KARYOTYPIC AND MORPHOMETRIC STUDIES OF TUNISIAN MAMMALS : BATS

by

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Les caryotypes et les mensurations de 8 espèces de *Chiroptera* de Tunisie sont présentés dans ce travail. *Asellia tridens* et *Rhinolophus mehelyi* montrent une variation sexuelle secondaire significative. Les mesures des *Plecotus austriacus* de Tunisie sont comparées à celle des *P. austriacus* et *P. auritus* de Hollande. Les auteurs donnent des indications sur la reproduction des chauves-souris de Tunisie.

Les caryotypes de *Rhinolophus ferrumequinum*, *Pipistrellus kuhli*, *Eptesicus serotinus*, *Plecotus austriacus* et *Miniopterus schreibersi* sont identiques en Tunisie et en Europe. *Rhinolophus mehelyi* a le même nombre diploïde qu'en Roumanie, mais le nombre fondamental est différent. Le caryotype de *Myotis blythi* de Tunisie est différent de celui de Tchécoslovaquie, mais il est semblable à ceux des *Myotis* de l'Ancien et du Nouveau Monde. Le caryotype d'*Asellia tridens* est 2N = 50, NF = 62.

Although Tunisia does not occupy a large portion of North Africa, it does occupy a most important zoogeographic position between the mesic mountains of Algeria-Morocco and the Libyan desert. This is one of several papers designed to describe the mammalian fauna of Tunisia that was collected during karyotypic and ecological studies sponsored by the Smithsonian Foreign Currency Program. The format of these papers is to present the morphometric and karyotypic data from each taxon in such a manner so that date will be useful to workers in other geographic areas. The scope of this paper is the Chiroptera (bats) collected during 1972-73.

Fourteen species of bats are reported for Tunisia (Aellen and Strinati, 1969). Of these we obtained representatives of eight species. For the pertinent literature on Tunisian Chiroptera the reader is referred to Aellen and Strinati (1969 & 1970).

METHODS AND MATERIALS

Specimens were mist netted or collected from caves or natural roosts. Karyotypic preparations were prepared as described by

Mammalia, t. 38, n° 4, 1974.

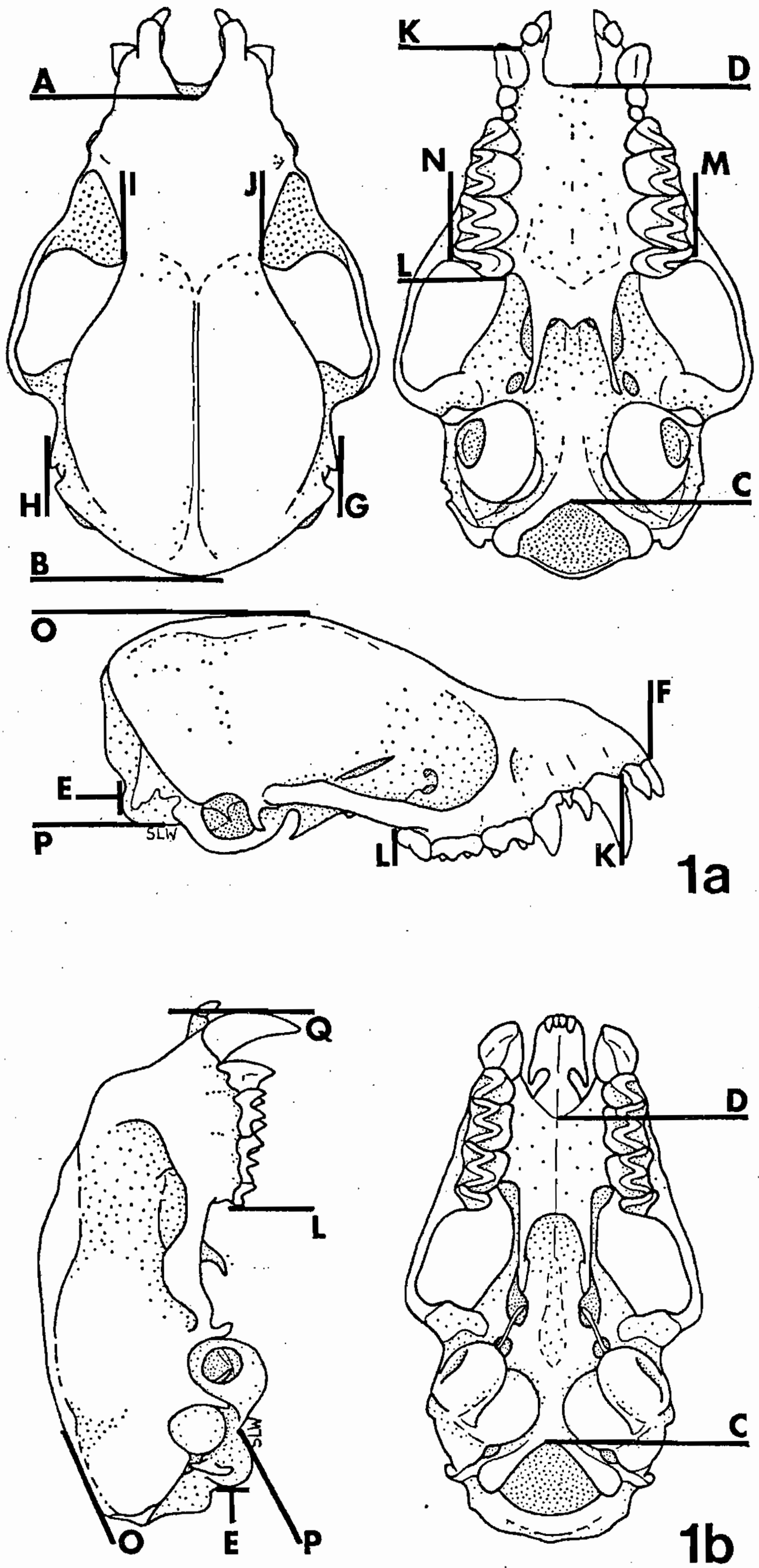

Fig. 1. — a. Drawing of a *Myotis blythi* skull showing cranial measurements used in the statistical studies.

b. Drawing of an *Asellia tridens* skull showing cranial measurements that differed from those taken on species of Vespertilionidae (see text for key).

Baker (1970) and karyotypic analyses were by standard procedures (Patton, 1967). A minimum of five spreads were studied per specimen examined.

Standard measurements that were recorded by the preparator were taken from the specimen's tag. In *Pipistrellus kuhli* several of the length of foot measurements were recorded as 8 or 9 mm. These measurements were believed to be much too large for the specimen and the dry foot was measured and this value substituted for that on the tag. Cranial measurements and forearm length were taken with dial calipers and recorded to the nearest tenth millimeter. Forearm length is the length of the dried forearm including the metacarpels. Skull measurements are shown on Figure 1a (*Vespertilionidae)* and where the equivalent measurement is somewhat different in the Rhinolophidae it is figured in 1b and marked below by asterisks. Cranial measurements are Occipitonasal Length (A-B) ; Basipalatal Length * (C-D) ; Condyloincisive Length * (E-F) ; Rhinolophidae-Condylocanine Length (E-Q) ; Mastoid Breadth (G-H) ; Least Interorbital Breadth (I-J) ; Length of the Maxillary Toothrow * (K-L), Rhinolophidae (L-Q) ; Greatest Breadth Maxillary Toothrows (M-N) ; Greatest Height of Skull * (O-P). Specimens from each species were lumped by sex without regard for locality. All statistical procedures were performed on the IBM 370-145 computer at Texas Tech University. Standard statistics were generated using the Texas Tech version of Power's UNIVAR Program. Tests for secondary sexual dimorphism were conducted by an ANOVA. Reproductive data were recorded by the preparator.

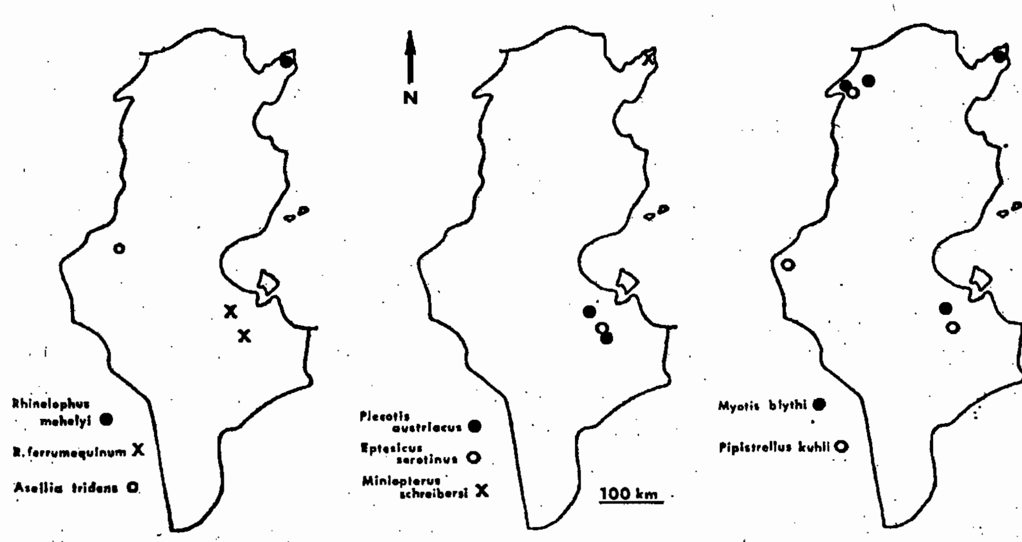

Fig. 2. — Geographic distribution of specimens collected in this study in 1972-73.

RESULTS

A total of eight species were collected from Tunisia. The geographic distribution of each taxon is shown in Figure 2. Chromosomal data are presented in Table 1. Morphometrics for each species are presented in Table 2. Secondary sexual dimorphism in *Asellia tridens* and *Rhinolophus mehelyi* is presented in Table 3. Representative karyotypes are shown in Figures 3-10. Specific comments for each species are recorded below in the species accounts.

Rhinolophus ferrumequinum (Fig. 3)

This species has been karyotyped from Italy (Capanna and Civitelli, 1964 *a* & *b*), Yugoslavia (Dulic, 1966 & 1967), and Tunisia. The diploid number is 58 in representatives from all three localities. The Yugoslavian and Tunisian material have a fundamental number of 60. The Italian specimens were reported as having a fundamental number of 62. This difference is probably an artifact of interpretation as Capanna and Civitelli (1964 *a* & *b*) counted a satellite pair as being biarmed raising the fundamental number by two. In our material we have observed this pair but to be consistent with our interpretation of biarmed versus uniarmed condition we assigned a fundamental number value of one to each element of this pair.

Reproduction.

The testicular size in our three males is 6 × 4, 6 × 4, and 5 × 3, respectively. The first two individuals were collected on 31 May 1973 and the last individual on 5 June 1973.

Rhinolophus mehelyi (Fig. 4)

The chromosomes of this species are very similar to those described for *R. ferrumequinum* with a diploid number of 58 and a fundamental number of 60. Based on our preparations we cannot tell the two karyotypes apart. Rumanian specimens of *R. mehelyi* have been karyotyped and the diploid number is the same but these specimens have 3 more pairs of biarmed elements than does the Tunisian material (Dulic and Soldatovic, 1969). The magnitude of difference between the two karyotypes reported for this species is sufficiently large to warrant further investigation, especially of intermediate populations. Because several species of *Rhinolophus* have a karyotype like the Tunisian representatives of *R. mehelyi* it is probable that the Tunisian representatives have the primitive karyotype. A comparison of the two cytotypes with the recently developed heterochromatin and G-Banding techniques would prove most valuable in determining the nature and significance of these changes.

Reproduction.

Ten females collected on 2 November and four females collected on 8 November 1973 were not pregnant. Testicular size for six males collected on 2 November was 2 × 1, 4 × 2, 4 × 3, 5 × 3, 6 × 3, and 7 × 4. Four males collected on 8 November had testes with 3 × 2, 4 × 3, 5 × 4, and 6 × 4 measurements. The testes of a male collected 4 May were 5 × 3 millimeters.

Secondary sexual variation.

Three characters, length of forearm, mastoid breadth, and length of maxillary toothrow exhibited significant secondary sexual differences (Table 3). Females had larger forearm measurements whereas males had larger measurements for other characters exhibiting sexual differences. It is common among bats for the female to have the larger forearm measurement. This phenomena is usually explained as an adaptation to overcome wing loading problems the female may encounter during pregnancy.

Asellia tridens (Fig. 5)

The karyotype of this species has not been published. Its diploid number is 50 and the fundamental number is 62. The autosomes consist of seven pairs of biarmed elements and seventeen pairs of acrocentric elements. All of the biarmed pairs have a submetacentric placement of the centromere, except the third largest and one of the smallest pairs which are subtelocentric in nature. The X is a medium sized submetacentric element and the Y is an acrocentric about one half the size of the X. There is a secondary constriction on one of the smallest pairs of acrocentrics.

Reproduction.

Of the several females collected on 25 February 1973 and 25 April, none were pregnant. Testicular size in males ranged from 2 × 1 to 6 × 3 in both samples from the two respective dates mentioned above. Most of the specimens from both samples had testes between 3 × 2 - 4 × 3.

Secondary sexual variation.

Of the thirteen characters measured, seven showed significant differences between the sexes (Table 3). As was the case in *R. mehelyi* females exhibited the larger forearm measurements but males were larger cranially in measurements that exhibited significant secondary sexual dimorphism.

Myotis blythi (Fig. 6)

The autosomes of our Tunisian specimens of this species are indistinguishable from the autosomes of North American *Myotis velifer* (Baker & Patton, 1967 and Hsu & Benirschke, 1967). In both species there are three large pairs of biarmed elements which are about the same size and a pair of small biarmed elements which are between one third and one fourth the size of the largest pair of biarmed elements. In both *M. blythi* and *M. velifer* the largest or second largest pair of acrocentrics have a small second arm. The X in both species is a medium sized submetacentric. The identification of the Y is not unequivocal but this seems to be the only area where the two karyotypes are distinguishable. In *M. velifer* the Y is small, almost minute and in *M. blythi* the Y is about half the size of the X.

Specimens of *Myotis blythi* were studied from Czechoslovakia by Ivana Kozokova (Baker, 1970) and a different karyotype was found. In the Czechoslovakian specimens there were five pairs of biarmed autosomes and three of these pairs were smaller than the X element. Only one rearrangement would be required to produce the autosomal karyotype of the Czechoslovakian specimens from that characteristic of both Old and New World species. If part of one of the larger pairs of biarmed autosomes was translocated to a short arm of a smaller pair of acrocentric autosomes then the two karyotypes would be more nearly interchangeable. In our material the relative size of the X is nearer to that of autosomal pair three (of the Czechoslovakian specimen) and pair three is nearer the size of the X of *M. velifer* and Tunisian *M. blythi.*

Reproduction.

Two females collected on 2 November were not pregnant. One of six females collected on 19 November contained two small embryos. The other five females collected on that date were not macroscopically pregnant. Of the 24 males collected in November 1973, 23 had testes that measured between 5 × 3 and 8 × 5 millimeters. The one exception was 4 × 3. Males collected 31 May had testes that measured 5 × 3, 6 × 3, 6 × 3, 6 × 3, and 6 × 4.

Pipistrellus kuhli (Fig. 7)

The karyotype of this species was described by Capanna and Civitelli (1966). The karyotype of our Tunisian material is indistinguishable from that described for specimens from Italy. The interesting thing concerning the karyotype of Old World *Pipistrellus kuhli* and *Pipistrellus savii* is that the diploid number, fundamental number and most chromosome morphology is identical to that described for most species of *Myotis*. It seems probable that the karyotype 2N = 44, FN = 50 was primitive to the line that gave rise to these *Pipistrellus* and *Myotis*.

Reproduction.

All fifteen females that were collected on 25 April were pregnant. Twelve individuals contained two embryos each and three contained a single embryo. Crown-rump length of embryos varied from 5 × 3 mm. to 11 × 6 mm. One of three females collected on 5 June was lactating. The other two were neither pregnant nor lactating. A female collected on 19 November was not pregnant. Testicular size of two males collected on 19 November was 7 × 4 and 4 × 3.

Eptesicus serotinus (Fig. 8)

Eptesicus is a widely distributed genus and New World and Old World species have identical autosomes and X chromosomes (Baker and Patton, 1967, Vorontsov *et al.*, 1969, and Fedyk and Fedyk, 1970). However, the karyotype characteristic of species of this genus has not been reported as characteristic of any other genus, a fact which strongly argues for a common origin for the species of the genus that have been studied to date.

The minor intraspecific variation that has been described within *E. serotinus* consists of the Y element being acrocentric in specimens from the Soviet Union (Voronstov *et al.*, 1969) and the Y is submetacentric in specimens examined from Poland (Fedyk and Fedyk, 1970). Unfortunately, we did not examine a male so we cannot compare the Tunisian material to these two cytotypes.

Reproduction.

All four females collected on 5 June were lactating.

Plecotus austriacus (Fig. 9)

The chromosomes of this species were described by Kozakova from Czechoslovakia (Baker, 1970) and Poland (Fedyk and Fedyk, 1970; and Fedyk and Fedyk, 1971), and the karyotype of our Tunisian material is indistinguishable from that of the Polish and Czechoslovakian material. The karyotype of the other species of the subgenus *Plecotus (P. auritus)* was described by Bovey (1949) and examined in greater detail by Fedyk and Fedyk (1971); the karyotype of the two species are distinguishable from each other only by detailed centromeric position values in three pairs of autosomes and the

X element. Species of the other subgenus *(Corynorhinus)* have autosomes that are very similar to those of the subgenus *Plecotus* but the X is an acrocentric in *Corynorhinus* and a submetacentric in *Plecotus*.

The implications of the karyological data for the group Plecotini were discussed by Williams *et al.* (1970) and Fedyk and Fedyk (1971) and our additional data agree with that available to these authors at the time of their study. We do not agree, however, with the conclusion of Williams *et al.* (1970) that the magnitude of karyological differences between *Idionycteris phyllotis* and members of *Plecotus* is sufficient to support the generic distinctness of *Idionycteris* from *Plecotus*. Handley (1959) placed *Idionycteris* as a subgenus of *Plecotus*. If *Idionycteris* is to be recognized as a genus distinct from *Plecotus*, this status must be based on additional morphological data as well as on the origin of the *Idionycteris* karyotype (instead of the magnitude of karyological divergence). We agree with Williams *et al.* (1970) that the *Idionycteris* karyotype appears to be more similar to that of *Euderma* than *Plecotus* and that if this similarity reflects the origin of the *Idionycteris* karyotype then data on the origin of the karyotypes support the generic distinction of *Idionycteris* from *Plecotus*.

Reproduction.

A female collected on 5 June was lactating. Testicular measurements of males collected on 31 May and 5 June were 3 × 1, 4 × 2, 4 × 2, 4 × 2, 4 × 3, 5 × 2, and 5 × 3.

Morphometrics.

Van Bree and Dulic (1963) reported comparisons of measurements between a single specimen of *P. austriacus* and 12 male specimens of *P. auritus*. Where comparisons can be made between our male material and those reported by Van Bree and Dulic (1963) we find our measurements agree in part with *P. auritus* but, we find little agreement with *P. austriacus* (Table 4). In length of tragus specimens of *P. auritus* from the Netherlands fall in the lower range of the Tunisian material reported here, however, the single specimen of *P. austriacus* reported by Van Bree and Dulic (1963) falls in the upper range for the Tunisian material. Forearm and Occipitonasal Length (Condylobasal Length of Van Bree and Dulic) are well within their reported range for *P. auritus*. Length of the maxillary toothrow averaged larger in the Tunisian material than *P. austriacus*, however, the smallest measurement in the Tunisian material met the largest measurements of *P. auritus* in the Netherlands material (Van Bree and Dulic, 1963). Mastoid breadth in our specimens is considerably larger than in either species reported by Van Bree and Dulic. The

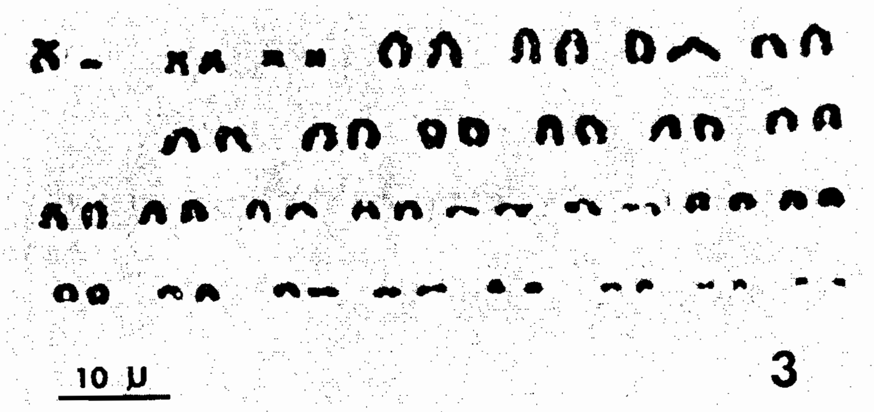

Fig. 3. — Karyotype of a male *Rhinolophus ferrumequinum* (TPV 1523).

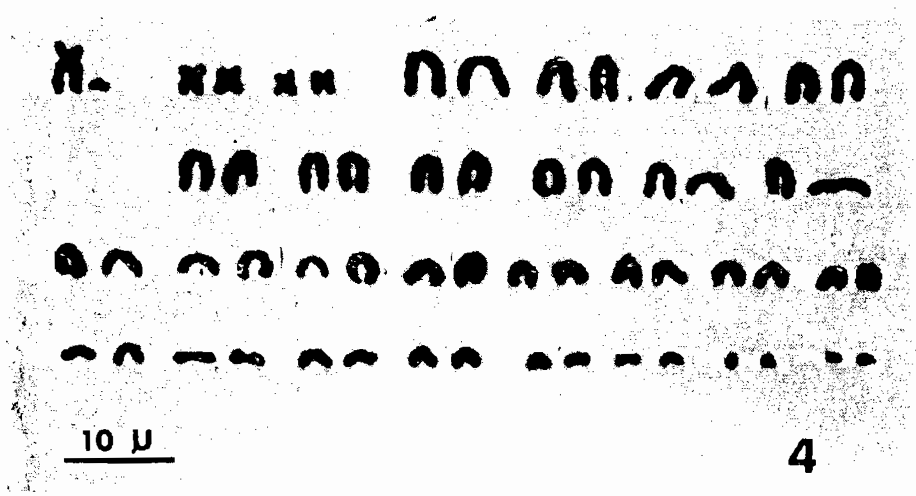

Fig. 4. — Karyotype of a male *Rhinolophus mehelyi* (TPV 674).

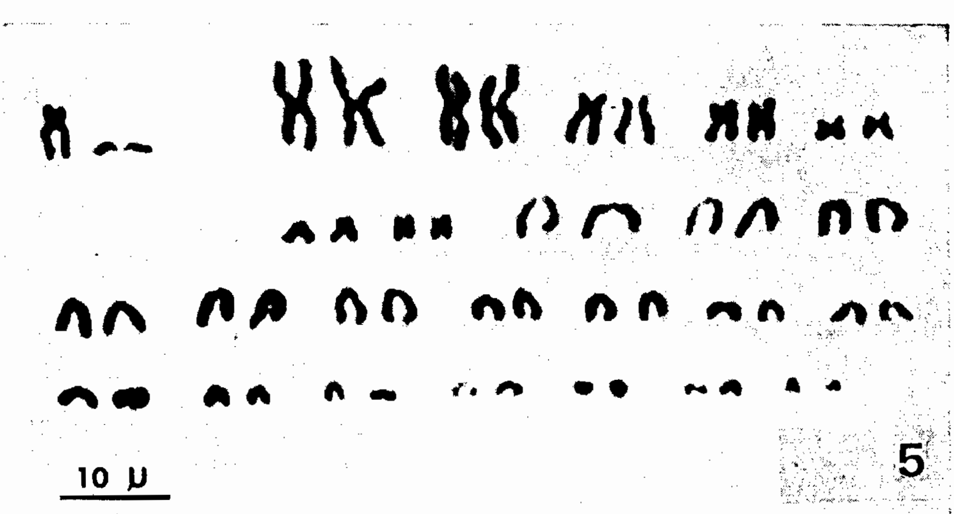

Fig. 5. — Karyotype of a male *Asellia tridens* (TPV 1360).

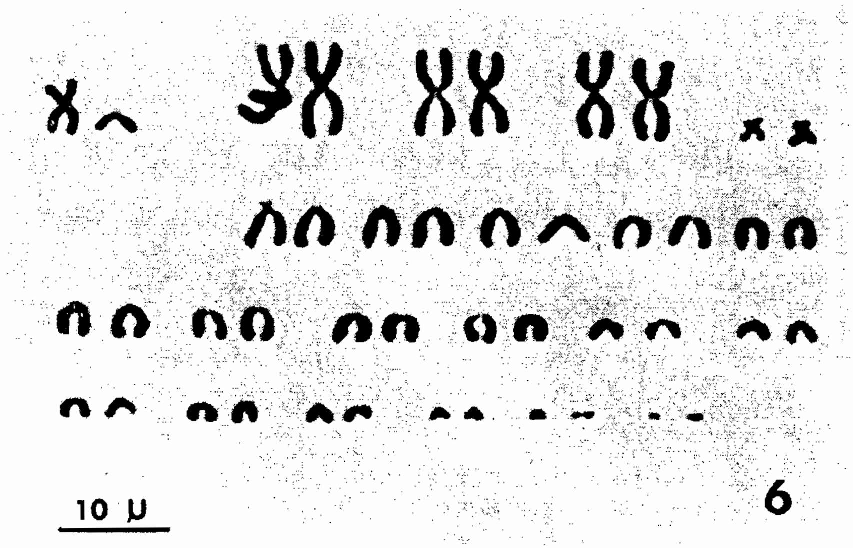

Fig. 6. — Karyotype of a male *Myotis blythi* (TPV 727).

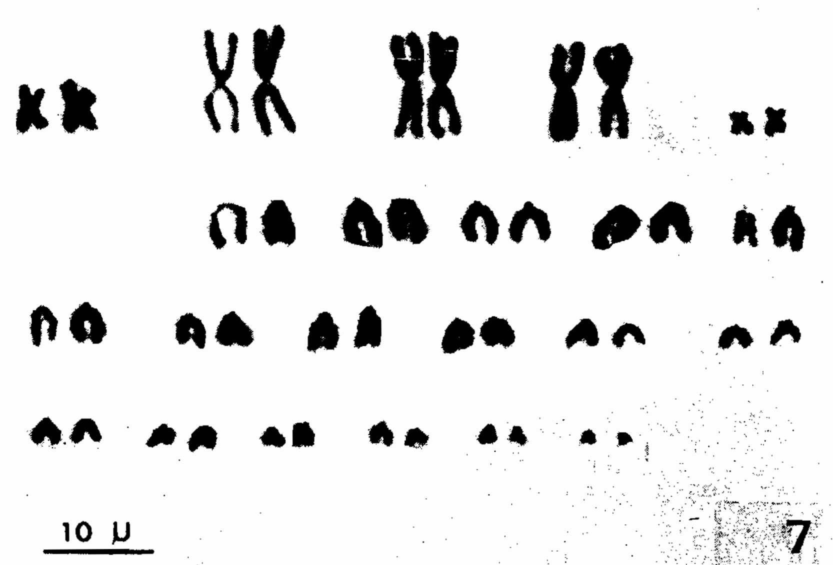

Fig. 7. — Karyotype of a female *Pipistrellus kuhli* (TPV 1542).

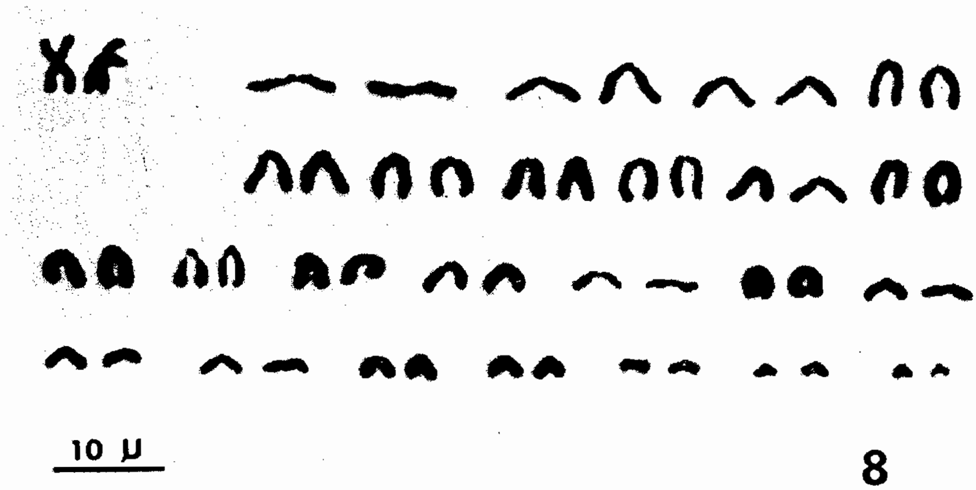

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Fig. 8. — Karyotype of a female *Eptesicus serotinus* (TPV 1543).

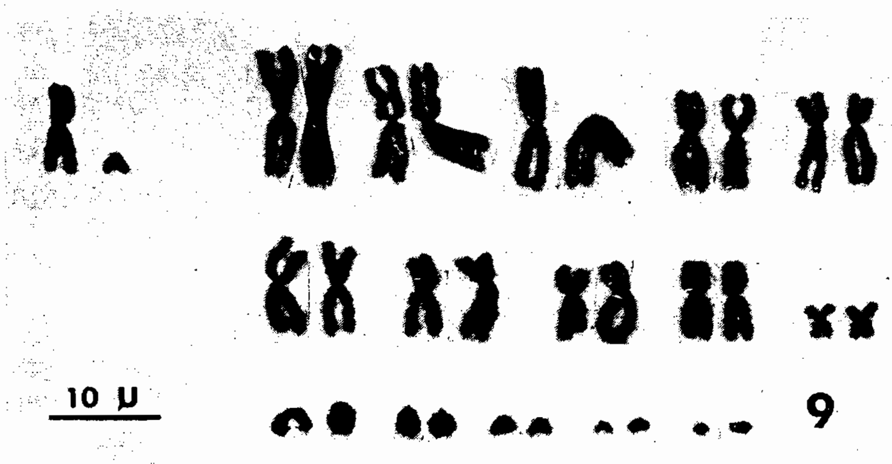

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Fig. 9. — Karyotype of a male *Plecotus austriacus* (TPV 1432).

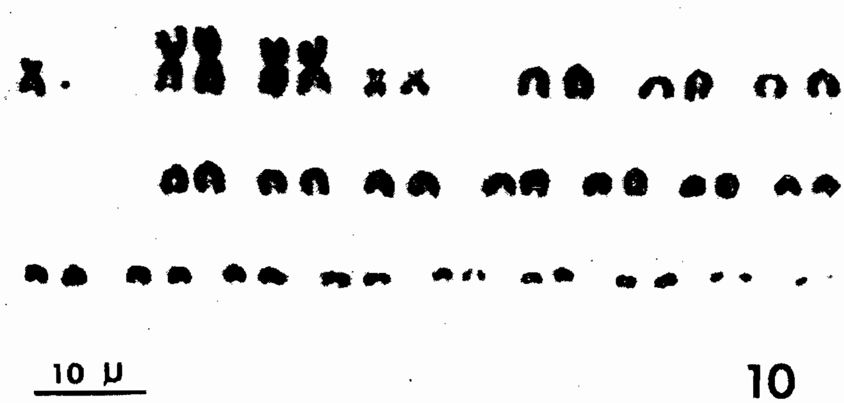

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Fig. 10. — Karyotype of a male *Miniopterus schreibersi* (TPV 639).

broad overlap in length of hind foot between the Tunisian material and the Netherlands material (includes both species) makes comparison for this character superfluous. Aellen and Strinati (1969) and Hayman and Hill (1971) refer specimens of *Plecotus* from Tunisia to *P. austriacus*. Until additional specimens of *P. austriacus* and *P. auritus* from Europe and North Africa are examined we continue to follow these authors in order to prevent undue taxonomic confusion.

Miniopterus schreibersi (Fig. 10)

The karyotype of this species has been described in detail elsewhere (Capanna and Civitelli, 1964 & 1965). Our material is indistinguishable from that of Italy. As was pointed out by Capanna and Civitelli (1969), this karyotype could easily be converted into the karyotype characteristic of *Myotis* by the fusion of one pair of acrocentric chromosomes.

Reproduction.

Three females collected on 8 November 1972 were not pregnant. A male collected on 8 November 1972 had minute testes.

SPECIMENS EXAMINED

Museum numbers have not been assigned to the specimens because they are to be divided between Tunisian and American museums and the division is not yet finalized. The field collectors' number is given for the specimens examined and these will be correlated with the museum numbers when they are assigned. Field collectors' numbers are preceded by the letters TPV (Tom and Pamela Vaughan).

Rhinolophus ferrumequinum : 2 km. S Foum Tatahouine, 1 male, TPV 1523 ; 3 km. NW Toujane on M.C. 104 (45 km. airline S Gabes), 2 males, TPV 1446-47.

Rhinolophus mehelyi : 1.5 km NW El Haouaria, 7 males, 12 females, TPV 613-14, 619-22, 624-26, 628-37 ; 4 km. NE El Haouaria, 5 males, 6 females, TPV 666-72, TPV 1419.

Asellia tridens : 12 km. N Tozeur, 37 males, 25 females, TPV 1096-104, TPV 1126-34, TPV 1142-66, TPV 1168, TPV 1176-80, TPV 1353-64.

Myotis blythi : 1.5 km. NW El Haouaria, 3 males, 2 females, TPV 615-618, TPV 623 ; 4 km. NE El Haouaria, 14 males, 1 female, TPV 646-56, TPV 661-64, TPV 1420 ; Chemtou, Roman theater (17 km. airline W Jendouba), 4 males, 1 female. TPV 707-711 ; Bulla Regia, 7 km. NNW Jendouba, 8 males, 5 females. TPV 712-722, TPV 727-28 ; 3 km. NW Toujane on MC 104 (45 km. airline S Gabes), 5 males, TPV 1148-51, TPV 1456.

Pipistrellus kuhli : Foum Tatahouine, 3 females, TPV 1510, TPV 1541-42 ; 4.5 km. S Nefta, Memorial bldg. Sidi Hassen Ayed, 15 females, TPV 1311-25 ; Chemtou, Roman theater (17 km. airline W Jendouba), 2 males, 1 female, TPV 704-06.

Eptesicus serotinus : Foum Tatahouine, 4 females, TPV 1543-47.

Plecotus austriacus : 3 km. NW Toujane on MC 104 (45 km. airline S Gabes), 13 males, TPV 1432-45 ; 2 km. S Foum Tatahouine on GP 19, 5 males, 1 female, TPV 1524-29.

Miniopterus schreibersi : 4 km. NE El Haouaria, 1 male, 5 females, TPV 638-42, 644-45.

ACKNOWLEDGEMENTS

We thank Mr. Z. Ben Mustapha, Tunisian director of the *Projet des Mammifères*, for his support and encouragement, We acknowledge Tom and Pamela Vaughan, who performed much of the field work. Stephen L. Williams drew Figure 1. We thank Dr. William P. Davis and Mr. Ernani Menez, directors of the Smithsonian Institution's Mediterranean Marine Sorting Center, for their continual support. Mr. Sam Erwin translated the Russian publications. Adderrazak Ben Smial assisted in the field work. Supported by the Smithsonian Foreign Currency Project Number SF-3-00094, E. L. Cockrum, Director, Hedia Baccar and Robert J. Baker, co-principal investigators. Drs. Hugh H. Genoways and Henry Setzer critically evaluated the manuscript.

SUMMARY

Karyotypic and morphometric data are presented for eight species of Tunisian Chiroptera. Significant secondary sexual variation is reported for *Asellia tridens* and *Rhinolophus mehelyi*. A discussion and comparison of *Plecotus austriacus* from Tunisia with published measurements of *P. austriacus* and *P. auritus* from the Netherlands is made. Reproductive data obtained from specimen tags are presented. The karyotypes of *R. ferrumequinum, Pipistrellus kuhli, Eptesicus serotinus, P. austriacus*, and *Miniopterus schreibersi* from Tunisia are the same as those reported from Europe. *Rhinolophus mehelyi* has the same diploid number but differing fundamental number than Rumanian specimens. The karyotypes of *M. blythi* differs from Czechoslovakian specimens of the same species but is similar to that of other Old and New World Myotis. The karyotype of *Asellia tridens* (2N = 50 ; NF = 62) is reported for the first time.

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TABLE 1. — Chromosomal data for some species of bats that occur in Tunisia.
M = Metacentric ; Sm = Submetacentric ; St = Subtelocentric ; A = Acrocentric.
All FN values are the number of arms of the autosomal complement

Species	2N	FN	X	Y	Sample size ♂♂	♀♀	Reference and locality
RHINOLOPHIDAE							
Rhinolophus ferrumequinum	58	60	Sm	A	2	0	This paper, Tunisia
	58	—	—	—	—	—	Makino, 1948
	58	62	Sm	A	5	3	Capanna and Civitelli : 1964a, b. Italy
	58	60	Sm	A	4	4	Dulic, 1966 ; Dulic, 1967. Yugoslavia
R. mehelyi	58	60	Sm	A	6	8	This paper, Tunisia
	58	64	Sm	A	5	0	Dulic and Soldatovic, 1969. Rumania
Asellia tridens	50	62	St	A	4	5	This paper, Tunisia
VESPERTILIONIDAE							
Myotis blythi	44	50	Sm	A	27	9	This paper, Tunisia
	44	52	Sm	A	—	—	Baker, 1970 citing Kozakova. Czechoslovakia
Pipistrellus kuhli	44	50	Sm	A	2	7	This paper, Tunisia
	44	50	Sm	A	2	1	Capanna and Civitelli, 1966. Italy
Eptesicus serotinus	50	48	Sm	A	0	5	This paper, Tunisia
	50	48	Sm	A	—	—	Voronstov, Radjabli, and Volobuev, 1969. Russia
	50	48	Sm	Sm	3	2	Fedyk and Fedyk, 1970. Poland
Plecotus austriacus	32	50	M	A	15	1	This paper, Tunisia
	32	50	Sm	A	—	—	Baker, 1970 citing Kozakova. Czechoslovakia
	32	50	Sm	A	1	1	Fedyk and Fedyk, 1970. Poland
Miniopterus schreibersi	46	50	Sm	A	1	5	This paper, Tunisia
	48	50	—	—			Matthey and Bovey, 1948
	46	50	M	A	3	0	Capanna and Civitelli, 1964b. Italy
	46	50	Sm	A	—	—	Capanna and Civitelli, 1965. Italy

TABLE 2. — Mean, ±2 times Standard Error, Coefficient of Variation and Range (smallest to largest) for 5 external and 9 cranial measurements of 8 species of Tunisian bats

	N	Mean	±2SE	CV	Range
Rhinolophus ferrumequinum					
(male)	3				
Total length		98.0	1.15	1.0	97.0- 99.0
Length of tail		33.3	3.71	9.6	31.0- 37.0
Length hind foot		12.3	0.66	4.7	12.0- 13.0
Length of ear		21.7	1.76	7.0	20.0- 23.0
Length of forearm		53.3	0.47	0.7	52.8- 53.5
Occipitonasal length		18.0	0.24	1.2	17.8- 18.2
Basipalatal length		13.2	0.07	0.4	13.1- 13.2
Condylocanine length		19.3	0.24	1.1	19.1- 19.5
Mastoid breadth		9.9	0.12	1.0	9.8- 10.0
Least interorbital breadth		2.6	0.07	2.2	2.5- 2.6
Length maxillary toothrow		8.0	0.07	0.7	8.0- 8.1
Breadth maxillary toothrows		7.9	0.18	1.9	7.8- 8.1
Greatest height of skull		7.0	0.07	0.8	6.9- 7.0
Rhinolophus mehelyi (male)	12				
Total length		88.2	1.68	3.3	83.0- 95.0
Length of tail		27.8	1.62	10.1	21.0- 31.0
Length hind foot		10.6	0.39	6.3	9.0- 11.0
Length of ear		22.0	0.46	3.6	21.0- 23.0
Length of forearm		49.2	0.41	1.4	47.7- 50.2
Occipitonasal length		16.4	0.10	1.1	16.2- 16.8
Basipalatal length		11.4	0.17	2.5	10.9- 11.8
Condylocanine length		17.1	0.16	1.6	16.8- 17.7
Mastoid breadth		9.9	0.08	1.3	9.7- 10.2
Least interorbital breadth		2.6	0.08	5.4	2.5- 2.9
Length maxillary toothrow		6.9	0.06	1.5	6.7- 7.1
Breadth maxillary toothrows		7.2	0.04	1.3	7.0- 7.3
Greatest heigth of skull		6.4	0.12	3.2	6.1- 6.8
Rhinolophus mehelyi (female)	17				
Total length		88.5	1.96	4.6	82.0- 96.0
Length of tail		27.5	1.25	9.4	21.0- 31.0
Length hind foot		10.5	0.35	6.9	9.0- 12.0
Length of ear		22.6	0.48	4.4	21.0- 24.0
Length of forearm		52.1	2.14	8.5	48.3- 59.8
Occipitonasal length		16.4	0.11	1.4	16.1- 16.7
Basipalatal length		11.2	0.12	2.2	10.8- 11.7
Condylocanine length		17.0	0.11	1.3	16.7- 17.4
Mastoid breadth		9.8	0.07	1.4	9.5- 10.0
Least interorbital breadth		2.6	0.04	3.8	2.5- 2.8
Length maxillary toothrow		6.8	0.05	1.6	6.5- 6.9
Breadth maxillary toothrows		7.1	0.04	1.4	7.0- 7.3
Greatest height of skull		6.5	0.14	4.4	6.1- 7.1
Asellia tridens (male)	31				
Total length		83.8	1.03	3.4	78.0- 89.0
Length of tail		23.8	0.83	9.7	20.0- 28.0
Length of hind foot		9.7	0.16	4.6	9.0- 10.0
Length of ear		20.6	0.18	2.4	20.0- 21.0
Length of forearm		50.4	0.34	1.9	48.3- 52.3
Occipitonasal length		16.4	0.10	1.6	15.9- 17.0
Basipalatal length		12.4	0.08	1.9	11.9- 12.9
Condylocanine length		16.8	0.10	1.7	16.2- 17.3

	N	Mean	±2SE	CV	Range
Mastoid breadth		8.8	0.05	1.7	8.4- 9.0
Least interorbital breadth		2.4	0.04	5.1	2.1- 2.6
Length maxillary toothrow		6.9	0.04	1.5	6.7- 7.0
Breadth maxillary toothrows		7.4	0.08	3.1	6.6- 7.7
Greatest height of skull		5.9	0.14	6.4	5.4- 7.5
Asellia tridens (females)	24				
Total length		82.6	0.89	2.6	79.0- 87.0
Length of tail		23.3	0.67	7.0	20.0- 25.0
Length of hind foot		9.7	0.19	4.8	9.0- 10.0
Length of ear		20.4	0.23	2.8	19.0- 21.0
Length of forearm		49.3	0.49	2.4	47.0- 52.1
Occipitonasal length		15.9	0.10	1.6	15.4- 16.3
Basipalatal length		11.9	0.08	1.7	11.4- 12.2
Condylocanine length		16.6	0.85	12.5	15.7- 26.3
Mastoid breadth		8.6	0.05	1.5	8.3- 8.8
Least interorbital breadth		2.4	0.04	4.5	2.2- 2.6
Length maxillary toothrow		6.6	0.06	2.1	6.4- 6.9
Breadth maxillary toothrows		7.2	0.05	1.8	6.9- 7.5
Greatest height of skull		5.7	0.13	5.5	5.2- 6.6
Myotis blythi (males)	35				
Total length		125.9	1.73	4.1	110.0-134.0
Length of tail		48.6	0.97	5.9	42.0- 54.0
Length hind foot		14.5	0.38	7.7	13.0- 17.0
Length of ear		26.0	0.50	5.6	23.0- 29.0
Length of tragus		11.2	0.32	8.3	9.0- 13.0
Length of forearm		58.9	0.52	2.6	55.5- 62.0
Occipitonasal length		19.2	0.15	2.4	18.3- 20.3
Basipalatal length		17.0	0.14	2.4	16.3- 17.9
Condyloincisive length		21.3	0.16	2.2	20.4- 22.3
Mastoid breadth		10.5	0.07	1.9	10.2- 10.9
Least interorbital breadth		5.2	0.04	2.5	5.0- 5.4
Length maxillary toothrow		9.2	0.06	1.9	8.8- 9.6
Breadth maxillary toothrows		9.1	0.08	2.6	8.5- 9.6
Greatest height of skull		7.7	0.06	2.5	7.2- 8.0
Myotis blythi (females)	9				
Total length		129.4	3.06	3.5	122.0-136.0
Length of tail		51.3	2.08	6.1	47.0- 56.0
Length hind foot		14.2	0.44	4.7	13.0- 15.0
Length of ear		25.6	0.68	4.0	23.0- 26.0
Length of tragus		11.0	0.33	4.5	10.0- 12.0
Length of forearm		60.0	0.98	2.5	57.7- 62.1
Occipitonasal length		19.0	0.23	1.8	18.4- 19.5
Basipalatal length		16.8	0.21	1.9	16.4- 17.3
Condyloincisive length		21.0	0.22	1.6	20.5- 21.6
Mastoid breadth		10.4	0.10	1.4	10.1- 10.6
Least interorbital breadth		5.2	0.08	2.4	5.1- 5.4
Length maxillary toothrow		9.2	0.20	3.3	8.6- 9.5
Breadth maxillary toothrows		9.0	0.15	2.5	8.7- 9.3
Greatest height of skull		7.5	0.12	2.5	7.1- 7.7
Pipistrellus kuhli (males)	14				
Total length		86.5	2.19	4.7	81.0- 93.0
Length of tail		36.0	0.94	4.9	33.0- 40.0
Length of hind foot		5.9	0.23	7.4	5.0- 6.0
Length of ear		12.3	0.33	5.0	11.0- 13.0
Length of tragus		5.6	0.34	11.2	5.0- 7.0
Length of forearm		33.0	0.49	2.8	31.3- 34.2
Occipitonasal length		11.1	0.17	2.9	10.6- 11.7

	N	Mean	±2SE	CV	Range
Basipalatal length		9.6	0.11	2.0	9.3- 10.0
Condyloincisive length		12.4	0.19	2.9	11.7- 13.0
Mastoid breadth		7.4	0.14	3.4	6.9- 7.8
Least interorbital breadth		3.3	0.05	3.0	3.1- 3.5
Length maxillary toothrow		4.6	0.06	2.6	4.5- 4.8
Breadth maxillary toothrows		5.4	0.07	2.4	5.3- 5.7
Greatest height of skull		4.6	0.08	3.1	4.3- 4.8
Eptesicus serotinus (females)	4				
Total length		132.0	2.45	1.9	129.0-135.0
Length of tail		49.5	1.00	2.0	49.0- 51.0
Length hind foot		11.2	0.50	4.4	11.0- 12.0
Length of ear		17.3	0.50	2.9	17.0- 18.0
Length of tragus		7.0	0.82	11.7	6.0- 8.0
Length of forearm		50.7	1.98	3.9	47.8- 52.3
Occipitonasal length		17.1	0.50	2.9	16.7- 17.8
Basipalatal length		15.7	0.50	3.2	15.3- 16.4
Condyloinicisive length		19.5	0.36	1.8	19.2- 20.0
Mastoid breadth		11.3	0.13	1.1	11.1- 11.4
Least interorbital breadth		4.3	0.19	4.5	4.1- 4.5
Length maxillary toothrow		7.3	0.24	3.2	7.0- 7.5
Breadth maxillary toothrows		8.4	0.10	1.2	8.4- 8.6
Greatest height of skull		6.6	0.26	4.0	6.4- 6.9
Plecotus austriacus	18				
Total length		97.3	1.51	3.3	92.0-104.0
Length of tail		44.6	1.73	8.2	38.0- 51.0
Length hind foot		9.4	0.29	6.5	8.0- 10.0
Length of ear		34.8	1.19	7.3	25.0- 36.0
Length of tragus		15.7	0.32	4.4	15.0- 17.0
Length of forearm		37.9	0.30	1.7	37.0- 39.2
Occipitonasal length		14.7	0.10	1.5	14.3- 15.1
Basipalatal length		12.8	0.08	1.4	12.3- 13.0
Condyloincisive length		15.6	0.09	1.3	15.3- 15.9
Mastoid breadth		9.1	0.06	1.5	8.8- 9.3
Least interorbital breadth		3.5	0.05	3.3	3.3- 3.7
Length maxillary toothrow		5.6	0.06	2.2	5.5- 5.9
Breadth maxillary toothrows		6.0	0.07	2.6	5.7- 6.3
Greatest height of skull		5.4	0.07	2.8	5.2- 5.6
Miniopterus schreibersi (females)	5				
Total length		110.4	2.87	2.9	105.0-113.0
Length of tail		49.6	3.20	7.2	45.0- 54.0
Length hind foot		9.8	0.75	8.5	9.0- 11.0
Length of ear		10.6	0.49	5.2	10.0- 11.0
Length of tragus		4.8	0.40	9.3	4.0- 5.0
Length of forearm		45.1	0.38	0.9	44.7- 45.7
Occipitonasal length		13.3	0.21	1.8	13.1- 13.6
Basipalatal length		11.2	0.13	1.3	11.0- 11.4
Condyloincisive length		14.4	0.17	1.4	14.1- 14.6
Mastoid breadth		8.6	0.10	1.3	8.5- 8.7
Least interorbital breadth		3.7	0.08	2.4	3.5- 3.7
Length maxillary toothrow		5.7	0.14	2.6	5.5- 5.9
Breadth maxillary toothrows		6.2	0.11	2.0	6.0- 6.3
Greatest height of skull		6.2	0.08	1.4	6.1- 6.3

TABLE 3. — Results of an ANOVA for secondary sexual differences in *Asellia tridens* and *Rhinolophus mehelyi*. NS = Non Significant

	SIGNIFICANCE LEVEL	
	A. tridens	*R. mehelyi*
Total length	NS	NS
Lentgh of tail	NS	NS
Length hind foot	NS	NS
Length of ear	NS	NS
Length of forearm	0.001	0.05
Occipitonasal length	0.0001	NS
Basipalatal length	0.0001	NS
Condylocanine length	NS	NS
Mastoid breadth	0.0001	0.01
Least interorbital breadth	NS	NS
Length maxillary toothrow	0.0001	0.05
Breadth maxillary toothrows	0.001	NS
Greatest height of skull	0.05	NS

TABLE 4. — Comparison of measurements for Tunisian *Plecotus austriacus* with *P. austriacus* and *P. auritus* (Netherlands ; Van Bree & Dulic, 1963)

	Tunisia	Netherlands	
	P. austriacus (N 18)	*P. austriacus* (N 1)	*P. auritus* (N 12-13)
Character	X (Range)		$\bar{X}$ (Range)
Forearm	37.9 (37.0-39.2)	40.5	38.8 (37.7-40.1)
Hind foot plus nail	9.4 (8.0-10.0)	8.7	9.3 (8.0-10.4)
Length of tragus	15.7 (15.0-17.0)	16.8	14.06 (12.9-15.8)
Occipitonasal length	15.6 (15.3-15.9)	16.8	15.3 (14.8-15.7)
Mastoid breadth	9.1 (8.8- 9.3)	8.4	8.3 (8.0- 8.6)
Length maxillary toothrow	5.6 (5.5- 5.9)	6.1	5.3 (5.0- 5.5)