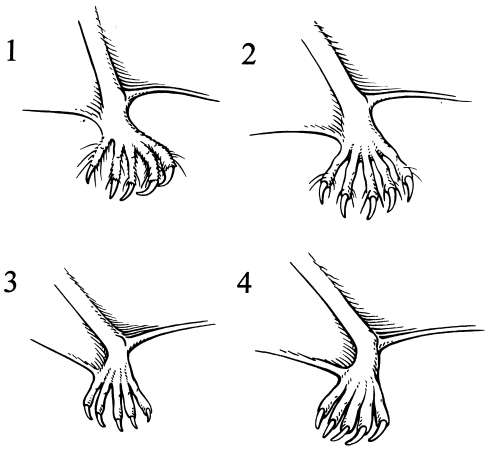

Fig. 5. Feet of *Plecotus auritus* (1), *P. microdontus* (2) and *P. austriacus* (4) from Austria and of *P. kolombatovici* (3) from Dalmatia, Croatia.

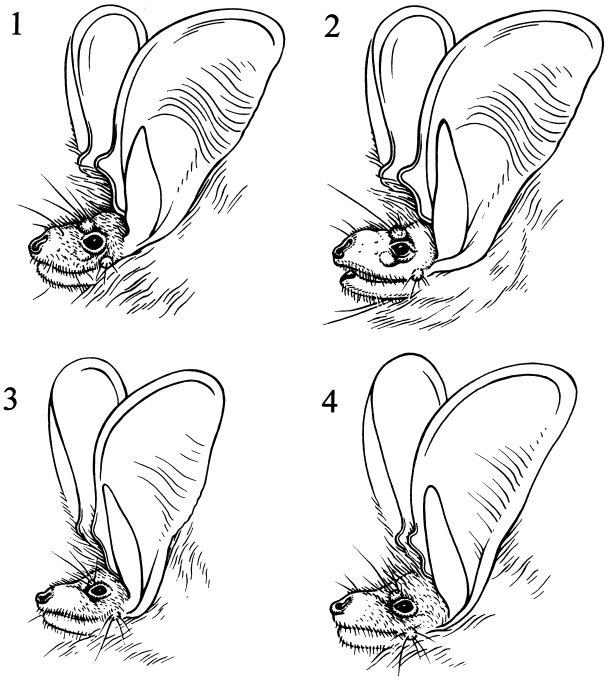

Fig. 6. Facial part of the head from lateral of *Plecotus auritus* (1), *P. microdontus* (2), and *P. austriacus* (4) from Austria, and *P. kolombatovici* (3) from Dalmatia, Croatia.

behind the corner of the mouth are somewhat larger in *P. microdontus* than in *auritus*. In *P. austriacus* and *kolombatovici* the anterior part of the muzzle is much less bulging, is covered with short hairs and its colour is dark. The protuberances are smaller in *P. austriacus* and *kolombatovici*. In *P. microdontus* the muzzle is longer than in *auritus* and *kolombatovici*, but shorter than in *austriacus* (Fig. 6).

Lower lip. In its central part the lower lip of *P. microdontus* displays a hard triangular pad that is elongated in distal direction (Fig. 7). This feature was found to exist in all specimens of *P. microdontus* preserved in alcohol. Judging from the material available, this feature distinguishes *P. microdontus* from the other three *Plecotus* species.

Dental characters

Anterior upper dentition. The mean length of I^1 of *P. microdontus* is smaller than in any other of the compared *Plecotus* species (Tab. 5, Fig. 8). The length of the upper canine of *P. microdontus*, however, is only a little shorter than in *austriacus*, which has the longest canine. As a consequence, the relations between the lengths of the upper canine and I^1 (Fig. 3) very clearly distinguish *P. microdontus* not only from *austriacus*, but also from *auritus* and *kolombatovici*. The two latter species are inseparable with respect to this dental character.

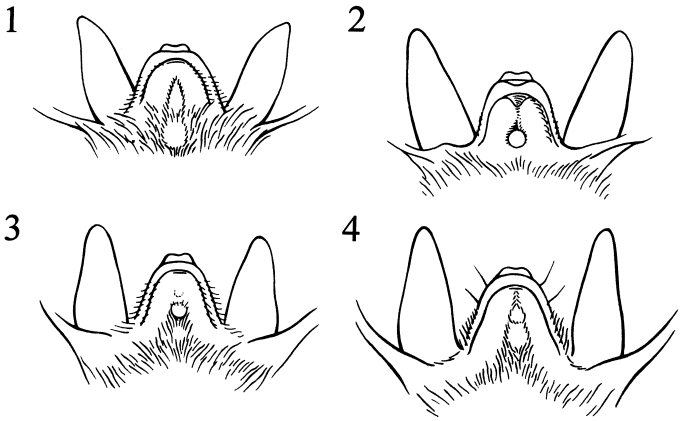

Fig. 7. Lower lip and chin of *Plecotus auritus* (1), *P. microdontus* (2), and *P. austriacus* (4) from Austria and of *P. kolombatovici* (3) from Dalmatia, Croatia

Tab. 4. Body and skull measurements of *Plecotus austriacus* from Austria.

	male						female				
	mean	s	min	max	n	p	mean	s	min	max	n
Hbl	50.22	3.64	42.00	56.00	46	*	52.12	4.70	43.00	60.00	38
T	43.73	3.37	35.00	52.00	46		44.60	3.91	36.00	51.00	36
Ear	35.73	2.02	31.00	40.20	41		36.66	2.91	28.60	41.00	31
Weight	6.65	1.15	5.00	9.00	33		7.36	1.91	4.50	12.00	21
FA+	39.22	1.45	33.90	41.60	46	***	40.27	1.05	37.00	42.10	40
FA-	38.44	0.90	36.20	40.60	33	***	39.41	1.07	37.20	41.00	25
Gsl	17.69	0.26	16.99	18.32	55	***	17.90	0.31	17.32	18.59	49
Ccl	15.60	0.24	14.95	16.17	54	***	15.78	0.29	15.12	16.38	50
Cbl	16.15	0.26	15.61	16.72	55	***	16.36	0.31	15.45	17.01	50
Bh^+	7.73	0.15	7.35	8.02	51		7.79	0.17	7.41	8.13	43
Bb	8.70	0.14	8.29	9.06	55	***	8.82	0.21	8.35	9.41	48
Mb	9.42	0.23	8.54	9.87	52	**	9.55	0.18	9.04	9.83	45
Zb	9.21	0.17	8.65	9.67	55	*	9.28	0.20	8.85	9.76	47
Iob	3.57	0.13	3.22	3.87	55		3.55	0.10	3.35	3.74	49
C-C	4.06	0.13	3.74	4.33	55		4.10	0.14	3.70	4.38	49
M^3-M^3	6.51	0.16	6.15	6.83	55		6.55	0.18	6.12	6.95	49
C-M^3	5.96	0.12	5.67	6.22	55		6.00	0.16	5.40	6.29	50
Cl	2.02	0.07	1.93	2.12	8		2.07	0.07	1.98	2.18	8
I^1l	1.08	0.04	1.03	1.14	8		1.08	0.04	1.02	1.15	8
DBt	4.65	0.12	4.17	4.85	52		4.69	0.12	4.40	4.94	46
M	11.73	0.21	11.13	12.21	55	**	11.86	0.23	11.16	12.38	49
C-M_3	6.42	0.13	6.16	6.68	55	*	6.47	0.13	6.14	6.83	50
Corh	3.33	0.11	3.03	3.53	55		3.38	0.13	3.02	3.64	50

Tab. 5. Length of I^1 and C in *Plecotus auritus*, *P. microdontus* and *P. austriacus* from Austria and *P. kolombatovici* from Dalmatia, Croatia.

		male					female				
		mean	s	min	max	n	mean	s	min	max	n
Cl	*P. microdontus*	1.87	0.05	1.77	1.95	7	1.93	0.04	1.85	1.99	11
	P. auritus	1.62	0.10	1.47	1.77	9	1.67	0.14	1.43	1.85	9
	P. kolombatovici			1.61	1.75	3			1.64	1.67	2
	P. austriacus	2.02	0.07	1.93	2.12	8	2.07	0.07	1.98	2.18	8
I^1l	*P. microdontus*	0.89	0.05	0.81	0.97	7	0.89	0.04	0.84	0.97	9
	P. auritus	0.96	0.06	0.86	1.03	9	1.00	0.07	0.87	1.09	9
	P. kolombatovici			0.94	1.04	4			0.93	0.93	2
	P. austriacus	1.08	0.04	1.03	1.14	8	1.08	0.04	1.02	1.15	8

Cranial characters (Fig. 8)

Skull shape. The two ridges separated by a groove on the anterior part of the skull are less well expressed in *P. microdontus* and *auritus* than in the other two species. The characters described by RUPRECHT (1969) to distinguish between *P. auritus* and *austriacus* – shape and relative length (in relation to the mandible length) of the processus angularis mandibulae – are expressed in *P. microdontus* as in *auritus*, while in *P. kolombatovici* they are as in *austriacus*.

Some **cranial measurements** are in Tab. 1–4. Austrian specimens of *P. microdontus* can be distinguished from Austrian *austriacus* and *auritus* by using the canonical discriminant functions mentioned already in the diagnosis. In the dimensions of the bullae tympani (DBt) *P. microdontus* resembles *austriacus* more closely than *auritus*. As the skull measurements used for computing the discriminant functions are very similar in *P. microdontus* and in *P. kolombatovici* from Dalmatia, the discriminant function does not differentiate between these two species.

Baculum

The baculum of the holotype of *P. microdontus* is illustrated in Fig. 9. Its shape clearly differs from that of *P. auritus* (TOPAL 1958, plate II, Fig. 22) and less well so from *P. austriacus* (TOPAL, 1958; plate II, Fig. 21) and *kolombatovici*. (ĐULIĆ, 1980; Fig. 3, no. 27).

ACKNOWLEDGEMENTS

We are grateful to Barbara Herzig for preparing and illustrating the baculum of the holotype, to Ingrid Dobsak for preparing figures 2, 4–8, to Edmund Weiß for taking all skull and tooth measurements and preparing the tables as well as Fig. 3., and to Draško Holcer and Igor Pavlinić for collecting fresh *Plecotus* specimens from the Dalmatian island of Lastovo.

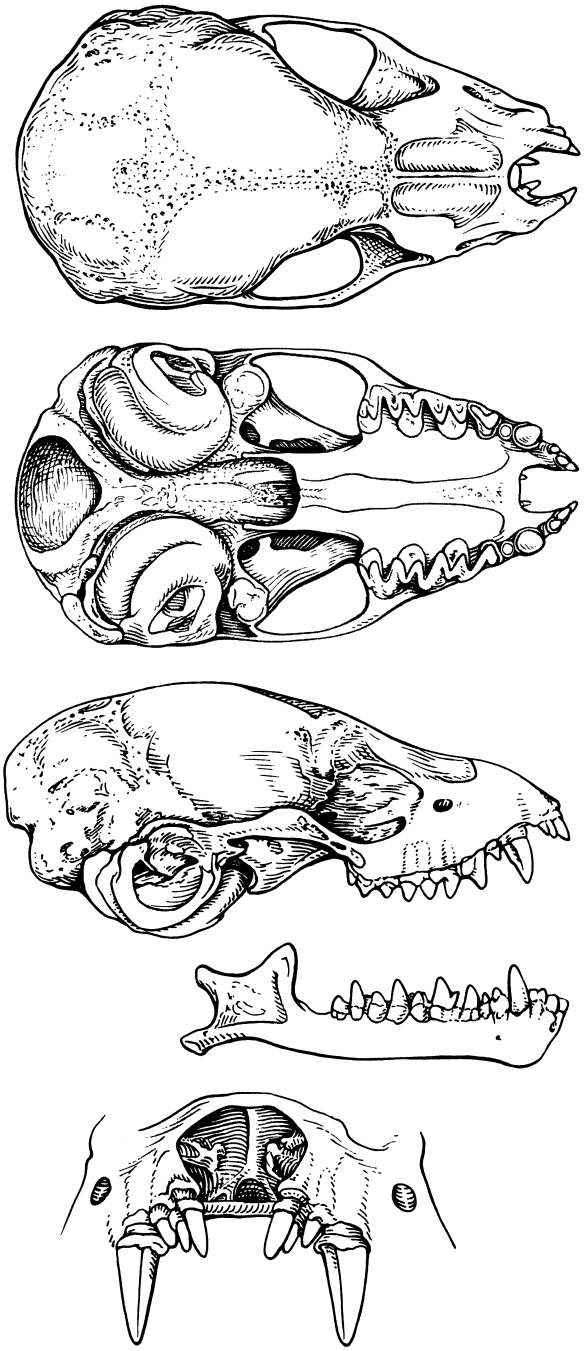

Fig. 8-1. Skull of *Plecotus auritus* (NMW 62006, Carinthia)

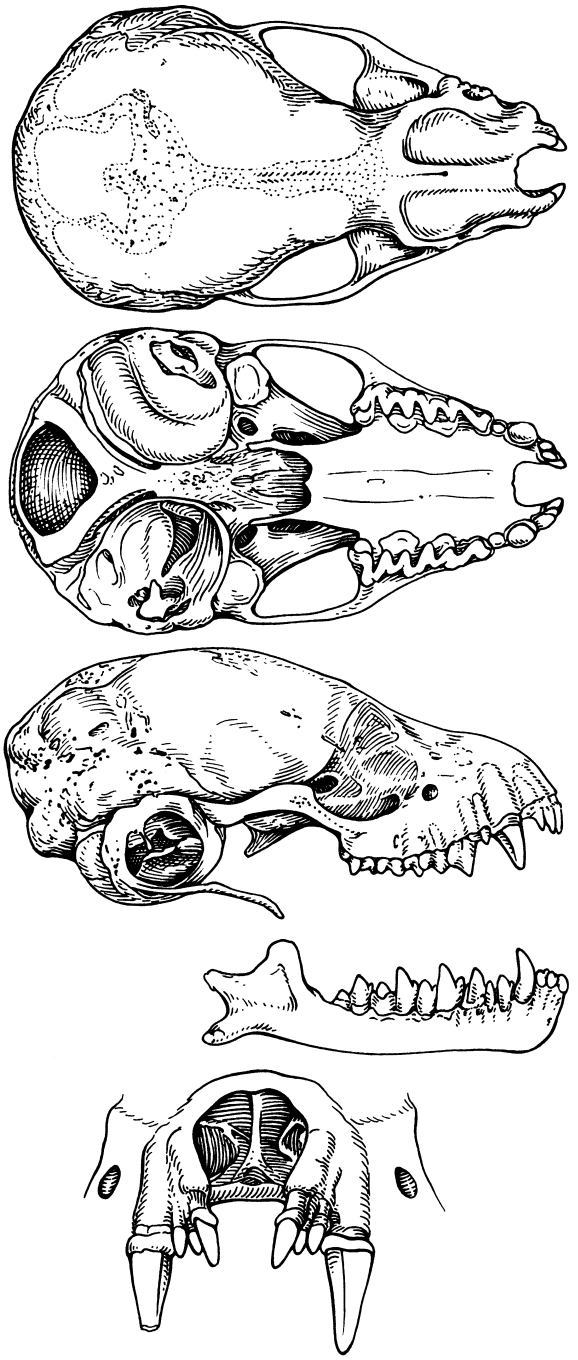

Fig. 8-2. Skull of *Plecotus microdontus* n. sp. (holotype)

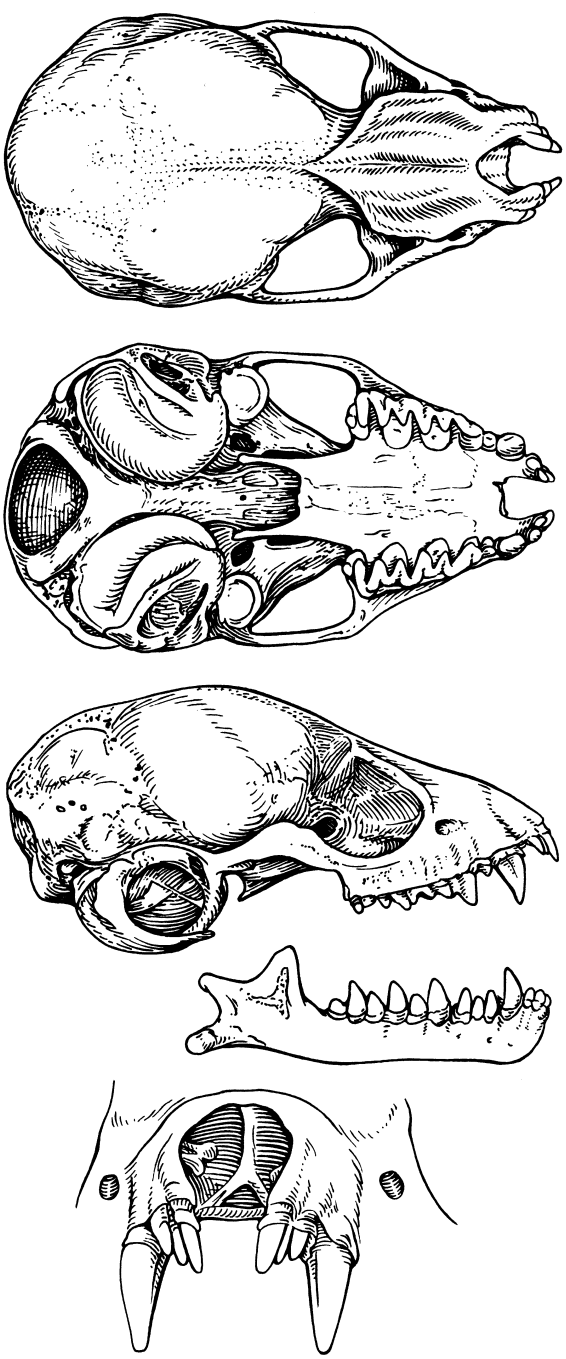

Fig. 8-3. Skull of *Plecotus kolombatovici* (CNHM 6113, Dalmatia)

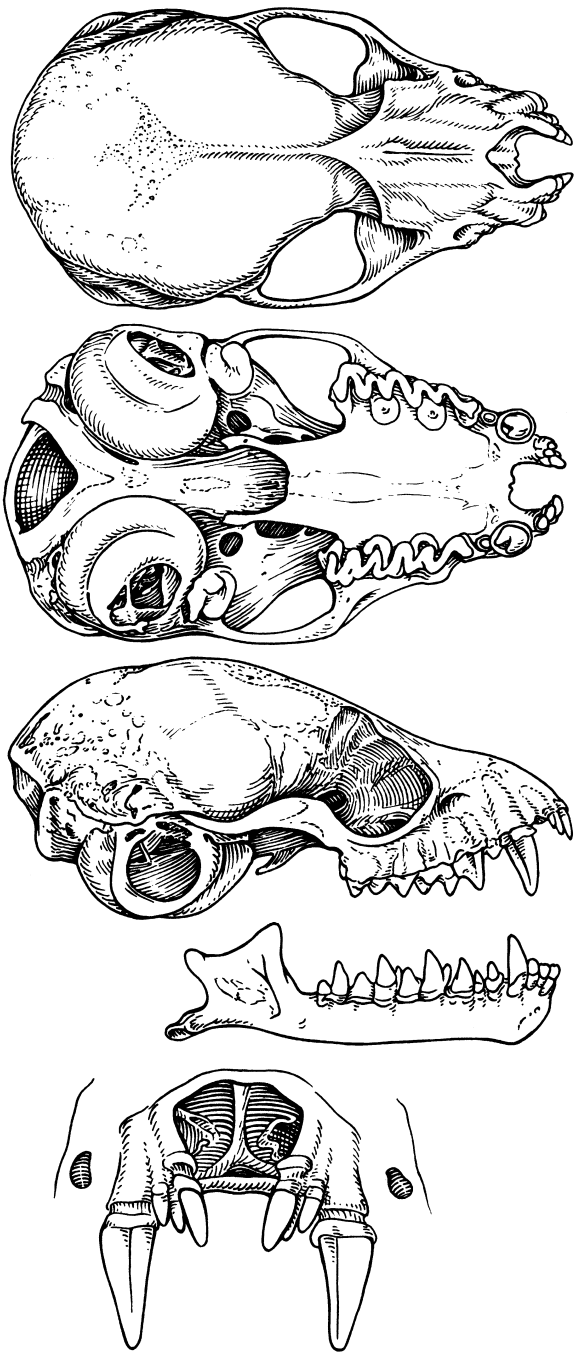

Fig. 8-4. Skull of *Plecotus austriacus* (NMW 55739, Lower Austria)

Fig. 9. Baculum of the holotype of *P. microdontus*.
Total length: 0.85 mm, greatest width 0.6 mm.

Abbreviations

Bb	braincase breadth
Bh	braincase height
Cbl	condylobasal length
Ccl	condylocanine length
Cl	length of upper canine
CNHM	Croatian Natural History Museum
DBt	largest diameter of bulla tympani
Ear	ear length
FA	length of forearm
Gsl	greatest length of skull
Hbl	head and body length
I^1l	length of upper incisor
Iob	interorbital breadth
M	mandible length
Mb	mastoid breadth
NMW	Natural History Museum in Vienna
T	tail length
Zb	zygomatic breadth
*	$p < 0.05$
**	$p < 0.01$
***	$p < 0.001$

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REFERENCES

ANDERSON, S., 1960: The baculum in microtine rodents. University of Kansas Publications **12**(3), 181–216.

ĐULIĆ, B., 1980: Morphological characteristics and distribution of *Plecotus auritus* and *Plecotus austriacus* in some regions of Yugoslavia. Proc. 5th International Bat Research Conference, Albuquerque, USA, Texas Tech Press, Lubbock, 151–161.

HARING, E., HERZIG-STRASCHIL, B. & SPITZENBERGER, F., 2000: Phylogenetic analysis of alpine voles of the *M. multiplex* complex using the mitochondrial control region. J. Zool. Syst. Evol. Research **38**, 231–238.

KIEFER, A., KOSUCH, J., VEITH, M., MAYER, F. & HELVERSEN, O., 2000: Kryptische Diversität unter europäischen Langohrfledermäusen. Z. f. Säugetierkunde **65**, Sonderheft, 23–24.

MAYER, F. & HELVERSEN, O., 2001: Cryptic diversity in European bats. Proc. R. Soc. Lond. B, **268**, 1825–1832.

RUPRECHT, A., 1969: Taxonomic value of Mandible Measurements in the genus *Plecotus* Geoffroy, 1818. Acta Theriol. **14**, 63–68.

SAITOU, N. & NEI, M., 1987: The neighbor-joining method: A new method for reconstructing phylogenetic trees. Mol. Biol. Evol. **4**, 406–425.

SPITZENBERGER, F., PIÁLEK J. & HARING, E., 2001: Systematics of the genus *Plecotus* (Mammalia, Vespertilionidae) in Austria based on morphometric and molecular investigations. Folia Zool. **50**, 161–172.

SWOFFORD, D. L., 2001: PAUP*: Phylogenetic analysis using parsimony (*and other methods). Version 4.0b3a. Sinauer, Sunderland, Mass.

STRELKOV, P., 1988: Brown (*Plecotus auritus)* and grey (*P. austriacus*) long-eared bats in the USSR. Zool. Zhurn. **67**, 90–101.

TOPAL, Gy., 1958: Morphological studies on the Os Penis of Bats in the Carpathian Basin. Ann. hist-nat. mus. nat. Hung., ser. nov. **9**, 331–342.

SAŽETAK

Plecotus microdontus (Mammalia, Vespertilionidae), nova vrsta šišmiša u Austriji

F. Spitzenberger, E. Haring & N. Tvrtković

Posljednjih deset godina istraživanja eholokacije, a osobito molekularne genetike, izazvala su seriju otkrića novih vrsta među šišmišima. Tako su KIEFER i ost. (2000) i MAYER & HELVERSEN (2001) na temelju sekvenci mitohondrijalnih gena utvrdili da je svojta *kolombatovici* Đulić, 1980, koja je opisana kao podvrsta *Plecotus austriacus*, samostojna vrsta. SPITZENBERGER i ost. (2001) su istovremeno analizirajući više od 200 muzejskih primjeraka roda *Plecotus* utvrdili da u Austriji uz dvije dosad poznate vrste postoji i treća koja je jasno genetički i morfološki odvojena. Zbog morfološke sličnosti nekih karakteristika lubanje smatrali su da pripada svojti *kolombatovici*.

Genetičkom i morfološkom analizom *P. kolombatovici* s nekih jadranskih otoka ovim radom je dokazano da austrijski primjerci treće vrste ne pripadaju toj vrsti, nego da se radi o potpuno novoj svojti šišmiša. Usporedbom su utvrđene morfološke razlike prema ostalim europskim vrstama roda *Plecotus*, te je na temelju primjeraka iz Austrije opisana nova vrsta *P. microdontus*. Ona je genetički i morfološki najsrodnija smeđem dugoušanu (*P. auritus*), a za sada se sigurno zna da je rasprostranjena u planinskom dijelu sjeverne Italije, jugozapadne Austrije i Slovenije. Detaljan opis i ilustracija morfoloških osobitosti pomoći će utvrđivanju stvarne rasprostranjenosti.