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Morphological Studies on the Os Penis of Bats in the Carpathian Basin

By Gy. Topál, Budapest

In the last few decades there were numerous mammalogical papers published which dealt with the morphology of the male copulatory organ, resp., the os penis. On the basis of the results of these studies we were in the position to conclude that these organs, aside of other criteria, establish good specific characters, further that their formation may, even within smaller systematical groups, be useful to ascertain relationships. By chance, studies of this kind made on bats are the most meagre. I wish to at least partly compensate by the present work the remarkably incomplete data of literature in this field.

It is well known since long that the penis of most bat species contains a bone. In spite of this fact, older authors, like Gilbert, Ercolani, Chaine, etc., studied the penis of but some common species, touching only perfunctorily on the morphology of the os penis. Unfortunately, even their findings are not always reliable. Lately, Matthews gave short references on the os penis of several European bats, when treating their penis. Some American authors, as Hamilton, then Krutzsch and Vaughan, examined the os penis of numerous Nearctic bat species and subspecies. Among others, they have found that the os penis of externally similar species may significantly differ, further, that the os penis of the subspecies of a species generally resemble each other to a high degree and show, at best, but differences in size.

Of the bats occurring in the Carpathian Basin, I was unable to examine the os penis of *Nyctalus leisleri*, in want of research material. On the other hand, I have studied more or less specimens of the other species. The material examined was mainly furnished by the old alcohol collection of the Natural History Museum and, in a smaller way, by my recently collected skin-material. For this very reason, I was compelled to disregard the soft parts of the penis, and could consider only the general position of the bone and its relation to the soft parts. For the preparations of the bones I have followed the method most frequently used. The penis obtained from the alcoholic or dry material was kept in a 6% KOH solition for 24—48 hours. In the case of a fresh material, the soft parts surrounding the bone became gelatinous and swollen even after 24 hours. In the majority of the os penis preparations, I have stained the lye solution with alizarin red. In this way, the penis bone, — in many cases of exceedingly small measurements — appeared stained to a lively violet color among the loosened and transparent tissues.

In the followings, I give the description of the os penis of the species.

Rhinolophus ferrumequinum (Plate I, figs. 1, 2). — Blainville (1), in his osteography, gives a good picture of the os penis of this species, whilst the profile drawing of Chaine (2) rather resembles that of *R. euryale*. I have examined 13 specimens. The bone occupies a large part of the penis, situated with its tip in the glans. The urethra passes ventrally to it, scarcely touching the bone. The proximal part of the bone resembles a dorsoventrally flattened cone. This is empty inside and the corpus cavernosum attaches itself to its basal margin and to the inequalities of its outer surface. There are incisions on its basal margin. The ventral incision is somewhat deeper. The rim of the basal cone is thickened everywhere, indeed, it forms a strong protuberance on both sides of the ventral incision. In the case of older specimens, these pro-

tuberances pass into a low crest advancing in a distal direction. The main part of the bone starts from the top of the basal cone, in the form of a tapering and approximately cylindrical shaft, to continue and end as a dorsoventrally strongly flattened spear-head or willow-leaf. A ventral main ridge bulges out on the w llow-leaf. The shaft bends down ventrally soon after its origin from the basal cone. The length of the bone is 3,20—4,30 mm (the main of 11 specimens : M = 3,70), its breadth measured on the basal cone is 0,75—1,40 mm (the main of 9 measurements : M = 1,07), the breadth of the leaf is 0,50—0,80 mm (the main of 10 specimens : M = 0,65).

Rhinolophus hipposideros (Plate I, figs. 3, 4). — According to M a t t h e w s, the urethra is much nearer to the ventral surface of the bone in this species than in *ferrumequinum*. I have examined 29 specimens. The os penis lies in the central axis of the penis and begins, as in the case of *R. ferrumequinum*, with a proximal basal cone which is, however, less flattened dorsoventrally. The basal margin is incised dorsally as well as ventrally. The ventral incision is deeper and always simple, the dorsal one is less deep and may have manifold lobes. The rate of this lobation on the margin is connected with the age of the animal. There is a a broad groove on the ventral surface of the basal cone, bordered by knob-like protuberances on both sides. The basal cone tapers into the first more or less triangular then cylindrical portion. This thins out continuously in a distal direction. The ventral side of the body has a shorter or longer flat surface according to the length of contact with the urethra. There is a button-like knob on the distal end of the bone. There are no lateral wings on the body. Of the *Rhinolophus* species under examination, *R. hipposideros* may, both in juvenile or in adult stages, be distinguished definitely by the fact that the medial and distal parts of the bone bend upwards as related to the proximal cone. With reference to body measurements, the size of the os penis is remarkably large as compared with that of the *R. ferrumequinum*. Its length is 245—3,45 mm (the main of 19 animals : M = 3,10 mm), the breadth of the cone is 0,90—1,25 mm (the main of 16 specimens : M = 1,05).

Rhinolophus euryale (Plate I, figs. 5, 6). — I have examined the os penis of 11 specimens. The shape of the bone stands much nearer to that of *R. ferrumequinum* than of *R. hipposideros*. Its proximal part may be comparable to a cone broadening toward the base which, if placed on it, would topple over in a ventral direction. This portion, contrarily to those of the other two rhinolophids, is not flattened; the base is approximately a circle. The lobation of its margin has the same build-up as those of the former two species. There are knobs on its outer surface, mainly on the two sides of the ventral groove where the urethra attaches itself to the bone. The top of the basal cone passes into the median portion of the bone. At first, this is a cylindrical body, becoming dorsoventrally flattened at approximately the middle of the bone. The breadth of the laterally flattening wings will, however, not even approach the breadth of the willow-leaf like shape of *R. ferrumequinum*. The bone bends but slightly down and that too only in its distal third. Its length is 3,20—3,45 mm (th e main of 6 specimen : M = 3,25), the breadth of the cone, measured on three specimens, is 1,0—1,1 mm, M = 1,5 mm.

Myotis mystacinus (Plate II, fig. 3). — Regarding the os penis of this species, M a t t h e w s mentions but briefly that the margins of its proximal part evolved into edges, between which the urethra lies. I have examined 14 specimens, among them many quite adult ones too. The bonelet is the smallest and of a

very simple shape as referred to the os penis of *Myotis* species. Viewed from above, it gives the following picture. There are no elongations on its proximal end, they have fused together. Here the bone is many times strongly narrowing. Anteriorly it is broader, and generally broadest in its middle. It again narrows distally, ending in a blunt or pointed tip. The saddle-like formation so characteristic for many species of the *Myotis* genus are present as slight traces at best on some bones, as a light median ridge, with a window-like thinning out of the bone wall on the right and left, and parallel with it. In a lateral view, it is well observable that both its proximal end distal ends bend upwards, and so there is a concavity in the dorsal profile. Ventrally, there is a trough with a quite thin margin, with its edges closed on the proximal extremity. The length of the bone is 0,44—0,56 mm (the main of 10 measurements: M = 0,52), its breadth 0,24—0,28 (M = 0,26).

Myotis mystacinus brandti (Plate II, figs. 1, 2). — The number of examined specimens is three. The bone is comparable to a small saddle. Viewed from above, it is rounded distally. It broadens backwards, there are two sharply developed elongations on its proximal end, which trend backwards and slightly downwards. In the majority of cases, there is, on the dorsal side of the bone and in its median line, a ridge which forms a proximally strongly protruding knob, whilst it runs distally into the conspicuously upward bending tip. So, in a lateral view, there is a strong concavity between the proximal knob and the tip of the bone. This formation is yet characteristical for the os penis of *M. nattereri* among the smaller *Myotis* species. The os penis forms ventrally a rather deep trough or, better yet, a channel; its side walls are roughly parallel and very thick. In this, the sulcus urethralis passes the distal end of the urethra. The length of the bone is 0,92—1,0 mm (M = 0,96), its breadth 0,52—0,58 mm (M = 0,55). The os penis is larger than that of the larger-bodied *M. nattereri*. The os penis of *M. mystacinus brandti*, as compared with that of the nominate form, shows therefore a striking deviation both in size and shape. This fact alone suffices to call attention on the necessity to intensively examine the taxonomy of European *M. mystacinus* forms. It should be considered whether a deviation of dimension and form be regarded as but a subspecific character. If, after the study of a suitably large material, there will have been found differences also between other features, *M. mystacinus brandti* will be regarded as a distinct species.

Myotis emarginatus (Plate II, fig. 16). — I have examined 9 specimens, of which 4 were adults. The os penis lies in the glans, as in all other *Myotis* species. Its form is the most simple among the os penis of the other species of the genus. The incision on its proximal end is scarcely observable, so one cannot talk about the development of extensions. Its distal tip is broadly rounded, medially slightly emarginate even in adult specimens. No median ridge evolves on the dorsal surface, but it slopes towards the margins from the median axis, and so the whole has a form like a house top. The dorsal margin of the flat bonelet (in a lateral view) is also wholly straight. There is a very shallow, trough-like cavity ventrally, with exceedingly thin margins. Its length is 0,60—0,64 mm (the main of 5 specimens: M = 0,61) its breadth 0,36—0,44 (M = 0,39).

Myotis nattereri (Plate II, figs. 4, 5). — I have examined the os penis of 5 specimens. The shape of the bone shew a great variability even in the case of these few specimens. Its construction is nearest to the os penis of *M. mys-*

tacinus brandti. Some were hardly distinguishable from it. It seems, however, that the proximal elongations were somewhat less developed than in *M. m. brandti*, also, they diverge more. In a lateral view, the dorsal concavity along the median ridge is not so expressed as in the other form. The margins of the ventral trough are much thinner. The length of the os penis is 0,74—0,88 mm (M = 0,80), therefore somewhat less than the baculum of the smaller *M. mystacinus brandti;* its breadth is 0,42—0,50 mm (M = 0,47).

Myotis bechsteini (Plate II, figs. 13, 14). — I have examined 3 specimens of this species, rarely to be met with in Europe. The baculum can be well separated from the os penis of the other members of the genus. Its remarkable shortness is very striking. There are two slight projections proximally, and, in the indentation between them, the posterior margin of the dorsal knob can be well seen. There is no longitudinal median ridge but the surface is sloping on the two sides of the midline. Viewed from above, the lateral margins of the bone are first shortly and definitely divergent, then break inwards in a sharp angle to run together into a broadly rounded tip anteriorly. Viewed laterally, the bone is rather high. Its dorsal margin is slightly concave. The lateral margins trend deeply downwards with a strong convexity. A deep channel evolves ventrally, tapering towards the tip. The length of the os penis is 0,68—0,70 mm (M = 0,69), its breadth 0,56 mm.

Myotis myotis (Plate II, figs. 11, 12). — According to Ercolani, its os penis is rudimentary. The figure of Blainville is very poor, indeed, it is difficult to recognise the baculum of a large mouse-eared bat. I have examined the os penis of 25 specimens. Viewed from above, the bone is roughly sagittate. Proximally, the two projections segregate mostly by a narrow indentation. Anteriorly, it will either graudally taper to end in a rounded and narrow tip, or its lateral margins will rapidly constrict not far from the proximal indentation to pass into the distal tip. From the lateral aspect, the bone is rather flat, its tip will sometimes slightly trend upwards, so that the dorsal surface is very slightly concave along the median line. Ventrally, it makes a shallow trough, with thin lateral walls. Its length is 0,88—1,12 mm (the main of 19 specimens : M = 0,98), its breadth 0,50—0,68 mm (M = 0,57).

Myotis oxygnathus (Plate II, figs. 9, 10). — This species stands very near to the former one, so also in the shape of the baculum. Its os penis is hardly distinguishable from that of *M. myotis*, but my material afforded the means of separation. Generally, the indentation between the proximal projections is much broader than in the bacula of *M. myotis*. The knob here is stronger and can be seen also from above, in the form of a slight protuberance. It is a further difference, when viewed from above, that the lateral margins of the bone are, in the majority of cases, parallel, indeed, they may be divergent, and only then do they converge into a generally more rounded tip than is the case with the distal extremity of the baculum of *M. myotis*. The bone seems to be broader than the os penis of the former species. In several cases, I have also observed a definite ridge, connected with the windowlike thinning out of the bone walls. This latter was never present in *M. myotis*. In spite of this, I found a wide latitude of variations in shape in the 37 examined specimens. There are animals with bacula hardly different from the os penis of the former species. On the other hand, the formation of the baculum in *M. myotis* seems to be more uniform. (Cf. figs. 1—2.) Laterally, it is higher than the os penis of *M. myotis*, and the dorsal concavity is also more expressed. There

is a deeper trough ventrally. The length of the bone is 0,72—1,10 mm (the main of 24 specimens is : M = 0,88) its breadth 0,50—0,72 mm (M = 0,58). On an average, therefore, it is still shorter and somewhat broader too than the os penis of *M. myotis*.

Myotis daubentoni (Plate II, fig. 15). — I have examined 9 specimens. The baculum is generally a simply formed bonelet, resembling in some regards that of *M. emarginatus*. It shows but rarely a saddle-like development, when there is a longitudinal median ridge on the dorsal surface with the bony wall

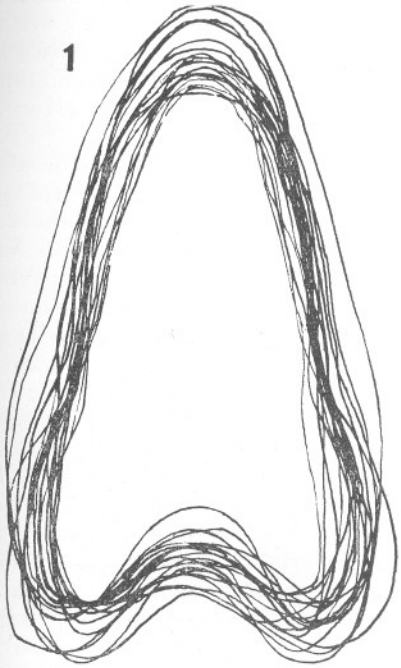

Fig. 1. Contour variations of 18 *Myotis myotis*. Dorsal view. Magnification as 86 ×.

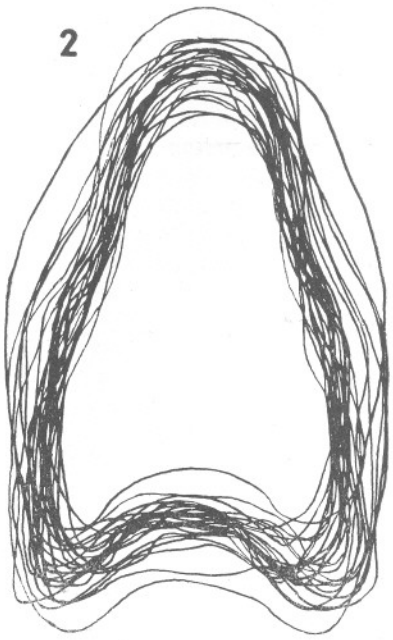

Fig. 2. Contour variations of 24 *Myotis oxygnathus*. Dorsal view. Magnification as 86 ×.

thinning out right and left to it. A further difference to the os penis of *M. emarginatus* is the presence of definite proximal projections, and also the convexity from above of the lateral margins. Viewed from the sides, the expressed convexity of the lateral margins, trending downwards and leaning over the urethra, is well visible too. The dorsal margin is straight. There is a rather deep trough ventrally, with thin walls. Its length is 0,66—0,80 mm (the main of seven specimens : M = 0,72), its breadth 0,42—0,48 mm (M = 0,47).

Myotis cappaccini (Plate II, fig. 6). — The three examined bacula differs from those of other *Myotis*, and are strikingly elongated. Viewed from above, the proximal projections are definite. The longitudinal median ridge is weak, but there is a rather strong knob on its proximal end, especially well visible from a lateral aspect. The lateral margins converge slowly and slightly to the narrowly rounded tip, which trends almost inconspicuously upwards. The

lateral margins show a very indistinct concavity in the distal third, when observed from a lateral aspect. The concavity of the dorsal surface is minimal. Ventrally, the bone has a deep trough or rather a channel. Its length is 0,76— 0,88 mm (M = 0,83), its breadth 0,36—0,40 mm (M = 0,38).

Myotis dasycneme (Plate II, figs. 7, 8). — I may state safely that, on the basis of six examined specimens, the bone differs sharply by its large size and elongated saddle-like shape from the bacula of the other *Myotis* species. Dorsally, the median ridge is mostly well developed ; it is the highest and widest proximally, flattening itself into the sometimes almost upcurling and rounded tip. At the proximal end of the bone, the two projections are much elongated. Viewed from the sides, there is a strong concavity between the proximal knob and the tip. Ventrally, one can see a long trough, tapering towards its two extremities. The length of the bone is 1,24—1,64 mm (M = 1,38), its breadth 0,60—0,72 mm (M = 0,66).

Vespertilio murinus (Plate I, figs. 13, 14). — I have examined the os penis of 12 specimens. The bone, in contrast with all other bats discussed in this paper, is situate in the proximal third of the penis, namely, its base is near the ventral wall of the penis, its distal end being in the main axis of the male organ. Viewed from above, the bone is lingulate. There is a relatively small incision proximally. Its lateral margins are at first shortly yet strongly divergent, up to about one-fifth of the bone. Then they uniformly converge to about half of its length or even further, extending outwards again after this concavity, to finally embrace in a large arch the widely rounded tip. Its dorsal surface is slightly convex and is either almost smooth or with two channel-like hollows, following the outline of the bone. Ventrally, a deep ditch passes lengthwise in the midline of the bone, not reaching its tip. The urethra is situated in this ditch, sometimes almost pressed in by its walls. The proximal part of the ditch is deeper, becoming more shallow distally, with — in some cases — a smaller or larger hornlet jutting out here, as if to support the urethra passing away from the bone at this place. In such cases, the distal part of the channel seems to lie on a rampart, with a terraced formation on both sides. The length of the baculum is 1,52—1,96 mm (the main of 11 measurements : M = 1,72), its largest width 0,88—0,96 mm (M = 0,91). Though it does not belong to the bone itself, I still have to discuss a special formation which spreads over the ventral surface, then closes into a tube reaching to the very tip of the penis. This is an evenly tapering tube, being straight at first but curving into an arch in a dorsal direction in the last third, to end in an oval aperture in an obliquely forward direction. The urethra passes within this, and we have to deal here with possibly a cartilaginous portion of the corpus cavernosum urethrae, similar to the one observed only in the case of *N. noctula* of all examined bat species. Regarding the os penis of *V. murinus* together with this tube, one may understand the description of Chaine when speaking of this bone, in the form of an "ongle d'Alouette" designing it with an aciculate end, and giving its longitudinal measurement as 5,5 mm.

Eptesicus nilssoni (Plate II, fig. 18). — I have examined the bacula of two specimens of this rare species. I found no data in literature. Méhely, on the basis of external characters, relegated it to the genus *Vespertilio* in 1900, but Thomas and Miller, acting also on external features, replaced it later in the genus *Eptesicus*. My present examinations indubitably show its proper place in *Eptesicus* and its relationship with *E. serotinus*. Contrarily to *V. muri-*

nus and similarly to *E. serotinus*, the baculum lies in the glans of the penis. It differs from the location of the bacula of *Myotis* species insofar as the longitudinal axis of the bone was at right angles to the main axis of the penis swollen in the lye, whilst the others shew a much smaller angle. The os penis is rather different from that of *E. serotinus*. It is a slender bone, bi-cleft up to its half length by a deep and wide cut. The proximal branches tend posteriorly and somewhat down- and inwards. They have knob-like swellings on their extremities. In one of the cases, the branches leaned on the urethra as ventrally widening lamellae. The distal end is widely rounded. Its length is 1,32 mm, the straddling of the branches 0,72—0,76 mm.

Eptesicus serotinus (Plate II, fig. 17). — In older literature, only C h a i n e discusses its os penis. He gives a description of the bone, and a drawing of its outlines from a lateral aspect. However, both his description and drawing refer evidently to the baculum of *N. noctula* and, in no case, to that of *E. serotinus*. The bacula of the ten *E. serotinus* specimens examined by me were situate in the glans, resembling, from above, a more or less elongated arrowhead. There is a shallower or deeper, wide, V-shaped incision on its proximal end, which tends forwards but to one-third of the whole length, so, whilst one may speak of proximal branches in *E. nilssoni*, there are only extensions in this case. The marginal sides of the bone converge anteriorly either gradually or, at first, generally rapidly and only then slower, after a constriction in the median third. In this way, the lateral margins show a certain concavity. The tip is mostly narrowly rounded. The dorsal surface is generally smooth, though there occurs sometimes a lengthwise dent along the midline. There may be a shallower or deeper concavity, when viewed laterally, between the tip and the proximal portion. The lateral margins of the proximal portion, — spreading over the urethra — trend in a considerable rate downwards in many cases, so that from a lateral view the bone will often be high in this place, with a concomitant deep trough ventrally, becoming quite shallow forwards on the ventral surface of the distal portion. The length of the bone is 1,08—1,36 mm (the main of 10 specimens : M = 1,23), its breadth 0,60—0,88 mm (M = 0,76).

Nyctalus noctula (Plate I, figs. 11, 12). — Older authors have treated relatively many times the os penis of this common and large bat. D a u b e n t o n discusses it already in 1760, B l a i n v i l l e gives a drawing, then C h a i n e, on the basis of the two former authors, publishes a description and a figure. These authorities all describe more or less correctly this bone, enormous among the other bacula of the European bats, yet, due probably to faulty preparations or weak magnifying instruments, they give an improper picture of the distal end. Namely, they do not mention the small, fork-like bifurcation at this place. I have studied the bacula of 22 specimens. The bone occupies, extending over the glans, about the distal half of the penis. It approaches by its base the ventral wall of the penis, its tip is in the tip of the glans. Its proximal portion is thick, gradually tapering distally, passing into the dorsally convex then gradually narrowing median portion. The proximal portion has a narrow incision in the median level, advancing anetriorly to about one-fifth of the bone. There is a ditch-like hollow on both the dorsal and ventral surfaces of the incised portion. The one on the dorsal surface is wider, flatter, bordered by rather sharp lobes on both sides. The one on the ventral side is really a channel with the urethra passing between its walls. After passing through this channel, the urethra moves on in a shallow indentation or on a flat of the ventral

surface of the median portion. It does not touch the clyindrical and tapering terminal portion of the bone. The os penis bifurcates very finely at its distal end. The small branches are flat and tend slightly down- and forwards, as if pressing down the end of the urethra. Their straddling is 0,20—0,22 mm. The length of the 20 measured bacula is 5,51—6,22 mm (M = 5,83), the width of the thick proximal portion is 0,84—1,09 mm (M = 0,94). After the distal bifurcation, there is a small, probably cartilaginous — histologically not examined — growth in the continuation of the bone. This covers the distal branches, then extends as a flat shaft to end as a conical tubelet. It is definitely distinct from the bone. Its length is about 0,5 mm. Evidently a homologous structure with the slightly staining tube observed in *V. murinus*.

Pipistrellus pipistrellus (Plate I, figs. 9, 10). — According to Méhely, its penis contains no bone. This statement is incorrect, since Leydig, as appearing from the citations of later authors, has correctly described the bone in 1857. Matthews, however, errs when he states that the baculum of *P. pipistrellus* is the widest in the median portion. I have examined 14 specimens of this bat. With regard to the general shape, the formation and trend of the distal and proximal ends of the bone, it is similar to the os penis of *N. noctula*, yet, naturally, much smaller. It has an angle of about 80° to the main axis of the penis. Its median portion bends upwards, so that bone has a convex arch. It has a crest proximally, and flattened on both sides. The thick proximal portion is elongated, with a narrow and deep incision in the median level. There are grooves on the dorsal and ventral surfaces of this incised portion. There is a relatively strong bifurcation on the distal end of the bone. The straddling of the branches is 0,08—0,10 mm. The length of the bone is 1,40—1,64 mm (the main of 8 measurements : M = 1,51), its breadth 0,28—0,36 mm (M = 0,33).

Pipistrellus nathusii (Plate I, figs. 7, 8). — Nor did Méhely find any os penis in this species, and thought, on this basis, to have the Hungarian *Pipistrellus* species sharply distinct from the Indian *P. abramus*. No other authors have examined this species from this point of view. I have studied six specimens. Its baculum resembles the one of *P. pipistrellus* only superficially. Its widened proximal portion is shorter, piriform. It has a wide, still more distended incision in its median level. The two margins of the incision are thickened, and club-like on the dorsal side, with a channel for the urethra ventrally. The median portion is triangular in a cross-section, its base afforded by the flat ventral surface, its tip by the dorsal edge. At its distal end, there is a much stronger bifurcation than in the case of *P. pipistrellus*, of a 0,2 mm straddling. The bone itself is generally stouter. Viewed laterally, it is bent more than once, so that it has an elongated shape. Its distal end bends upwards. Its length is 1,20—1,36 mm (the main of six measurements : M = 1,30), its breadth 0,34—0,38 mm (M = 0,36). The bone is small, as related to the baculum of the smaller-bodied *P. pipistrellus*.

Barbastella barbastellus (Plate II, figs. 19, 20). — I have examined two specimens. Its baculum is well distinguishable from those of the other species. It is a fine bonelet, broadening proximally, and strikingly narrowing distally. Its basal and anterior parts bend strongly upwards, whilst its lateral margins bend down ventrally, so that it is shaped like a narrow and highly bent shoe-horn. Its ventral concavity embraces the urethra. It is situated in the glans penis. Its length is 0,76 mm, its breadth 0,28—0,32 mm.

Plecotus auritus auritus (Plate II, fig. 22). — I have examined the bacula of 5 recent specimens, and studied a bone found in the cave sediment (the Solymár Cave) from the Riss. According to Matthews, the os penis of this species is a proximally bifurcate cylindrical bone. It is situated in the glans, above the urethra, at right angles to the main axis of the penis, as in the *Eptesicus* species. Its proximal end is composed of two cylindrical branches, terminating in a broad knob. The branches bend downward in the ventral direction. The main portion is slightly concave ventrally, otherwise approximately cylindrical. Viewed from above, the bone resembles the letter Y. The fossil bone corresponds in everything to the recent ones. The length of four specimens is 1,08—1,12 mm (M = 1,10), the straddling of the branches is 0,68—0,76 mm (M = 0,71).

Plecotus auritus meridionalis (Plate II, fig. 21). — I use this name only provisionally for the designation of this form, more frequent than the former one in the area in discussion. On the basis of nine examined specimens, one may say that it is definitely distinct from *P. a. auritus*. The difference is so strong, that it supports rather powerfully the justness of a specific separation. The two proximal projections of the os penis are quite short, flattened, indeed, hollowed and wide ventrally. They end in a flat edge. The main portion is also broad and flat. Disregarding its proximal incision, the bone takes the shape of a wide spoon. The longitudinal measurements of nine specimens are 0,68—0,80 mm (M = 0,75), their breadth 0,44—0,60 mm (M = 0,51). In this way, it differs even in sizes from the bacula of the above form.

Miniopterus schreibersi. — A painstaking examination of five specimens shew that they have no bone in the penis.

Summary

Of the examined 23 bat species and subspecies, I have found no bone in the penis of *Miniopterus schreibersi*. As concerns the others, the location of the baculum in the penis is as follows. It is situated in the glans penis or, according to the terminology of Pohl, in the caput penis, so one may call it also os glandis for the members of the genera *Myotis*, *Eptesicus*, *Plecotus* and *Barbastella*. It extends backwards from the glans into the corpus penis in the members of the genera *Rhinolophus*, *Nyctalus*, and *Pipistrellus*. Finally, it can be found in the proximal third of the penis in the genus *Vespertilio*. In the case of the *Rhinolophids*, there are identical portions to be distinguished on the bone, but the different formation of the several parts serve excellent characters for the separation of the species. The shape of the os penis of *R. ferrumequinum* and *R. euryale* testifies on a near realationship between the two species, whilst *R. hipposideros* stands, from this point of view, further from the two other species. Within the genus *Myotis*, the os penis shows a similarity of shape between *M. mystacinus brandti* and *M. nattereri* on the one hand, and between *M. myotis* and *M. oxygnathus* on the other. Further, the os penis is rather well identifiable in the species *M. mystacinus*, *M. bechsteini*, *M. emarginatus*, *M. daubentoni*, *M. dasycneme*, and *M. capaccini*, a good basis to distinguish these species. The bacula of *M. mystacinus* and *M. m. brandti*, however, refer to a more distant relationship between the two forms than was thought up to now. There is a similar os penis formation in the members of the genera *Nyctalus*

and *Pipistrellus*. On the basis of the location and morphological features of the os penis of *E. nilssoni* and *E. serotinus* one may consider a rather near relationship between the two species. On the same token, *E. nilssoni* cannot be brought into any kind of a near relationship with *V. murinus*. I have found differences of such extent in the shapes of the bacula of the two *Plecotus* forms, *P. a. auritus* and *P. a. meridoinalis* occurring in the Carpathian basin, that one has to deal probably with distinct species. One needs as large materials as possible in the case of any further examinations of this kind since it was found that the possibilities of variations are enormous even within a given species. With my present work, I hope to have amended and supplemented — at least in bold outlines — the rather serious scarcity of data in literature pertaining to our knowledge on the os penis in the majority of European bats.

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Explanation of Plates

Plate I.

Bacula of bats in dorsal and lateral views. The figures given in a lateral aspect show the left side of the bacula, so that the dorsal contour is on the right. Magnification of figs. 1— 6 as 15 ×, figs. 7—10 as 57 ×, figs. 11—12 as 19 ×, figs. 13—14 as 36 ×. Figs. 1—2 *Rhinolophus ferrumequinum* (dors., lat.). Figs. 3—4. *Rhinolophus hipposideros* (dors., lat.). Figs. 5—6. *Rhinolophus euryale* (dors., lat.). Figs. 7—8. *Pipistrellus nathusii* (dors., lat.). Figs. 9—10. *Pipistrellus pipistrellus* (dors., lat.). Figs. 11—12. *Nyctalus noctula* (dors., lat.). Figs. 13—14. *Vespertilio murinus* (ventral and lateral views).

Plate II.

Bacula of bats in dorsal and lateral views. The figures given in a lateral aspect show the left side of the bacula, so that the dorsal contour is on the right. Magnification a uniform 36 ×. Figs. 1—2. *Myotis mystacinus brandti* (dors., lat.). Fig. 3. *Myotis m. mystacinus* (dors.). Figs. 4—5. *Myotis nattereri* (dors., lat.). Fig. 6. *Myotis capaccini* (dors.). Figs. 7—8. *Myotis dasycneme* (dors., lat.). Figs. 9—10. *Myotis oxygnathus* (dors., lat.). Figs. 11—12. *Myotis myotis* (dors., lat.). Figs. 13—14. *Myotis bechsteini* (dors., lat.). Fig. 15. *Myotis daubentoni* (dors.). Fig. 16. *Myotis emarginatus* (dors.). Fig. 17. *Eptesicus serotinus* (dors.). Fig. 18. *Eptesicus nilssoni* (dors.). Figs. 19—20. *Barbastella barbastellus* (dors., lat.). Fig. 21. *Plecotus auritus meridionalis* (dors.). Fig. 22. *Plecotus a. auritus* (dors.).

PLATE I.

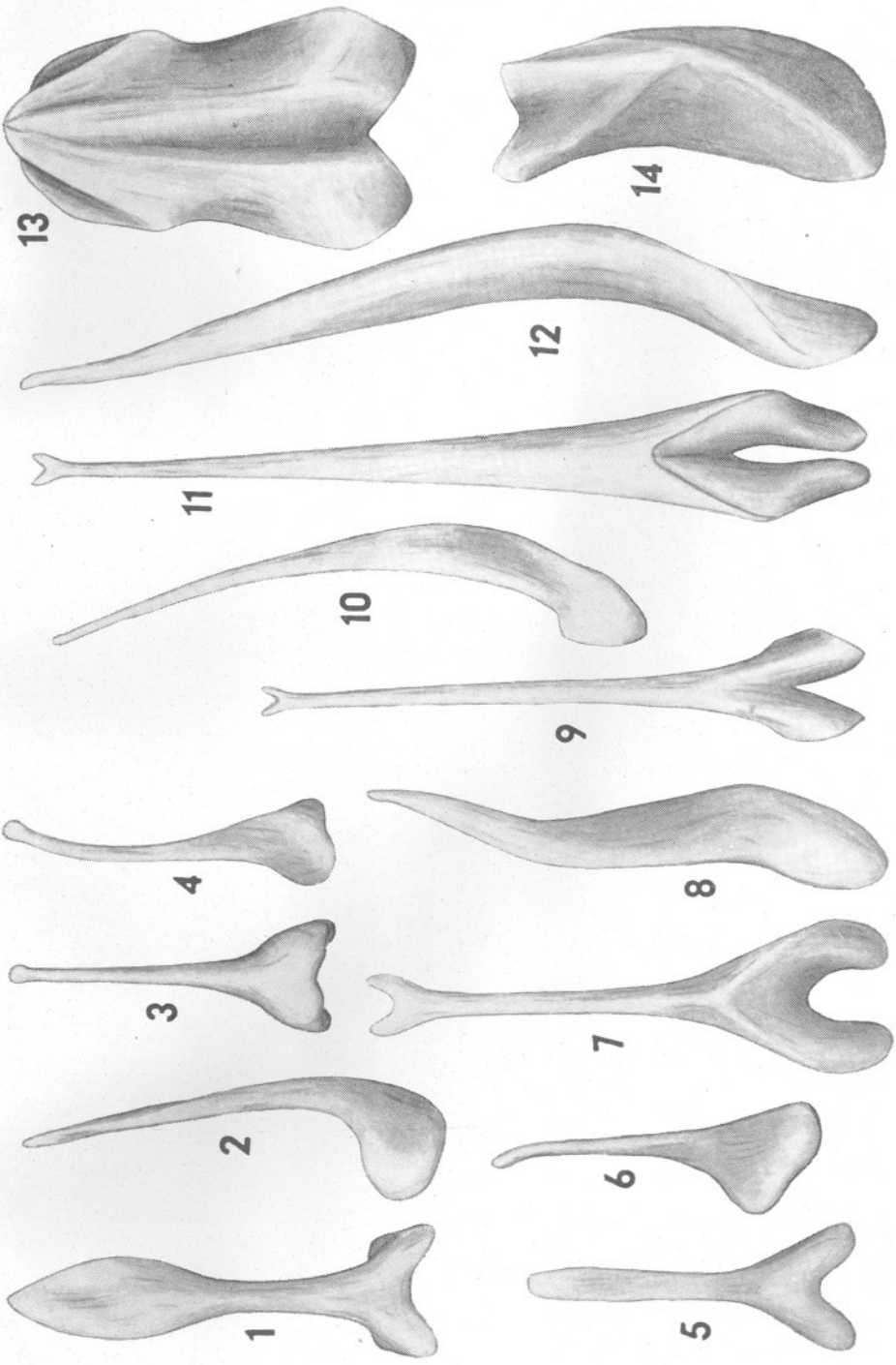

PLATE II.