

NOTES ON THE DISTRIBUTION AND SYSTEMATICS OF *MYOTIS* *MYSTACINUS* KUHL, 1819

by

VLADIMÍR HANÁK

Department of Systematic Zoology, Faculty of Natural History, Charles University, Prague, C.S.S.R.

In 1965 I recorded the occurrence of two distinct forms of *Myotis mystacinus* in Central Europe; my preliminary ranking was that they were two subspecies, *Myotis mystacinus mystacinus* and *Myotis mystacinus brandtii*. Those findings were in agreement with previous information by Topál (1958) pointing out differences in the morphology of the baculum in Hungarian populations of that species, and even considering the differences between the two forms of specific value. The present paper is a summary of new discoveries concerning this problem; the characters distinguishing the two forms are discussed, whereas new information on their distribution in Central Europe is presented, and their systematic position is evaluated.

DISTINGUISHING CHARACTERS BETWEEN THE TWO FORMS

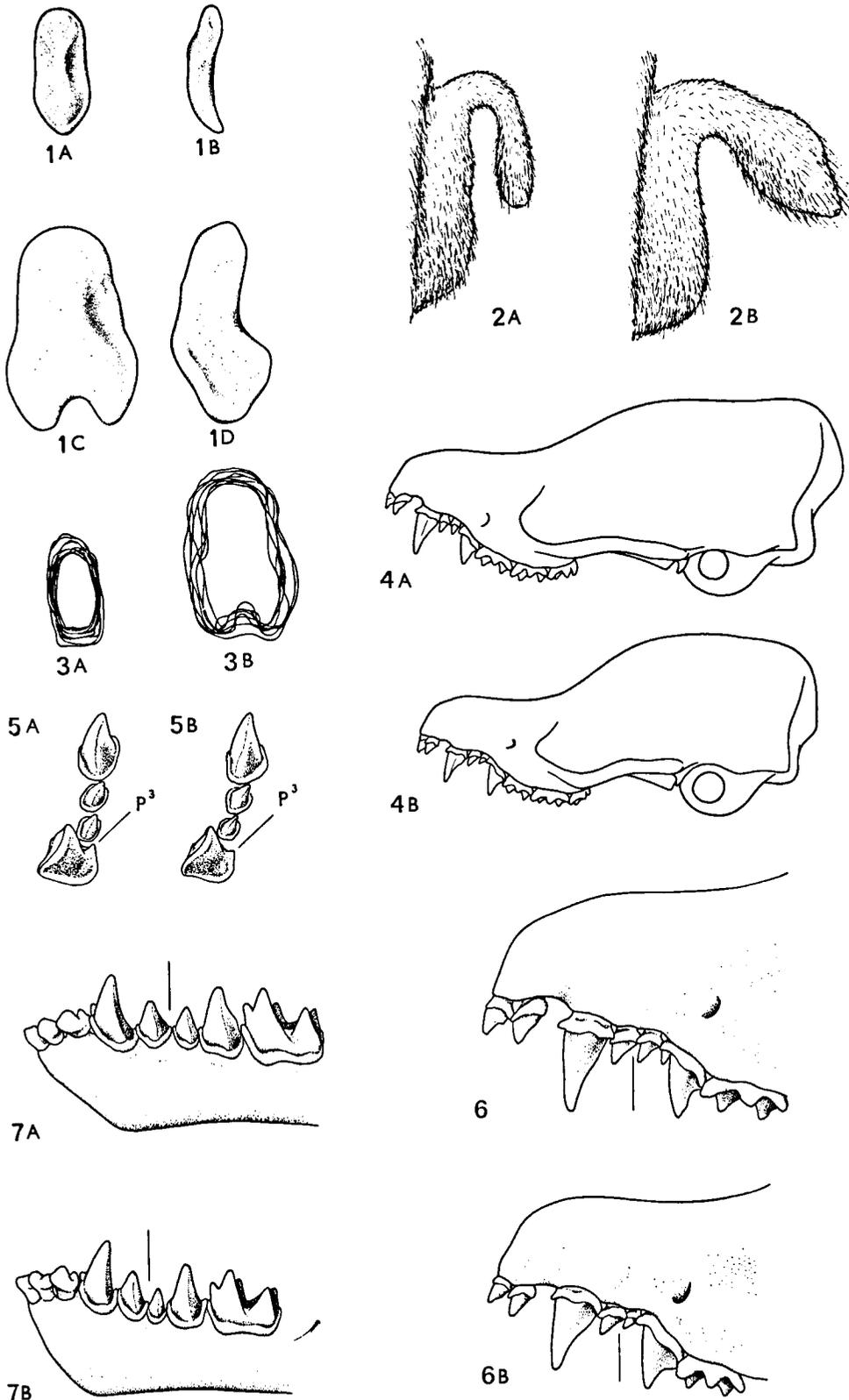
Baculum. — The differences in the shape and size of baculum have already been described in detail by Topál (1958), as supplemented by Hanák (1965) based on Czechoslovak material. More detailed data have been obtained by a later study of 11 specimens of *M. m. mystacinus* and 8 specimens of *M. m. brandtii* from Bohemia and Slovakia. The baculum of *M. m. mystacinus* is minute, its shape resembles the baculum of young specimens of *M. myotis*. In dorsal view its outline is approximately oval, projections at the proximal end are missing. The saddle shape, characteristic of the *Myotis* species (Topál, 1958), is only slightly indicated in some individuals by an obsolete medial ridge on the dorsal side (fig. 1 A). The whole profile of the baculum is concave, the ventral depression is moderately indicated in some specimens only. Its length ranges from 0.43 to 0.62 mm (mean 0.49 mm), its width from 0.22 to 0.29 mm (mean 0.26 mm).

The baculum of *M. m. brandtii* is markedly bigger, typically saddle-shaped. The medial ridge on the dorsal side, forming a protuberance in the proximal part, is characteristic. On the ventral side there is a distinct depression, the sulcus urethralis (fig. 1 C, D). Measurements: length 0.81—0.97 mm (mean 0.87 mm), width 0.41—0.59 mm (mean 0.50 mm). It appears that there are striking differences in the morphology of the baculum in the material from Czechoslovakia as well, although the size differences are less pronounced than those given by Topál (1958). On the whole we can say that the differences found between the two forms of *M. mystacinus* are larger than those between the other species of this genus.

Penis. — The differences in the shape of penis were pointed out in my previous paper (Hanák, 1965). The penis of *M. m. mystacinus* is smaller, evenly thick along its entire length (fig. 2 A). The one of *M. m. brandtii* is more robust and markedly thicker in the region of glans penis (fig. 2 B).

So far the differences in the morphology of the penis and baculum have been the most conspicuous distinguishing characters between *mystacinus* s.str. and *brandtii*. That is why we were interested in their variability during the postnatal development. The study of banded individuals at winter quarters in Slovakia has proved that the shape of the penis and of the baculum, characteristic for each of the two forms, does not change during 1 to 4 years after the banding. Of course, the baculum of adult specimens of both forms varies individually, as is shown in fig. 3.

The shape of skull. — Apparently there are only minor differences in the general morphology of the skulls of both forms, except for their size. In lateral view the skulls of the *mystacinus* form seem to be more convex in the frontal region than the skulls of the *brandtii* form (fig. 4).



Figs. 1—7, Morphology of *Myotis mystacinus* and *M. brandtii* from Czechoslovakia.

1, bacula of *mystacinus* (A, B) and *brandtii* (C, D); dorsal view (A, C), lateral view (B, D); 2, morphology of the penis in *mystacinus* (A) and *brandtii* (B) both in lateral view; 3, bacula, contour variations of 11 *mystacinus* (A) and 8 *brandtii* (B); 4, lateral view of skull in *brandtii* (A) and *mystacinus* (B); 5, upper dentition (C—P³) of *brandtii* ♂ (A) and *mystacinus* ♂ (B) in lateral view; 6, upper dentition (I¹—M¹) of *brandtii* ♂ (A) and *mystacinus* ♂ (B) in lateral view; 7, lower dentition (I₁—M₁) of *brandtii* ♂ (A) and *mystacinus* ♂ (B) in lateral view.

Table I. The comparison of external and cranial measurements of *M. brandtii* and *M. mystacinus*.

	sex	n	<i>brandtii</i>			<i>mystacinus</i>		
			Min.	Max.	x	n	Min.	Max.
Forearm	♂	25	33.2—38.0		35.5	34	31.0—36.0	34.1
	♀	5	35.0—36.0		35.7	49	31.5—37.0	34.7
Greatest length	♂	24	14.0—15.0		14.3	38	12.9—14.0	13.5
	♀	5	14.3—14.6		14.5	41	12.9—14.0	13.5
Condylbasal length	♂	25	13.3—14.2		13.7	37	12.0—13.3	12.8
	♀	5	13.5—13.9		13.8	44	12.0—13.4	12.9
Zygomatic width	♂	18	8.4—9.1		8.7	34	7.7—8.5	8.2
	♀	4	8.4—8.8		8.6	22	7.3—8.6	8.1
C—M ³	♂	24	5.2—5.6		5.4	40	4.6—5.4	5.1
	♀	5	5.3—5.4		5.4	45	4.6—5.7	5.1
C—M ₃	♂	24	5.6—6.0		5.8	40	5.1—5.8	5.4
	♀	5	5.6—5.9		5.8	47	5.0—5.7	5.4
Mandible length	♂	24	10.1—10.7		10.4	38	9.3—10.3	9.7
	♀	5	10.2—10.4		10.3	45	8.7—10.1	9.7

Measurements of the body and skull. — An analysis of material from Czechoslovakia and the Soviet Union showed marked differences between the cranial measurements of both forms (Hanák, 1965). They were evident, above all, in the length and width of the skull, length of maxillar and mandibular rows of teeth, and in the length of mandible. Differences in the body measurements appeared markedly in the length of antebrachium only. Meristic values of the Czechoslovak material are given in table I.

Differences in dentition. — Topál (1963) pointed out a conspicuous character of fossil material of the *brandtii* form, viz., a secondary conus on the inner margin of P³ (fig. 5). This character is well developed in recent material as well, as was shown by Stubbe & Chotolchu (1968) and as is also evident in our material. The height of this conus is striking in all individuals in our material, compared to its poor development in the *mystacinus* form (fig. 5 B). Other characters mentioned by Stubbe & Chotolchu (1968) — differences in the relative size of P¹ and P² (fig. 5 and 6) — have also been applicable to our material. Similar differences in the height of P₁ and P₂ have been found on the lower jaw (fig. 7), and there they seem to be much more conspicuous.

Conclusions. — A new evaluation of known distinguishing characters of the *mystacinus* and *brandtii* forms has shown that they are particularly useful for identification of museum material. For identification in the field, the differences in the morphology of the penis remain the most advantageous. However, a complex of various characters should always be employed for a precise identification. It is important that the morphology of penis

and baculum is stable in both forms and does not change in the course of ageing.

Distribution. — Although the distribution of *Myotis mystacinus* in Europe is quite well known, information about the occurrence of individual forms is still very incomplete. The occurrence of the Eastern European *brandtii* form in Central Europe was first recorded by Topál (1958). He reported that 3 specimens had been found in Hungary without mentioning the locality. Later, more hibernating individuals were found at one site in eastern Slovakia, and one hibernating specimen in northern Bohemia (Hanák, 1965). Individuals bearing characters of the *brandtii* form were recorded at several places in Italy (Lanza, 1959) and Yugoslavia (Hanák, 1965). The occurrence of both forms in Sweden was reported by Wallin (1969). The records of the *brandtii* form in Hungarian Pleistocene (Topál, 1963) are important, as well as a simultaneous occurrence of both forms in Holocene layers in some caves in the Tatra in Poland (Woloszyn, unpubl.).

With regard to this insufficient information I studied in the past years an extensive material from Central Europe. Thus new data on the occurrence of both forms in that region were obtained. New material from Czechoslovakia as well as the collections of the Zoological Museum of the Humboldt University (Berlin), the Senckenberg Museum (Frankfurt a.M.), British Museum (Natural History) (London) and Muséum d'Histoire naturelle (Paris) * were examined. Although this

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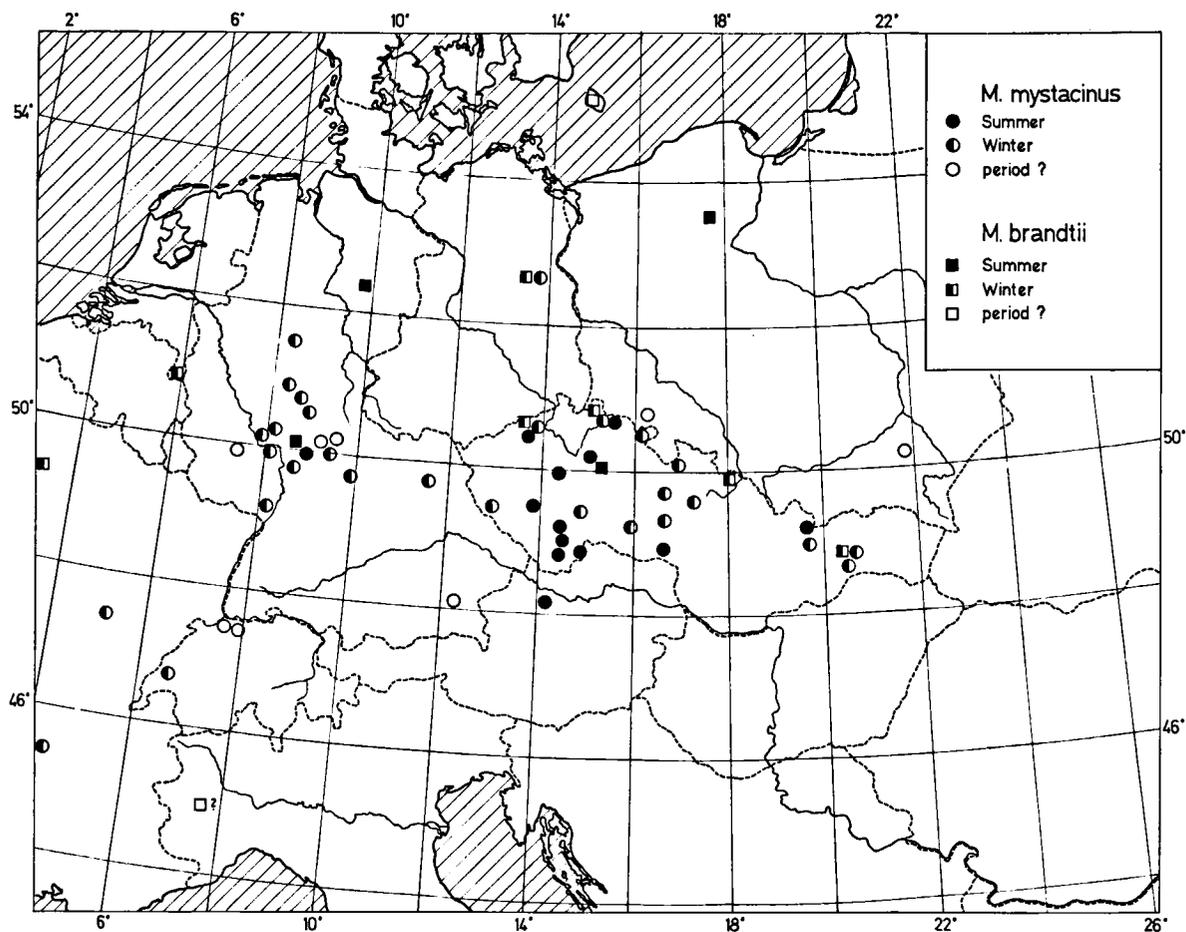


Fig. 8. Map showing the distribution of *Myotis brandtii* and *M. mystacinus* in Central Europe. Only precisely known localities are indicated.

material does not give an entirely complete picture of the distribution of the two forms in Central Europe, because data from Hungary, Rumania, and a large part of Poland are missing, our study has added new information.

Rich material from Czechoslovakia has shown that the nominal form predominates in this region in summer as well as in winter. However, individuals of the *brandtii* form were found at another hibernation site in northern Bohemia (Jizerské Mountains) and in northern Moravia (Opava) at the time of autumnal migrations. Also the females of one summer colony in central Bohemia (Kolín) agreed with this form by their cranial characters.

Unfortunately, only the cranial characters of the museum material could be evaluated; nevertheless, the results obtained are important. A series of individuals from northern Poland, one male from the island of Bornholm, and most of the popula-

tion hibernating in the well-known winter quarters at Rüdersdorf near Berlin could be classified with the *brandtii* form. Also individuals from a summer colony found near Hannover (Germany), 4 specimens from Maastricht (southern part of the Netherlands) and even 2 individuals from Chantilly, Aisne (northwestern France) fit well into the range of variability of this form. Certainly most interesting is the record of 3 individuals of the *brandtii* form in Frankfurt a.M. (summer). The other material from central and southern Germany, southern Poland, Austria, Switzerland and western France completely agrees with the measurements of the *mystacinus* form. The localities of both forms in Central Europe is plotted in fig. 7.

DISCUSSION AND RESULTS

The taxonomic analysis of the extensive material of *Myotis mystacinus* has produced a number of

new pieces of information on the distribution of both its forms in Central Europe. It proves that the *brandtii* form occurs farther to the West than it had been previously thought. It seems to predominate in the lowlands of Poland and Germany, and to reach through The Netherlands and Belgium to northwestern France. In the highlands of Central Europe south of southern Poland — in Czechoslovakia, central and southern Germany, Austria, Switzerland, and southern France — the nominal form predominates. However, even in this region of continuous distribution of the nominal form the *brandtii* form occasionally occurs. Such occasional finds are the above mentioned ones in the winter quarters in Czechoslovakia and two summer records (central Bohemia, Frankfurt a.M.). The occasional occurrence of the nominal form in the region of a continuous distribution of *brandtii* is proved by one find in the winter quarters at Rüdersdorf (Berlin) and the occurrence of both forms in southern Sweden (Wallin, 1969). All these records suggest that the areas of both forms overlap in Central Europe. According to our own checked records, both forms occur simultaneously only in a relatively narrow zone at the borders of

their respective ranges. However, taking into account the above mentioned and so far not completely verified literature data, the two forms are sympatric in a relatively large region of Europe from Scandinavia to Italy and in the Balkan. The sympatric occurrence means that both forms behave toward each other as good species, and this ought to be expressed in their systematic position. This would also confirm the original presumption (Topál, 1958; Hanák, 1965) that they are distinct species, *Myotis mystacinus* Kuhl, 1819 and *Myotis brandtii* Eversmann, 1845. However, this preliminary ranking has to be supported by further information on the distribution of both forms in Europe. In this connection the fossil material, should be mentioned. The discovery of the *brandtii* form in Riss material from Hungary (Topál, 1963) and the occurrence of both forms in Holocene layers in caves in the Tatra (Woloszyn, unpubl.) suggest that *brandtii* has been the original Central European form. *Mystacinus* seems to have penetrated Central Europe only in the postglacial period. This would agree with hitherto held views on the distribution of both species of the genus *Plecotus* in Central Europe.

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