Bonn. zool. Beitr.	Bd. 42	H. 2	S. 115—123	Bonn, Juni 1991

Notes on the morphology, ecology and geographic origin of the Cyprus Long-eared hedgehog (*Hemiechinus auritus dorotheae*)

Peter Boye

Abstract. Morphological and ecological data on the Long-eared hedgehog in Cyprus are given based on new material and observations. White ear tips are frequent and variability of dental characters is high, probably due to island effects. Illustrations of the skull and penis of the endemic subspecies are given. The hedgehog occurs within the Mediterranean climatic zone with an upper limit at 900 m above sea level. Its main habitats are villages and cultivations. Remains of *Hemiechinus* lack in the fossil record; the species was probably brought to Cyprus from the Levant coast by man in historical times.

Key words: Mammalia, Insectivora, Erinaceidae, *Hemiechinus auritus*, Cyprus, morphology, ecology.

Introduction

Geographically, Cyprus is a part of the Middle East but politically and economically it has been bound up with Europe and Turkey for hundreds of years. However, faunal research was neglected and only two revisions of the recent mammals were published so far (Bate 1903, Spitzenberger 1978, 1979). Since 1987 the author has been trying to complete the list of Cyprus mammals and collect more information about taxonomy, biology and ecology (Boye 1990, Boye et al. 1990). In this paper new data on the Cyprus Long-eared hedgehog are presented.

The easternmost Mediterranean island Cyprus has four main natural regions: the Kyrenia hills along the north coast, the Troodos mountains covering most of the south western island raising up to 1951 m above sea level, the Mesaoria plain between these two elevations and finally lowlands along the southern coasts. Cultivation started during early men's history but today landuse is intensified. On the northern slopes of the Kyrenia hills and the western slopes of Troodos forestry is done. On hills and plains grapes, olives, citrus or vegetables are grown and sheep or goats are grazed. Towns are growing fast especially near the coast where new touristic buildings are established every year. Agriculture and urbanization exploited most water resources.

Material and Methods

Since 1987, the author went on six research trips to Cyprus during the months of spring and winter. Observations of living hedgehogs were recorded as well as carcasses on the roads. 11 specimens of the latter were collected (Collection numbers PB). Further material was kindly provided by Prof. J. Niethammer, Bonn (Collection numbers JN) who stayed in Cyprus in spring 1974. In total 10 skins and 23 complete or fragmented skulls were studied.

Locations of material's origin (m = male, f = female): Famagusta district: Famagusta 22. III.—2. IV. 1974: 5 m, 2 f, 4 sex? (JN 4776—82, 4817—19, 4897), Trikomo 20. III. 1974: 1 m (JN 4775), Cape Greco 22. III. 1987: 1 m (PB 218); Paphos district: Coral Bay 13. IV. 1988: 1 sex? (PB Zy16), Prodhromi 16. IV. 1988: 1 m (PB 349), Mandria 18. IV. 1988: 2 f (PB 350—51), 2. XII. 1990: 1 f (PB 532), Konia 16. V. 1988: 1 sex? (PB 373), Trimithousa 17./20. V. 1988: 1 m, 1 f (PB 374, 376), 3. VI. 1988: 1 m (PB 382), Kissonerga 17. XII. 1989: 1 sex? (PB 478). PB Zy16 (skull fragments) and PB 350 (skin and skull) are deposited in the Alexander Koenig Zoological Research Institute and Museum, Bonn.

Most measurements were taken with a dial calliper to the nearest 0,05 mm. Body data except hind foot length were taken from the labels. Length and breadth of molars were measured with optical aid to the nearest 0,02 mm. Teeth nomenclature and measurements follow Niethammer (1973) and Niethammer & Krapp (1990).

Results

1. Morphology

The coloration of Cyprus Long-eared hedgehogs was accurately described by Spitzenberger (1978): Ventral white, sometimes buffy or greyish, head light brown becoming grey towards the snout and feet, tail and ears dusky. However, most specimens do not have entirely dark ears, the ear tips being more or less unpigmented. Only three animals out of 12 examined had totally dark ears. The spines have a brown basis, a white and a brown band and a white apical part. Just the very tips of the spines are dark again.

Measurements of body and skull are given in Table 1.

Characteristic for Cyprus *Hemiechinus* are its large teeth compared to the size of the skull. P^4 often has reduced bone cover on its buccal roots (Fig. 1, Tab. 2) which occurred on an upper and a lower canine as well. The size of M^1 is very large and induced Spitzenberger (1978) to compare the relation of its breadth to condylobasal length in different *Hemiechinus auritus* populations. Although measurements may

Table 1: Measurements of *Hemiechinus auritus dorotheae*.
Abbreviations: HBL = head and body length, TL = tail length, HF = hind foot, CBL = condylobasal length, Zyg = zygomatic breadth, IOB = interorbital breadth, Mand = mandible length, T^{sup} = length of upper tooth row, T_{inf} = length of lower tooth row, M^1B = breadth of M^1, M^1L = length of M^1, M_1B = breadth of M_1.

	$\bar{x}$	min	max	s	n
HBL	157,5	140	182	13,19	11
TL	17,5	12	24	3,89	12
HF	31,50	30	33	1,01	12
Ear	36,15	33	40,7	2,28	12
CBL	45,55	43,83	47,05	1,17	8
Zyg	26,13	22,8	27,25	1,45	8
IOB	12,51	11,2	13,20	0,74	9
Mand	32,75	30,10	34,35	1,05	20
T^{sup}	22,60	21,20	23,70	0,69	18
T_{inf}	18,11	16,95	19,25	0,59	20
M^1B	4,87	4,49	5,19	0,15	23
M^1L	4,63	4,34	4,97	0,17	23
M_1B	5,54	5,27	5,98	0,19	23

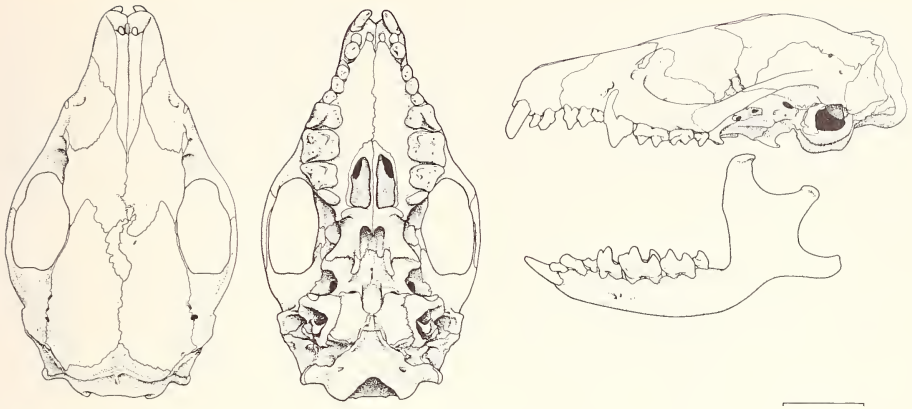


Fig. 1: Skull of *Hemiechinus auritus dorotheae* (PB 351). Scale = 10 mm.

be taken slightly differently the new series supports Spitzenberger's result. Cyprus Long-eared hedgehogs have bigger skulls and broader molars than specimens from Israel, Syria, Iraq or Egypt (*Hemiechinus auritus aegyptius*). Cyprus measurements are comparable to specimens from Kasachstan which belong to *Hemiechinus auritus auritus*.

Variations in dentition occur frequently in Cyprus Long-eared hedgehogs (Tab. 2). The normally two roots of I^3 may be fused to a single root. In two specimens C^1 and P^2 have such a close contact that they share one alveole. P^3 normally has three roots and a small protoconus. Both elements are reduced to a certain extent in several specimens up to a two-rooted P^3. In one specimen P^3 is even missing. Only four specimens out of 22 show the normal type of all characters treated in Tab. 2.

Tooth wear may be taken as an indicator of age although there is a great variation depending on the preferred food consistence and the habitat of the individuals. In Tab. 3 I have grouped the observed tooth wear stages in an annual sequence. My interpretation is that none of the examined animals was older than three years.

Two specimens of an estimated age of nearly one year showed black tooth film (PB 374, JN 4775) and another specimen of about two years age showed a pathogene bone reduction at the nose, the roots of the left P^4 and the lower incisors (JN 4779).

Another characteristic for the Cyprus population is the extension of the frontalia backwards between the parietalia (Fig. 1). This is mostly asymmetric and sometimes followed by a porous bone structure in this area.

The penis of one male (PB 382) was examined (Fig. 2). The rows of spines on the glans were doubled on one side and formed a cluster on the other. Normally *Hemiechinus* has two rows of spines on the glans penis (Corbet 1988).

2. Ecology

The Long-eared hedgehog is very common in cultivated areas in Cyprus. Habitats are mainly in areas where grapes, citrus, carob or vegetables are grown. Villages and even built-up areas are colonized as well as phrygana and maccia. No hedgehog was

Table 2: Occurrence of dental modifications in *Hemiechinus auritus dorotheae*. n = number of studied animals. [Correction added in proof: read lingual instead of labial]. I^3: A = two roots (normal type), B = one root; $C+P^2$: C = separated (normal form), D = allied, sharing one alveole; P^3: E = three roots and a protoconus (normal type), F = three roots without protoconus, G = three roots without protoconus and lingual root very small, H = two roots, I = P^3 missing; P^4: K = roots buccal entirely covered by bone (normal type), L = frontal root distal half free, M = frontal root totally free, N = both roots totally free, O = caudal root totally free, P = frontal root proximal half free, Q = both roots proximal half free.

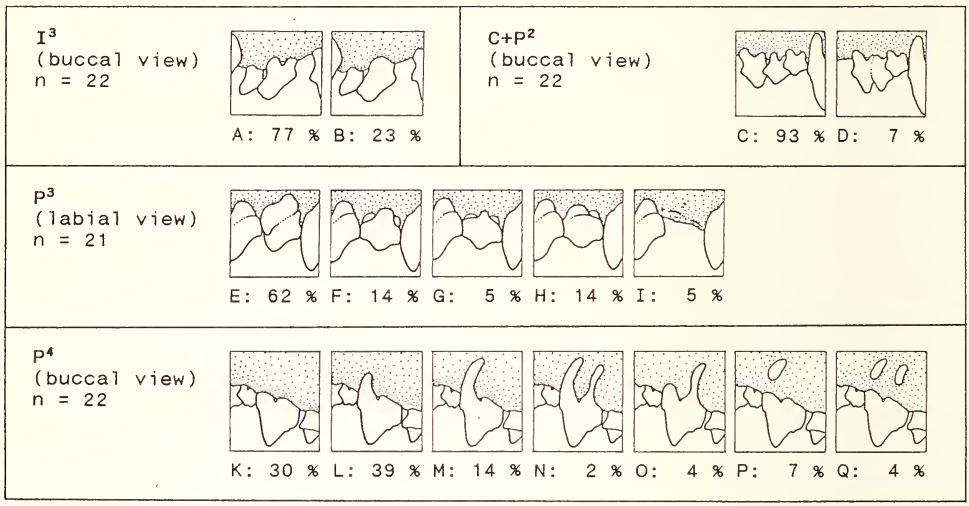


Table 3: Tooth wear as a possible indicator of age.

age	month	upper toothrow	lower toothrow	M^1 wear variation
1st year	December			
	March/April			
	May/June			
2nd year	March/April			
3rd year	May			

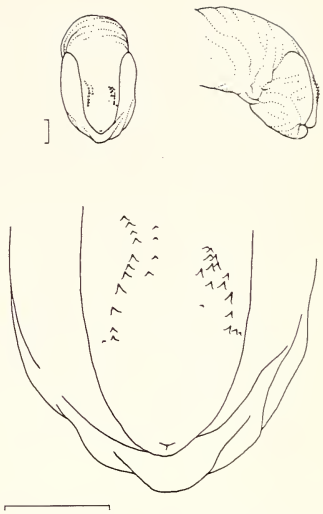


Fig. 2: Penis of a Cyprus Long-eared hedgehog (PB 382). Scale = 2 mm.

recorded in pine forests and only very few in the Mesaoria plain which is a dry area of intensive corn growing.

Distribution in Cyprus was recorded by specimens killed on the road (Fig. 3). This was started by Spitzenberger (1978) who maintained a restriction to coastal lowlands. In fact the hedgehog is distributed up to about 900 m above sea level (e. g. Sykopetra, Limassol district) but it is quite rare at these hights. The seeming concentration of records in the western area indicated by Fig. 3 just reflects the author's main observation area in the Paphos district.

During the day hedgehogs hide in stone walls, under trees or bushes or under rubbish. A burrow was never found but it seems likely that Cyprus *Hemiechinus* dig burrows the same way as they do in Israel (Schoenfeld & Yom-Tov 1985). In the evening they appear after dusk. Although preferring darkness hedgehogs in villages do not hesitate to cross an illuminated open field. A specimen kept in captivity for three days just froze for some minutes when light was switched on.

As food they take mainly insects which they find by a rapid stop-and-go walk while listening for prey. When stopping their ears move like those of a bat to find the origin of a sound. When the position of an insect or snail is located the hedgehog finds it by sniffing. Besides invertebrates small vertebrates like lizards and young mice are taken as well as fruits and remains of human food.

As we were in Cyprus neither in summer nor in autumn there is only little information about the annual life history. Until May none of the dissected females showed any sign of pregnancy. Bate (1903) reports on three young ones which she got in June 1902. This would correspond to the situation in Israel where Schoenfeld & Yom-Tov (1985) noticed parturition in June. Both specimens collected in December were subadults which had just changed their incisors. In *Erinaceus* these teeth also change as the last ones together with the first upper premolars (Holz & Niethammer 1990). One specimen (JN 4817) collected in March 1974 near Famagusta being in full dental change was probably born in late autumn.

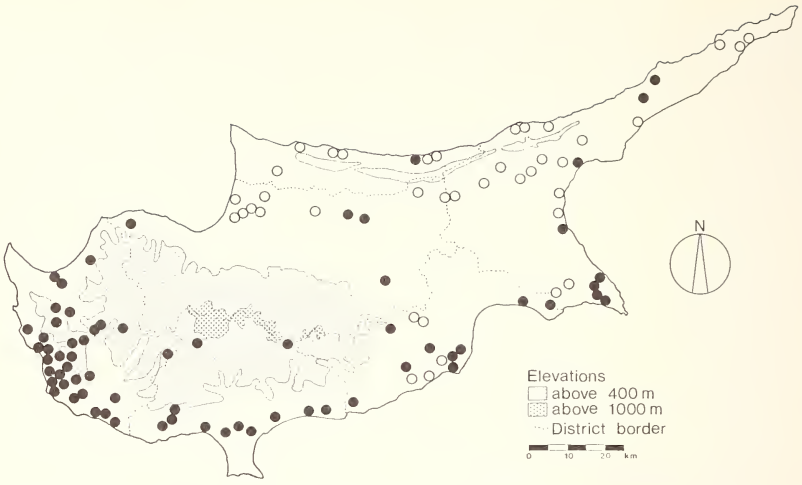


Fig. 3: Distribution of the Long-eared hedgehog in Cyprus after records of roadkills. Open symbols = records 1972—74 from Spitzenberger (1978), points = records by the author 1987—90.

During winter Cyprus hedgehogs are inactive most days. If one takes the number of road kills there is a significant pattern in time. In December only single specimens were recorded, all near the coast where temperatures of 20° C occurred during the day. From the second half of March on hedgehog activity raises and in April or May one may find a killed hedgehog each day every third mile along the main roads. Abundance is always higher in coastal areas than in the hills.

As parasites only ticks were recorded but not yet determined.

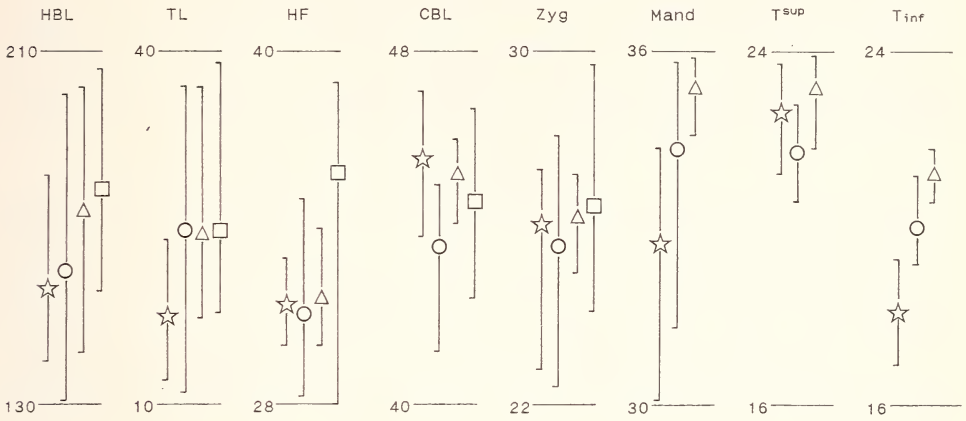
Some Cyprus farmers take the hedgehog as a pest because it is said to eat grapes which sometimes hang down to the ground. Locally the author was told that village people eat hedgehogs, however, this might be a custom of former times.

Discussion

The Cyprus Long-eared hedgehog is well characterized by its white ventral coat, relatively small body size and a big skull compared to neighbouring populations in Syria, Israel and Egypt (Tab. 4). The molars are broad and sometimes look as if they were a little too big for the skull. This impression is especially given by the P^4 when its roots are partly uncovered by bone. The analysis of new material in this respect supports Spitzenberger's (1978) description of an endemic subspecies in Cyprus. *Hemiechinus auritus dorotheae* is of course closely related to *H. e. aegyptius* distributed from Libya through Arabia to the Caucasus and southern USSR, having also a white belly and a condylobasal length of maximum 46 mm (Niethammer 1969).

In Cyprus *Hemiechinus auritus* is the only hedgehog species whereas in Israel two more species occur: *Erinaceus concolor* and *Paraechinus aethiopicus*. Interspecific competition leads to vicariance following climatic and pedological factors in that region. *Erinaceus* lives in the Mediterranean zone, *Paraechinus* occurs in the arid

Table 4: Mean value (symbols) and range of measurements of *Hemiechinus auritus* in the Middle East. Data from Iraq, Syria, Jordan and Israel after Harrison (1964) (excl. no. BM 51.721), data from Egypt (east of River Nile) after Osborn & Helmy (1980). Abbreviations as in Tab. 1.



☆ = Cyprus (n =8-22), ○ = Iraq, Syria and Jordan (n = 10-13),
△ = Israel (n = 4-6), □ = Egypt (n = 32-37).

zones of the Negev and Judean deserts and the lower Jordan Valley while *Hemiechinus* is restricted to sandy or light soils (Yom-Tov 1988). Lacking competing species the Long-eared hedgehog is able to colonize habitats in the Mediterranean climate otherwise occupied by *Erinaceus* or *Paraechinus*. So in Cyprus it is found in various habitats from cultivated river beds in the western island to dry and rocky areas near Cape Greco in the south east of Cyprus. The altitude limit is about the highest occurrance of olive trees (*Olea europaea* L.) in 1000 m above sea level. The distribution of live olive trees characterizes the Mediterranean climate.

Anomalies of the teeth and other skull deviations are well documented and not unusual in hedgehogs (Ruprecht 1965, Poduschka & Poduschka 1986). However, high percentage of dental variation as well as general enlargement of teeth and frequent albinism at the ear tips indicate island effects caused by a small gene pool and gene drift. This leads to the question, how and when did Long-eared hedgehogs reach Cyprus?

In Cyprus no hedgehog remains have been excavated from Pleistocene and prehistoric sites (e. g. Boekschoten & Sondaar 1972, Davis 1987, Held 1989, Schwartz 1973). Oberhummer (1903) who reviewed all ancient authorities available to him about natural history of Cyprus quoted only Unger & Kotschy (1865) mentioning a hedgehog. This may be taken as hints to an arrival of the Long-eared hedgehog in Cyprus within historic times or even recently. Up to now a natural immigration to Cyprus is definitely proved only for Pleistocene elephants and hippopotamus (Swiny 1988) and bats.

As *Hemiechinus* does not occur in southern Turkey it is supposed that people took the Long-eared hedgehog from the Syrian or Palestine coast to Cyprus. This would find a parallel in the Cyprus Lesser white-toothed shrew *Crocidura suaveolens cypria*

which has a small genetic distance to the *Crocidura suaveolens* population in Israel (Catzeflis et al. 1985) and probably was shipped across the 102 km distance from the Syrian coast to Cyprus. Pleistocene records of Cyprus shrews (Boekschoten & Sondaar 1972) turned out as a mistake (Reumer & Oberli 1988).

Acknowledgements

Work in Cyprus was kindly sponsored by my father Dr. Ralph Boye. Study material was provided by Prof. Dr. Jochen Niethammer and Kirsten Osenegg.

Zusammenfassung

Aufgrund neuer Beobachtungen und Aufsammlungen werden Daten zur Morphologie und Ökologie des Ohrenigels auf Zypern zusammengefaßt. Die endemische Unterart *Hemiechinus auritus dorotheae* wurde von Spitzenberger (1978) zutreffend durch folgende Merkmale charakterisiert: Weiße Bauchfärbung, kleine Körpermaße, relativ großer Schädel mit sehr breiten Molaren. Hinzu kommen häufig fehlende Pigmentierung der Ohrspitzen und eine hohe Variabilität von Zahnmerkmalen, was als Inseleffekt gewertet wird. Bevorzugter Lebensraum ist Kulturland, die Höhenverbreitung reicht etwa bis zur Ölbaumgrenze (900 m ü. NN.). Wahrscheinlich wurde *Hemiechinus* erst in historischer Zeit durch den Menschen von der benachbarten Levanteküste nach Zypern gebracht.

References

Bate, D. M. A. (1903): The Mammals of Cyprus. — Proc. zool. Soc. London 2: 341—348.

Boekschoten, G. J. & P. Y. Sondaar (1972): On the fossil Mammalia of Cyprus. — Proc. K. ned. Akad. Wet. B 75 (4): 306—338.

Boye, P. (1990): Der Einfluß des Menschen auf die Säugetierfauna der Insel Zypern. In: Schmidt, C. & R. Schröpfer (eds.): Deutsche Gesellschaft für Säugetierkunde, 64. Hauptversammlung in Osnabrück 23. bis 27. September 1990. — Z. Säugetierk., Sonderheft: 6—7.

Boye, P., B. Pott-Dörfer, K. Dörfer & A. Demetropoulos (1990): New records of bats (Chiroptera) from Cyprus and notes on their biology. — Myotis 28: 93—100.

Catzeflis, F., T. Maddalena, S. Hellwing & P. Vogel (1985): Unexpected findings on the taxonomic status of East Mediterranean *Crocidura russula* auct. (Mammalia, Insectivora). — Z. Säugetierk. 50: 185—201.

Corbet, G. B. (1988): The family Erinaceidae: a synthesis of its taxonomy, phylogeny, ecology and zoogeography. — Mammal Rev. 18: 117—172.

Davis, S. J. (1987): The archaeology of animals. — B. T. Batsford Ltd., London. 224 pp.

Harrison, D. L. (1964): The mammals of Arabia I. Insectivora, Chiroptera, Primates. — E. Benn Ldt., London. 192 pp.

Held, S. O. (1989): Colonization cycles on Cyprus 1: The biogeographic and paleontological foundations of early prehistoric settlement. — Rep. Dep. Antiquities Cyprus 1989: 7—28.

Holz, H. & J. Niethammer (1990): *Erinaceus europaeus* Linnaeus, 1758 — Braunbrustigel, Westigel. — In: Niethammer, J. & F. Krapp (eds.): Handbuch der Säugetiere Europas. Band 3/1 Insektenfresser — Insectivora, Herrentiere — Primates: 26— 49. — Aula Verlag, Wiesbaden.

Niethammer, J. (1969): Zur Taxonomie der Ohrenigel in Afghanistan (Gattung *Hemiechinus*). — Z. Säugetierk. 34: 257—274.

Niethammer, J. (1973): Zur Kenntnis der Igel (Erinaceidae) Afghanistans. — Z. Säugetierk. 38: 271—276.

Niethammer, J. & F. Krapp (1990): Handbuch der Säugetiere Europas. Band 3/1 Insektenfresser — Insectivora, Herrentiere — Primates. — Aula Verlag, Wiesbaden. 524 pp.

Oberhummer, E. (1903): Die Insel Cypern, eine Landeskunde auf historischer Grundlage. — Theodor Ackermann, München. 488 pp.

Osborn, D. J. & I. Helmy (1980): The contemporary land mammals of Egypt (including Sinai). — Fieldiana Zool. N. S. 5: i-xix, 1—579.

Poduschka, W. & C. Poduschka (1986): Zahnstein, Zahnfleischerkrankungen und Zahnanomalien bei Erinaceinen (Mammalia: Insectivora). — Z. angew. Zool. 73: 231—243.

Reumer, J. W. F. & U. Oberli (1988): Shrews (Mammalia: Soricidae) from a Bronze Age deposit in Cyprus, with the description of a new subspecies. — Bonn. zool. Beitr. 39: 305—314.

Ruprecht, A. (1965): Anomalies of the teeth and asymmetry of the skull in *Erinaceus europaeus* Linnaeus, 1758. — Acta theriol. 10 (17): 234—236.

Schwartz, J. H. (1973): The palaeozoology of Cyprus: a preliminary report on recently analyzed sites. — World Archaeology 5 (2): 215—220.

Schoenfeld, M. & Y. Yom-Tov (1985): The biology of two species of hedgehogs, *Erinaceus europaeus concolor* and *Hemiechinus auritus aegyptius*, in Israel. — Mammalia 49: 339—355.

Spitzenberger, F. (1978): Die Säugetierfauna Zyperns Teil I: Insectivora und Rodentia. — Annln naturh. Mus. Wien 81: 401—441.

Spitzenberger, F. (1979): Die Säugetierfauna Zyperns Teil II: Chiroptera, Lagomorpha, Carnivora und Artiodactyla. — Annln naturh. Mus. Wien 82: 439—465.

Swiny, S. (1988): The Pleistocene fauna of Cyprus and recent discoveries on the Akrotiri peninsula. — Rep. Dep. Antiquities Cyprus 1988: 1—14.

Unger, F. & T. Kotschy (1865): Die Insel Cypern ihrer physischen und organischen Natur nach mit Rücksicht auf ihre frühere Geschichte. — W. Braunmüller, Wien. 598 pp.

Yom-Tov, Y. (1988): The zoogeography of birds and mammals of Israel. — In: Yom-Tov, Y. & E. Tchernov (eds.): The zoogeography of Israel, 389—410. W. Junk Publ., Dordrecht.

Peter Boye, Baumschulallee 32, D-5300 Bonn 1.