BORIS KRYŠTUFEK & VLADIMÍR VOHRALÍK

MAMMALS OF TURKEY AND CYPRUS

INTRODUCTION
CHECKLIST
INSECTIVORA

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Boris KRYŠTUFEK
Vladimír VOHRALÍK

Mammals of Turkey and Cyprus
Introduction, Checklist, Insectivora

Knjižnica Annales Majora

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DEDICATION

To the memory of a friend and a fine mammalogist

GORDON L. KIRKLAND, Jr.

Shrews were his favourites

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Boris KRYŠTUFEK and Vladimir VOHRALÍK

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FOREWORD

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Mammals of Turkey and Cyprus (Insectivora) is the latest and most complete compilation of the insectivores of Turkey and the island of Cyprus. It is a landmark publication, hopefully only the first in a series which will bring together our knowledge of the mammals of this region - in total over 140 terrestrial mammal species. The Insectivora covered in this volume constitute 12% of the region's mammal fauna: 17 species of hedgehogs, shrews and moles.

The book is an attempt to compile our current knowledge of the mammal fauna representing the northeastern-most region of the Mediterranean basin. This area is of prime biogeographical interest due to its position between Europe and Asia Minor. This arid region has experienced a long and intensive period of agricultural use and development resulting in large-scale habitat degradation.

Each species account is a detailed and extensive treatment of taxonomy, description, variation, distribution, and habitat, aiming to develop an up-to-date source for future research.

The importance of this long-awaited compilation cannot be stressed strongly enough. The need for such a compilation has long been recognized by biologists, and this book is a response to that need. It is a beginning towards developing conservation measures for the mammals of this region and future assessment of habitat requirements and threats to the species according to IUCN criteria. Conservationists will find this book and checklist useful in updating the IUCN Red List. It is also another step towards completing the IUCN Species Information Service (SIS) Databank.

Biologists should be planning ahead for studies of ecosystem function. In small mammals, as in all heterotrophic organisms, nutrient relationships and habitat requirements are key. The existing literature for this region and its species is sparse, and additional data are needed on many species, e.g. the Jackass White-toothed Shrew, *Crocidura artispa*, which is known from only two voucher specimens. It will also be necessary to assess ecotoxicological threats and establish conservational guidelines.

The book will serve the needs of the taxonomist, biogeographer, and conservation biologist. It is hoped that this book will encourage closer collaboration between mammalogists of the region and scientists from abroad.

Werner Haberl

Vienna, August 8, 2001

Werner Haberl
Chair, Insectivore Specialist Group
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PREFACE

Our interest in the mammals of Turkey and Cyprus is a logical extension of our shared early mammological engagement: the mammals of the Balkans. While enjoying field trips to various regions of the Balkans, we frequently had Turkey in our minds and in our words. However, it was not until 1993 when we undertook our first field trips to the country, and started to explore its biotas and mammal fauna. This publication, hopefully only the first one in a series which is to bring together our actual knowledge of the mammals of Turkey and Cyprus is the result of our travels and studies.

Our first and deepest thanks go to all those who accompanied us during our fieldwork. Particular gratitude is due to Dr. Jan Zima (Brno) and Dr. Ivan Horáček (Prague) who were not only excellent companions in the field but also broadened our understanding of natural history in friendly evening discussions, after traps had been set. Many other people took part in field trips and helped to collect specimens: Dr. Petr Benda (Prague), Dr. Miloš Macholán (Brno), Dr. Daniel Frynta (Prague), Mr. František Hubínek (Hřebeč), MS Eduard Kletečki (Zagreb), and Mr. Bogdan Horvat (Ljubljana). The following scientists and students from Prague contributed additional specimens which are now in the collections of the Department of Zoology, Charles University, Prague (IZCU): Dr. Daniel Frynta, Dr. Ivan Horáček, Dr. Jovana Čiháková, Dr. Antonin Reiter (Znojmo), Dr. Petr Voříšek, and Dr. Michal Andreas.

This study would not have been possible without the efforts of numerous other collectors who provided voucher specimens, as well as curators who preserved them and made them available to us: Dr. Paula Jenkins (BMNH), Dr. Friederike Spitzenberger, Dr. Barbara Herzig, and Dr. Kurt Bauer (NMW), Dr. Haluk Kefelioğlu (OMU), Dr. William Stanley (FMNH), Dr. Gerhard Storch and Dr. Dieter Kock (SMF), Dr. Peter Vogel (IZUL), Dr. Linda Gordon (NMNH), Dr. Rainer Hutterer (ZFMK), Dr. Petr Benda (NM), and Ing. Ján Obuch (JOC).

Field trips to Turkey were sponsored by the Ministry of Science and Technology, Republic of Slovenia (grants to B.K.) and by the Grant Agency of Czech Republic (to V.V.); final work was partly sponsored by the MŠMT ČR grant J13/98136100004 (to V.V.). Grants for the visits of collections (to B.K.) were provided by the Slovenian Science Foundation, Ministry of Science and Technology of the Republic of Slovenia, and by Naturhistorisches Museum Wien; visits to the USA museums would have been much less comfortable without the help and hospitality of the late Dr. Gordon L. Kirkland and Mrs. Carol Kirkland.

In Turkey we enjoyed the hospitality and friendship of Prof. Dr. Cengiz Kurtonur and Dr. Beytullah Özkan (Trakya University, Edirne) and of Prof. Dr. Haluk Kefelioğlu and Dr. Coskun Tez (Ondokuz Mayıs University, Samsun). V.V. expresses his particular gratitude to the staff of the Faculty of Science and Literature, Çukurova University in Adana, for the hospitality during his study visit in 1993.

Many people shared with us their experience and knowledge on the mammals, as well as of the lands and natural history of Turkey and Cyprus, but also broader. We particularly thank Dr. Kurt Bauer, Dr. Friederike Spitzenberger (both NMW) and Dr. Huw I. Griffiths (Kingston upon Hull, UK). Dr. Griffiths and Dr. Werner Haberl (Vienna) read this text in draft, provided valuable comments and improved English and style. Dr. Petr Benda (Prague) commented the Annotated Checklist and Dr. Jiří Sádlo (Prague) helped with vegetation data. All made most helpful comments and suggestions, though as usual the views and mistakes remain our responsibility. Mr. Slavko Polak (Postojna) prepared the black & white line drawings for each genus; Mr. Karel Kolarič (Ljubljana) helped with distribution maps; MS Jitka Lazarová (Prague) prepared climate diagrams for Fig. 3; Mr. Ciril Mlinar (Ljubljana), Mrs. Alenka Kryštufek (Ljubljana), Dr. Jaroslav Červený (Prague), Dr. David Král (Prague), Dr. Daniel Frynta (Prague), and Mr. Milan Kaftan (Prague) contributed photographs. Material on which drawings and photographs are based was partly collected by us during 1993-1995; the rest is from the collections of the Natural History Museum London, (BMNH), Naturhistorisches Museum Wien (NMW); Ondokuz Mayıs University, Samsun, (OMU); Field Museum of Natural History, Chicago (FMNH), Institut de Zoologie et d'Ecologie animale, Université de Lausanne (IZEA), and Department of Zoology, National Museum (Natural History), Prague, (NM).

We hope that this volume will encourage closer

collaboration between the mammalostis from Turkey, Cyprus and Europe. Combining historical collections (as housed in various European and USA museums) with the recently acquired material and the accumulated knowledge by the students from the region, would result in more complete compilation of the rich and unique fauna in the amazing and diverse north-eastern corner of the Mediterranean basin.

Introduction

Mammals of Turkey and Cyprus is an attempt to compile our actual knowledge of the mammal fauna in a diverse north-eastern corner of the Mediterranean realm: in Turkey and on the island of Cyprus. The area is a contact point between two continents. The recent composition of its fauna reflects the influences of several biogeographic centres of species richness as well as of complex Plio-Pleistocene vicariant interactions between south-eastern Europe and Asia Minor. Due to the strong human impact on the landscape, many habitats have suffered a large scale deterioration with severe consequences on the fauna of the area. The entire region is thus of prime interest to the taxonomist, biogeographer and conservation biologist.

The work consists of two major parts: (i) annotated checklist and (ii) compilation of insectivorous mammals. The checklist aims at updating the knowledge of the fauna accumulated since the comprehensive review by Kumerloeve (1975a). The progress in the field of mammalogy has been considerable in the last quarter of the century, partly due to the application of new methods and approaches (karyotyping, electrophoretic and molecular studies, multivariate statistical elaboration of morphometric data) and because of increased research activities, primarily by Turkish mammalogists.

The part on insectivores compiles our actual knowledge on the taxonomy, distribution, variation and life history of seventeen species of hedgehogs, shrews and moles, established so far in the region. Lack of time, funds, and personal contacts unable us of elaborating the entire Turkish fauna in a way comparable to this volume. Although a large amount of museum material has accumulated recently, much of it seems still not to be accessible for scientific study.

Each species account contains the following categories of information:

Species names. The valid scientific name (in bold) is followed by the name as it first appeared, together with the name of the authority and the year of publication. We should like to remind the reader that the author's name and the year are in parentheses if the generic name when first used differs from the current one' (see Annotated Checklist for the proper use of complete scientific names). Given are also junior synonyms originating from Turkey and Cyprus. In exceptional cases we also listed names with their type localities from outside this geographic framework. For the nomenclatoral and taxonomic sources see Annotated Checklist. In the captions to species accounts, the scientific name follows the English vernacular name; we relied on Corbet (1978) and Wolsan & Hutterer (1998; shrews only). Turkish names are available in Banoğlu (1953; game species), Demirsoy (1966) and Mitchell-Jones *et al.* (1999; European species only).

Taxonomy. This category is added for species or species groups with unstable taxonomy and includes historical facts and reasons for the actual status. Comparisons with closely related and/or morphologically similar taxa are also provided where necessary. For several species we give more detailed comparisons with the taxa from adjoining regions.

Description. Data on the external characters (colour, size, body proportions) are followed by cranial and dental description and, when available, also by the diploid number of chromosomes (2N) and the fundamental number of chromosomal arms (NF; NFa - fundamental number of autosomal arms). In some cases we were able to provide molecular data derived from recent studies. The "Description" is completed by a table of standard external and selected cranial measurements. Data in the table are given as summarised statistics: sample size (N), arithmetic average (mean) and the observed range (min - max).

Variation. Albeit this category is mainly devoted to describe patterns of geographic (*i.e.* interlocal) variation, cases of individual (*i.e.* intrapopulation) variation are also given where appropriate. In general, the geographic variation is poorly understood in Turkish mammals, even at the level of conventional morphological data sets. Particularly evident is the lack of comprehensive statistical elaboration, based on representative samples from large geographic areas. Conventional subspecies are considered, although we lack proof of any discontinuity for the majority of the trinomials. Trinomials are based on very few thorough revisions available.

Distribution. A description of the general distribution is followed by the species' range in Turkey and on Cyprus. It is accompanied by a dot distribution map with marginal individual records and the approximate range (shaded).

Habitat. This category gives information on the habitat selection of a particular species, *i.e.* of the plant communities utilised, the altitudinal range populated, and the co-existing small mammals. Data on other aspects of life history are also provided when available from the study area or its close proximity.

Geography

Turkey and Cyprus form the north-eastern corner of the Mediterranean basin (Fig. 1). Thus, in spite of their extremely diverse landscape, climate and biota, the entire area has a strong Mediterranean character (Blondel & Aronson, 1999; Fig. 2). This is even more pronounced because of the influences of the Black Sea (Karadeniz) and Caspian Sea (Hazardeniz), which isolate Anatolia to the north and the east: both are remnants of the ancient Paratethys Sea.

and its median altitude is 1,128 meters. More than 80% of the Turkish land surface is rough, broken or mountainous, and flat or gently sloping land makes up no more than 15% of the country's surface.

Geologically, the entire region is the product of the complex crustal movements that have shaped it in the past, and which still manifest themselves as frequent earthquakes. The region emerged as a part of the Alpine belt, extending from the Pyrenees to the Himala-

Fig. 1: Position of Turkey and Cyprus in the eastern Mediterranean. Scale bar is 500 km.

The Mediterranean is not the 'sea between the lands, but rather a sea between mountains' (McNeill, 1992), and this also applies to Turkey and Cyprus. Cyprus is barely more than a set of two parallel ridges along a submerged mountain chain. Turkey has nearly 85% of its land at elevations of at least 450 meters asl

yas. Although the area was formed during the Tertiary (starting *ca.* 65 million years ago) folding and faulting processes are still at work as the Turkish and Aegean plates continue to collide.

The periphery of Turkey *(ca. 30%* of the land area) and the entirety of Cyprus have a Mediterranean cli-

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1 – Edirne (47)												
precipitation	53	48	40	47	42	51	33	22	30	60	69	83
temperature	2	4	5	12	17	21	20	23	19	14	8	4
2 – Ankara (860)												
precipitation	32	31	32	31	48	26	12	10	15	22	31	48
temperature	-1	1	5	11	16	20	23	23	19	13	8	2
3 – Rize (4)												
precipitation	253	203	183	103	94	130	155	205	265	284	263	245
temperature	7	7	8	11	16	20	22	23	20	16	13	9
4 – Kars (1775)												
precipitation	26	29	30	47	86	82	59	45	31	39	29	25
temperature	-12	-10	-4	5	10	14	17	17	13	7	1	-8
5 – Surt (875)												
precipitation	110	93	100	98	60	8	3	0	4	43	93	92
temperature	2	4	7	13	20	25	31	30	24	18	10	5
6 – Urfa (515)												
precipitation	100	67	58	50	20	2	0	0	0	20	50	75
temperature	5	7	10	17	22	28	32	31	28	19	12	8
7 – İslahiye (514)												
precipitation	190	160	100	60	37	6	4	6	8	60	100	130
temperature	4	6	9	15	20	24	26	27	25	18	12	7
8 – Nicosia (159)												
precipitation	80	61	32	20	27	8	2	2	8	19	43	75
temperature	10	11	13	16	21	25	28	28	26	20	16	12
9 – İzmir (25)												
precipitation	139	105	72	43	36	9	2	3	16	46	82	150
temperature	9	9	11	15	20	25	28	27	23	19	14	11

Table 1: Average monthly precipitation (mm) and temperature (°C) for nine localities in the study area. Months are in Roman numerals. Altitude (meters above sea level) is in parentheses. Based on Walter & Leith (1960) and Novotný (1971). See Fig. 3 for locality identities.

mate (Jeftic *et al.*, 1992) with cool, rainy winters and hot, moderately dry summers. The high plateau of Anatolia, which is shielded from Mediterranean influences by the mountains, has a continental climate with cold winters and dry, hot summers. The mountains in the east have a particularly inhospitable climate, with hot and exceedingly dry summers and severe, cold winters. Rainfall varies from an annual average of *ca.* 2,500 mm along the eastern Black Sea Coast, to less than 250 mm in the central plateau (Figs. 3, 4, Table 1).

The area largely coincides with the "fertile crescent". As a consequence, human pressure on habitats has been for longer here than anywhere else in the world. Neolithic culture thrived in Anatolia as early as the 7th millennium BC: the world's earliest towns (*e.g.* Hacılar and Çatalhöyük at *ca.* 8,000 BC) have been uncovered in central Anatolia. Çatalhöyük is believed to be the first site recording plant domestication. The oldest settlement on Cyprus dates back to before 6,000 BC. Both Turkey and Cyprus were an integral part of the Greek expansion after the 8th century BC. The Aegean coasts of Anatolia were influenced by the Minoan-Mycenean civilisation more than a millennium earlier (*ca.* 2,600 BC). The unsustainable land use in this arid environment resulted in large-scale habitat degradation.

In this paper, with some modification, we utilise the zoogeographical division of Turkey into nine regions proposed by Cook (1997). Although Cyprus is climatically very similar to the Mediterranean part of Turkey, it is considered as a region on its own (Fig. 5).

Fig. 2: Southern coastline of Cyprus with scarce Mediterranean vegetation. In spite of their diverse landscape, climate and biota, Turkey and Cyprus have a strong Mediterranean character. Photo: A. Kryštufek.

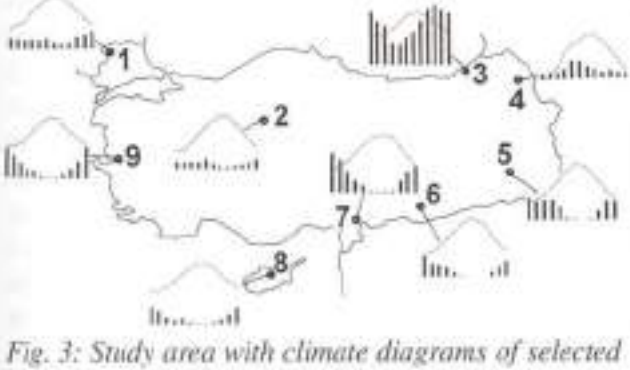

Fig. 3: Study area with climate diagrams of selected localities. Months are from January (left) to December (right); line = average monthly temperatures; bars = monthly precipitation. Based on Walter & Lieth (1960) and Novotný (1971). For details and locality identities see Table 1.

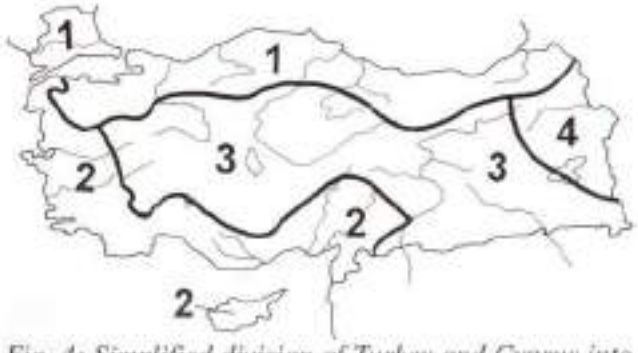

Fig. 4: Simplified division of Turkey and Cyprus into four vegetation units. Partly based on Zohary (1973). 1 = mesic deciduous and mixed forests of oak Quercus *spp., beech* Fagus orientalis *and spruce* Picea orientalis; *2 = Mediterranean maquis and woodland of oak* (Quercus calliprinos, Q. cerris) *and pine* (Pinus brutia, P. nigra); *3 =Anatolian* Artemisia *steppe; 4 = mosaic of* Artemisia *steppe and oak woodland.*

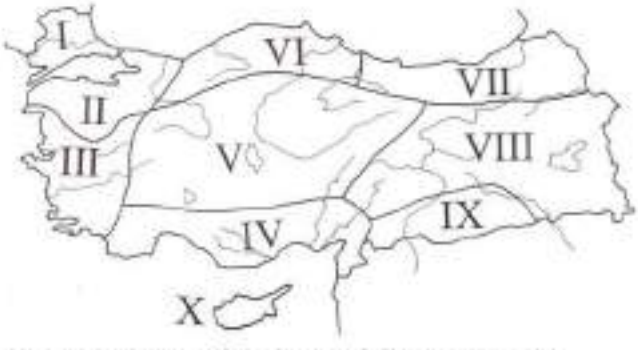

Fig. 5: Division of Turkey and Cyprus into ten geographic regions. Modified from Cook (1997). I = Thrace; II = Marmara; III = Aegean; IV = Taurus; V = central Anatolia; VI = western Black Sea Mts, VII = eastern Black Sea Mts, VIII = eastern Anatolia; IX = south-east Anatolia; X = Cyprus.

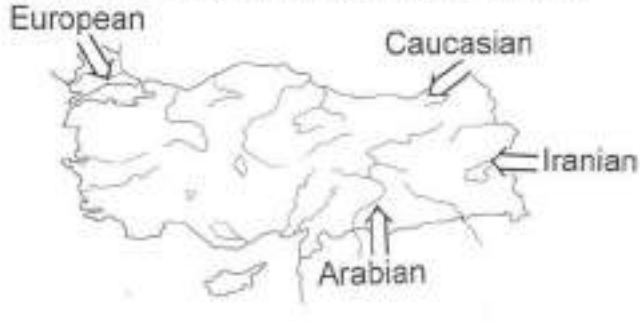

Fig. 6: Schematic presentation of the biogeographic impact of regions neighbouring Turkey on the country's species richness. See text for further information.

Turkey

The Republic of Turkey (Türkiye Cumhuriyeti) is a large peninsula situated bridge-like between the Balkan Peninsula and Asia. Of the total land area (779,452 km²), 755,688 km² is in Asia and 23,764 km² in Europe. The two continents are separated by the Bosphorus Strait (Karadeniz Bogazi), the Sea of Marmara (Marmara Denizli) and the Dardanelles Strait (Çanakkale Bogazi). The European part is also known as Turkish Thrace (Trakya, Rumeli) and the Asiatic part as Asia Minor or Anatolia (Anadolu).

Turkey basically consists of two main folded zones, the northern and the southern, with the high plateau (Anatolia) lying between them. Both principal mountain chains are geologically young folded-mountain zones, trending predominantly from east to west. In eastern Turkey, the two mountain folds converge to produce an extensive, predominantly rough terrain landscape of severe climate.

The human population of Turkey was estimated at 61.2 million in 1994, compared with 44.7 million in 1980 and *ca.* 13.6 million in 1927. Population growth was particularly rapid after World War II, reaching nearly *3% per annum* in the 1960s. Although the rate of growth has declined since then, Turkey's population is still one of the most rapidly growing in the Mediterranean area, with an estimated doubling period of 25 years (Jeftic *et al.*, 1992). The average population density is 72.5 persons per km². More than 65% of Turkey's population live in the cities (and *ca.* 60% in the coastal zone) however, over 50% of employment is still based in agriculture. Consequently, more than half of the land surface is utilised for agriculture, but less than one tenth of this land (8% in 1984) is irrigated. The major expansion of arable land was in the 1950s, largely due to the advent of mechanisation.

Fig. 7: The ridges of the Istranca (Yıldız) Mts are mainly below 1,000 m asl. Regardless of their modest altitudes, these are one of the largest forested regions of Turkey. Photo: B. Kryštufek.

Fig. 8: Humid deciduous forest near Sivriler, the Istranca Mts, Thrace. Habitat of Talpa levantis, Apodemus agrarius *and* A. flavicollis. *Photo: B. Kryštufek.*

Thrace (Trakya) includes the entirety of the European part of the country, but only 3% of Turkey's total area. It consists mainly of a rolling plateau landscape, although the Thracian (Ergene) Lowlands are among the largest flat areas in Turkey. In the northern part, the Istranca Mts (Yıldız; Fig. 7) emerge above the lowlands, however, their ridges are mainly below 1,000 meters asl; the highest peak is Büyük Mahya Dağı at 1,031 m asl. Regardless of their modest altitudes, the mountainous parts are among the largest forested regions of Turkey; beech *Fagus orientalis* predominates at higher altitudes whilst oak *(Quercus pubescens, Q. cerris, Q. frainetto)* and hornbeam *Carpinus orientalis* are the principal trees in the lower, drier parts, which have southern exposures (Fig. 8). The lowlands are deforested and cultivated intensively (Plate I.1). Wheat, barley, corn, tobacco, sunflowers, vegetables, olives and fruit are the main crops. The summers are warm (July mean *ca.* 25 °C) and winter temperatures are close to freezing. Annual precipitation ranges between 600–900 mm, and there is a pronounced summer drought, although the higher elevations receive more rainfall (Fig. 9). Thrace is densely populated and supports *ca.* 10% of the nation's population, including the İstanbul region with a density of 1,330 people per km².

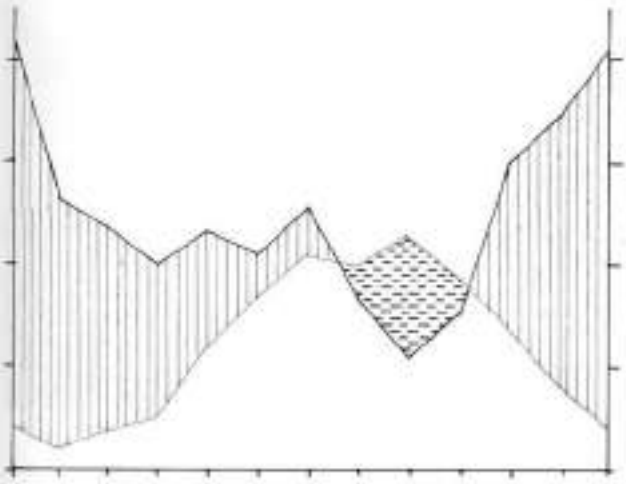

Fig. 9: Climate diagram of Edirne, Turkish Thrace. Months are on the x-axis from January (left) to December (right); thin line: average monthly temperature curve (1 unit = 10 °C); heavy line: average monthly precipitation curve (1 unit = 20 mm); dotted area: relatively arid season; vertically shaded area: humid season; black area: average monthly precipitation exceeding 100 mm; box below the zero-line: months with average daily temperature under 0 °C. See also Table 1.

From a geographical point of view (biogeography included) the **Marmara** region is very similar to Thrace and, as such, is frequently joined to it. This is a hilly area with fertile lowlands along the coasts. Ulu Dağ Mt. (2,493 m asl) is high enough to be above the timber line (Plate I.2), but the majority of other peaks are below 1,000 meters asl. Oak forests *(Quercus cerris, Q. frainetto, Q. conferta)* mixed with *Carpinus orientalis, Castanea vesca* and *Populus tremula* predominate (Plate II.1), however, they have become severely degraded by unregulated timber exploitation and grazing. There are patches of beech *Fagus orientalis* forest, mixed with *Abies equitrojana*, between 1,100–1,400 m asl on Mt. Ulu Dağ (Fig. 10). Similar to Thrace, the climate is characterised by hot summers and moderately cold winters; summers are dry while winters receive the majority of precipitation. The entire area is densely populated, particularly along the coast around the Sea of Marmara.

Going further south is the **Aegean** region. With its rolling plateau country, coastal lowlands and fertile soil it is highly suitable for agriculture (Plate II.2, Plate III.1). Summers are hot and dry, with July temperatures between 25–30 °C; winter frosts are rare. Annual precipitation averages *ca.* 400 mm with a pronounced summer drought (Fig. 11). Along the Aegean coastline is a belt of evergreen Mediterranean vegetation of the maquis type, composed mainly of evergreen hardwood species and conifers *(Cupressus, Juniperus, Ephedra, Quercus, Laurus, Genista, Pistacia* and *Pinus)*. Deciduous shrubs of various oaks predominate inland. The natural vegetation is largely degraded to pasture or transformed by cultivation. Cotton is the main industrial crop, while cereals are less important. Other crops include olives, grapes and figs. The region is densely populated, particularly so around İzmir. Numerous islands off the western Anatolian coast are politically part of Greece, although biogeographically they belong to Turkey (Laar & Daan, 1967).

Fig. 10: Fir Abies equitrojana *forest on Mt. Ulu Dağ, Marmara. Habitat of* Sorex satunini, Clethrionomys glareolus, *and* Apodemus uralensis. *Photo: B. Kryštufek.*

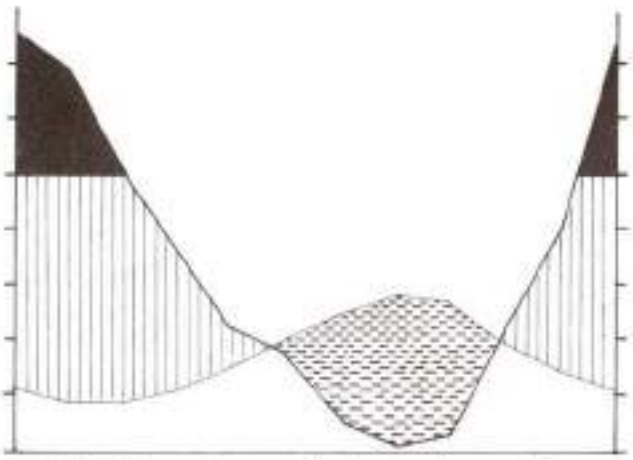

Fig. 11: Climate diagram for İzmir, Aegean Turkey. See Fig. 9 for explanation.

The **Taurus Mts** is a series of steep ridges, running parallel with the Mediterranean coast and reaching elevations of 2,000–2,750 m asl (Plate III.2); some peaks exceed 3,000 m asl. The mountains are rough and not much dissected by rivers. Over most of its length, the Mediterranean coastal plain is narrow at the foothills of the mountains, and with only two lowland embayments: the smaller Antalya Plain and the more extensive Adana Plain (the latter is formed by the combined deltas of the Seyhan and Ceyhan rivers around the Gulf of Iskenderun). The climate is similar to that in the Aegean region, but more intense. July means exceed 28 °C and winter temperatures are above freezing. Precipitation is scarce, particularly along the coast, which hardly receives any rainfall in dry summers. Annual rainfall declines from 1,000 mm in the west to 600 mm in the east (Fig. 12). On the coast, evergreen maquis is the predominant vegetation type (Plate IV.1), followed by the upper Mediterranean belt with *Pinus brutia*. Above the weakly developed montane belt with *Pinus nigra pallasiana* is a high montane belt with *Cedrus libani* and *Abies cilicica* in moister areas, or various *Juniperus* species where dry conditions prevail. *Fagus orientalis* occurs within the

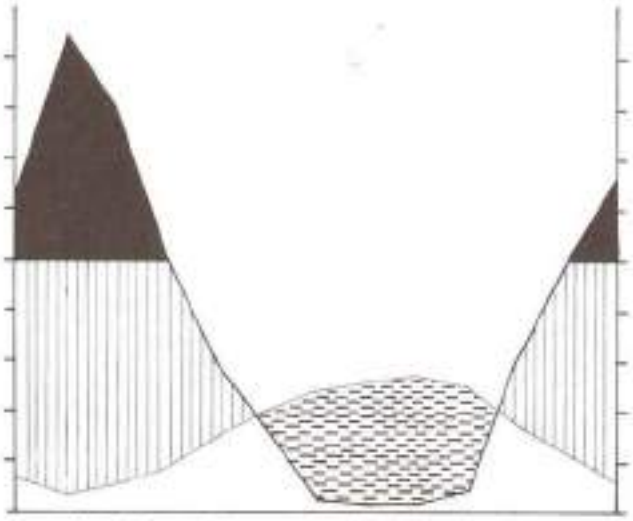

Fig. 12: Climate diagram for İslahiye, the eastern Taurus Mts. See Fig. 9 for explanation.

Fig. 13: Deforested valley with scattered pines and cedars on corroded limestone near Balkusan, central Taurus Mts (altitude at the bottom of the valley is 1,550 m asl). The narrow strip of dense herbaceous vegetation along a small stream is the habitat of Neomys anomalus, Crocidura suaveolens, Microtus guentheri, *and* Apodemus iconicus. *Photo: V. Vohralík.*

Fig. 14: Grassland with scattered bushes and trees near Adana, the eastern Taurus Mts (altitude 150 m asl). Habitat of Crocidura suaveolens, Apodemus iconicus *and* Mus macedonicus. *Photo: V. Vohralík.*

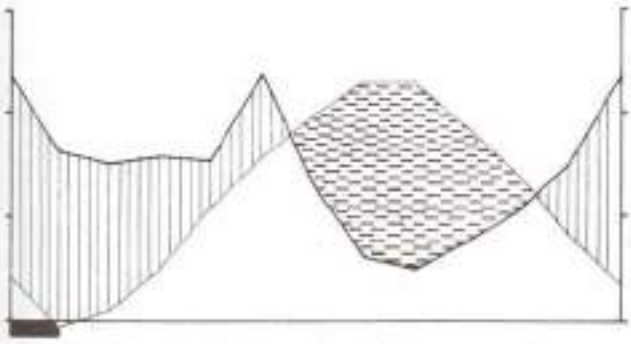

Fig. 15: Climate diagram for Ankara, central Anatolia. See Fig. 9 for explanation.

cloud belt of the Amanos Mts in the east. The subalpine belt is of *Juniperus excelsa* and *J. foetidissima* (Walter, 1979). Fertile soils and the Mediterranean climate allow growing of citrus fruits, figs and even bananas in the narrow coastal lowland belt. Cotton is the main crop of the Adana lowland. The mountains, however, are mainly of limestone and thus exposed to chemical erosion, so karstic phenomena are widespread in the lowlands to the west of Adana (Figs. 13, 14). The Mediterranean coast is much more thinly settled, with pockets of high population density in the lowlands of Antalya and Adana.

Central Anatolia (Anatolian Plateau) is situated between the two mountain chains, extending as far east as the point where the two ranges converge. This semi-arid highland is the heartland of Turkey. The region varies in altitude from 600 m in the west to 1,000 m in the east. Mountain ranges rise to over 2,000 m and some peaks are well above 3,000 m *(e.g.* Erciyes at 3,916 m asl; Fig. 16, Plate V.1). The plateau is dominated by two large basins (Konya Ovasi and Tuz Gölü), both characterised by inland drainage. The alluvial plains along the larger rivers (Gediz, Küçükmenderes, Büyükmenderes) are among the largest in Turkey and, as such, of special agricultural value. The climate is semi-continental with a wide temperature range. Summers are hot with hardly any rain, and winters are cold with heavy snow. The mean January temperature in Ankara is –1 °C, and the July average is 23 °C. Rainfall is scarce, with *ca.* 300 mm per year (600 mm in the eastern part) but less than 200 mm falls in dry years (Fig. 15); the Konya Basin is the driest part of Turkey. May is the wettest month and July and August are the driest. The entire area is subject to climatic extremes, and the growing period is as brief as four months. Lakes

Fig. 16: Semi-arid highlands of central Anatolia are the heartland of Turkey. Flat steppe to the west of Mt. Erciyes (3,916 m asl). Photo: B. Kryštufek.

are common in this part of Turkey, but many are saline. Steppe grassland is the dominant vegetation of central Anatolia (Plate IV.2); oak forests occur at climatically and edaphically more favourable sites, however, these patches were probably more numerous in earlier times. Poplar stands are restricted to the banks of watercourses, irrigation ditches and lakes (Fig. 17). Dry mixed and deciduous forests of oak, juniper, pine and fir occur on the margins of the vast steppe area (Fig. 18). Land use is intensive and livestock farming is a major activity; cultivation occurs where precipitation or other water sources allow (Fig. 19), and wheat

Fig. 17: Poplar stands along a small river near Yeşilhisar, central Anatolia (altitude 1,350 m asl). Habitat of Erinaceus concolor, Plecotus austriacus, Eptesicus serotinus, Microtus rossiaemeridionalis, Apodemus iconicus, Mus macedonicus, *and* Dryomys nitedula. *The plateau above the valley is arid. Photo: B. Kryštufek.*

Fig. 18: Steppe vegetation, intersperse with trees near Sivrihisar, central Anatolia. Habitat of Spermophilus xanthoprymnus. *Photo: B. Kryštufek.*

and barley are the main crops. Originally, central Anatolia was covered by herbaceous grass steppe *(Stipa* spp., *Bromus tomentellus, Festuca vallesiaca)* but has been changed mainly to an *Artemisia fragrans - Poa bulbosa* semi-desert with many spring therophytes and geophytes (Walter, 1979). Compared with other regions of Turkey, central Anatolia is lightly populated; together with eastern Anatolia (the two occupy two thirds of the national area) it contains less than half of the Turkish population.

The **Black Sea (Pontic) Mts** are an interrupted chain of folded highlands that run parallel to the Black Sea Coast. In the west, the mountains tend to be low (elevations rarely exceed 1,500 m asl), but they rise steeply towards the east, reaching 3,000 meters asl. The coastal lowland is narrow, except for the deltas of the Kızıl Irmak and Yeşil Irmak rivers. These rivers break through the mountain barrier, thus dividing the Pontic Mts into western and eastern sections. The Black Sea Mountains take advantage of water-carrying cloud from the Black Sea; annual precipitation is 1,400 mm on average, but reaches 2,400 mm in the

Fig. 19: Cultivated landscape in a fertile valley of the Kızıl Irmak River; vicinity of Şarkışla, central Anatolia (altitude 1,400 m asl). Habitat of Eptesicus serotinus, Spermophilus xanthoprymnus, Mesocricetus brandti, Cricetulus migratorius, Mus macedonicus, *and* Apodemus iconicus. *Photo: B. Kryštufek.*

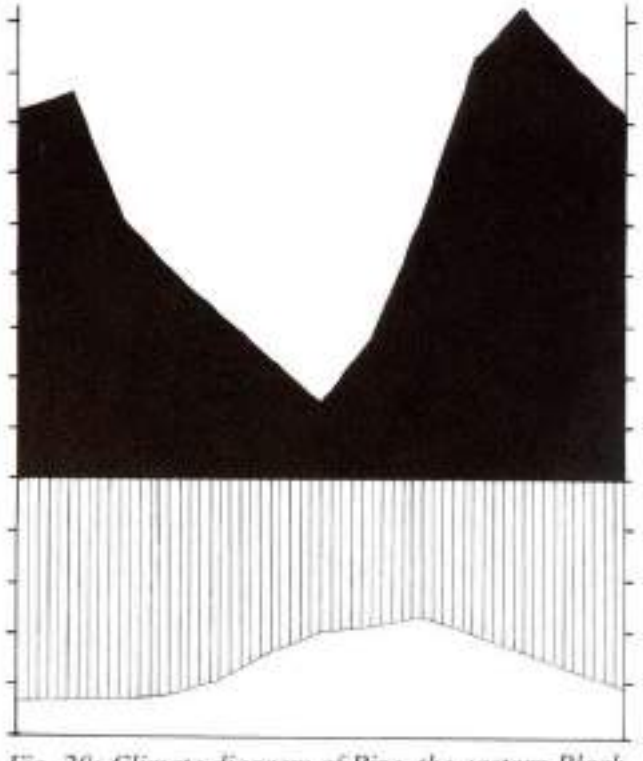

Fig. 20: Climate diagram of Rize, the eastern Black Sea Mts. See Fig. 9 for explanation.

Fig. 21: The eastern Black Sea Mts above Rize. Photo: B. Kryštufek.

east (Fig. 20). This is the only part of Turkey to receive rain throughout the year. Summers are hot (the July mean is 20 °C) and drier, but there are no summer droughts. Winters are mild (January average is between 6–7 °C), at least along the coast, and frosts are rare at sea level. Northern slopes in the east *(i.e.* facing the Black Sea Coast) are consequently overgrown by the richest type of woodland, *i.e.* the Pontic or Colchian forest (Plates V.2, VI.1). The humid deciduous forests of the western Black Sea zone are second only to the Colchian type in richness and variety. Locations along the Black Sea coast up to altitudes of about 400 m have forests of *Platanus orientalis* with *Arbutus andrachne*, *Crataegus pyracantha* and *Tamarix* spp. The next belt is formed of mixed broad-leaved forests, primarily composed of *Castanea vesca*, different oaks *(Quercus pubescens, Q. cerris, Q. frainetto, Q. aegilops)*, *Juglans regia* and *Carpinus betulus*. From about 600 m asl to 1,000–1,100 m asl one finds beech forests *(Fagus orientalis)*. Temperatures are lower at this elevation (annual mean 7.5–11 °C; average of the coldest month –2 to –4 °C) and relatively short winters have abundant snowfall. Undergrowth is dominated by evergreen shrubs, especially *Ilex colchica*, *Rhododendron ponticum* and *Vaccinium arctostaphylos*. In general, the beech forests are followed by a coniferous zone. To the west of the Kızıl Irmak, *Abies bornmuelleriana* and beech grow up to 1,800 m asl, being replaced east of this river by *Abies normanniana* mixed with *Picea orientalis*. The tree line in the eastern part of the Black Sea Mts is formed nearly everywhere of pure beech forests (Röhrig, 1991). The human population is concentrated in the coastal belt, with Samsun being the main centre. This narrow lowland zone is intensively cultivated; corn is the chief cereal, and other crops include tobacco, tea, hazelnuts, citrus and vegetables.

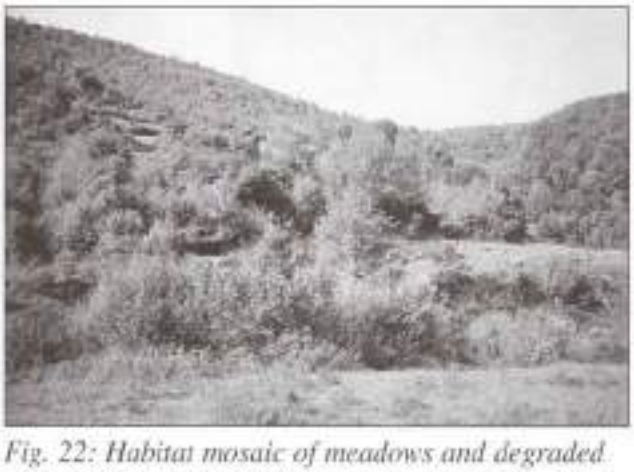

Fig. 22: Habitat mosaic of meadows and degraded woodland near Zonguldak, western Black Sea Mts. Habitat of Crocidura suaveolens, Microtus subterraneus, Apodemus iconicus, A. uralensis, *and* A. mystacinus. *Photo: B. Kryštufek.*

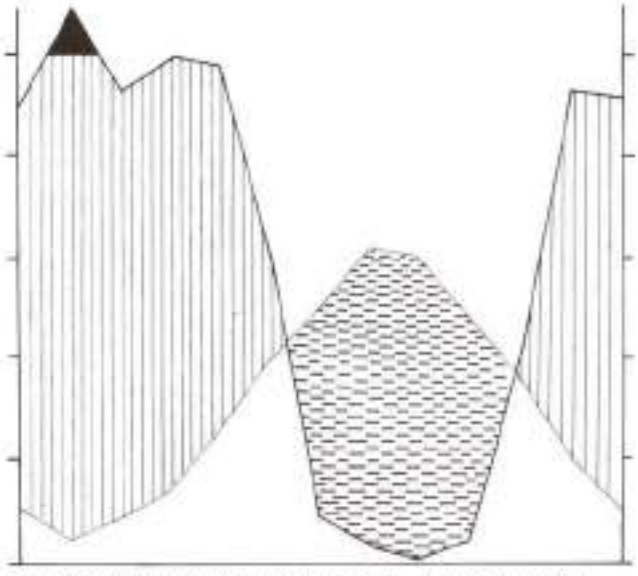

Fig. 23: Climate diagram of Siirt , East Anatolia. See Fig. 9 for explanation.

Where the two principal mountain chains converge, a rugged **East Anatolia** of higher elevations starts (the area is also known as Anti-Taurus). Amongst mountain ridges one finds pockets of level land confined to valleys and enclosed basins (Malatya, Elazığ, Muş). The climate is harsh, but precipitation is higher than in central Anatolia. Winters are severe with heavy

Fig. 24: Eroded slopes of the Euphrates (Fırat) valley; East Anatolia. Photo: B. Kryštufek.

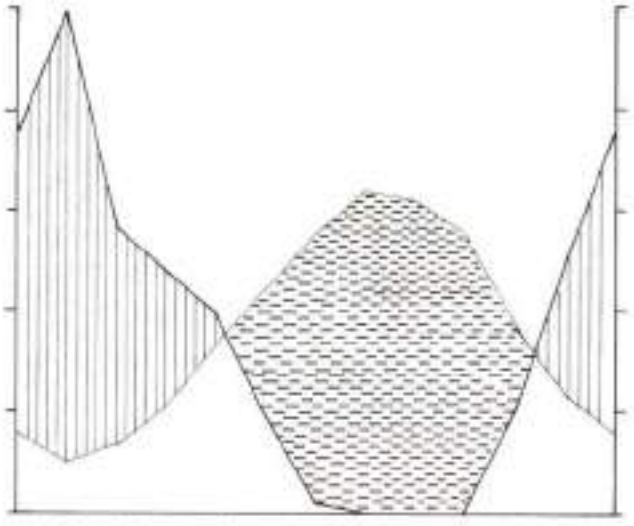

Fig. 25: Climate diagram of Urfa, south-east Anatolia. See Fig. 9 for explanation.

snowfalls. Temperatures of –30 °C to –40 °C can occur in the mountains, and snow cover may remain for 120 days per year (Fig. 23). Many of the region's peaks (their average elevation exceeds 3,000 m asl) are extinct volcanoes; the highest is Mt. Ararat (or Ağrı – 5,137 m asl). The headwaters of the three major rivers arise in the mountains of East Anatolia: Aras, Euphrates (Fırat; Fig. 24) and Tigris (Dicle). Also located in eastern Anatolia is Lake Van, the largest continental lake in Turkey which, however, is hypersaline. Steppic vegetation of *Stipa* spp., *Bromus tomentellus*, *Festuca vallesiaca*, *Astragaalus* and *Acantholimon* predominates, but semi-deserts are also widespread (Plates VII and VIII.1). Broad-leaved forests extend in altitude from about 1,000 to > 2,000 m asl. These forests are usually exploited coppice stands, degraded, and often in the process of dissolution. Oaks predominate *(Quercus castaneifolia, Q. petraea, Q. pubescens, Q. cerris, Q. hartwissiana, Q. haas)* together with *Acer platanoides* as well as *Prunus* and *Pyrus* species. The area is traditionally populated by nomads and transhumance farmers, who migrate seasonally between the uplands and the plains.

To the south of the mountains of eastern Anatolia, between the Gaziantep and the Tigris, is the Arabian Platform (**South-east Anatolia**). This region of rolling hills and broad plateau surfaces extends further south into Syria (Plate VIII.2). Elevations decrease from 800 meters in the north to 500 meters near the Syrian border. The climate is dry and hot during summer with July means mainly above 30 °C. Winters are cold, with January means approaching freezing. Annual rainfall ranges between 300–600 mm (Fig. 25), and steppe grassland is the predominant vegetation type.

Cyprus

The island of Cyprus (Kıbrıs, Kípros) is the third largest Mediterranean island (area = 9,251 km²) and is situated 72 km south of Turkey and 105 km west of the Syrian coast. Since 1974 the island has been shared by two countries: the Republic of Cyprus (Kikpriaki Demokratia) in the south and the Turkish Republic of Northern Cyprus (Kuzey Kıbrıs Türk Cumhuriyeti); the latter covers 37% of the island's surface.

The island basically consists of two mountain ridges and the plain between them. Running approximately parallel to, and just inland from the northern coast, is the Pentadaktylos Range (Kyrenia Mts); the highest peak is only slightly above 1,000 m (Kyparissovoano = 1,024 m asl). In the south and south-west are the much higher Troodos Mts (Mt. Olympus = 1,951 m asl). The land between the two ranges is the flat, low-lying Mesaorian Plain. All major rivers originate in the Troodos Mts and these became dry in summer. Approximately half of the 780 km coastline of the island is rocky.

Cyprus emerged from the sea *ca.* 20 million years ago. It was only connected with the mainland during the great Messinian salinity crisis, and thus been iso-

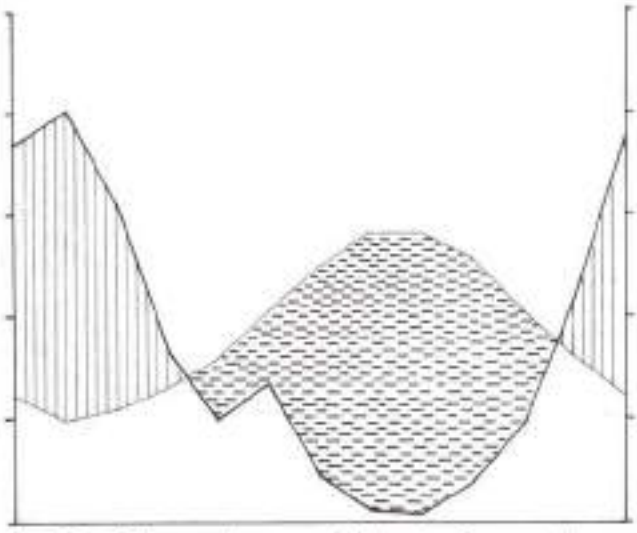

Fig. 26: Climate diagram of Nicosia, Cyprus. See Fig. 9 for explanation.

Fig. 27: Cedars and pines on eroded slopes of Mt. Troodos, Cyprus. Photo: A. Kryštufek.

lated for the last 5.3 million years. Human settlement during the Holocene was followed by rapid extirpation of the indigenous species and the establishment of a novel mammal fauna (*e.g.* Simmons, 1999).

The climate is Mediterranean with a typical, strongly marked seasonal rhythm. Summers (June to September) are hot and dry and winters (November to March) are rainy. Average annual rainfall is *ca.* 500 mm, less in the lowlands (250 mm) than in the mountains (1,000 mm). At Nicosia (Lefkoşa) summer temperatures range between an average daily maximum of 37 °C and an average daily minimum of 21 °C; in winter the range lies between 5–15 °C (Fig. 26). The Troodos Mts experience several weeks of freezing temperatures and snow cover.

Vegetation has been strongly transformed by man. Only 18.7% of the island has remained wooded (16.8% are closed forests) and fire is destroying up to 3,700

hectares of forests annually. The coastal region and the lower mountain zones are covered by Mediterranean shrubland (maquis): *Arbutus adrachne*, *Styrax officinalis*, *Olea europaea oleaster*, *Quercus coccifera* and *Ceratonia siliqua*. The more degraded the maquis is, the more common the grazing-resistant *Juniperus phoenicea* becomes (Plate IX). The mountain belt (between 600–1,300 m asl) is under extensive forests of *Pinus brutia* with the local *Quercus alnifolia* and *Cedrus libani* and, in the highest zones, are forests of *Pinus nigra pallasiana* (Fig. 27). The Mesaorian Plain is extensively cultivated and the remnants of indigenous vegetation are reduced to *Crataegus azarolus* shrubland (Sfikas, 1996).

The Mesaorian Plain is the island's principal cereal-growing area, and 22% of the arable land is irrigated. Major crops include wheat, grapes, citrus, seasonal fruits, vegetables, olives, carobs, barley and tobacco. Pastures occupy about 10% of the total land area and support > 300,000 sheep.

The human population of Cyprus was estimated at 748,000 in 1991, which gives an average density of 82 people per km^2, with population growth reaching 1.1% annually. Traditionally, the Cypriots were a largely rural people, but a steady drift to the towns began early in the 20th century. At present, 64% of population lives in urban environments, the great majority (*ca.* 50% of the total) concentrating in the two main cities (Nicosia and Limassol). The coast is most densely populated (*ca.* one half of the population), being followed by the fertile Mesaorian Plain. Settlements are scarcer at higher altitudes.

History of mammalian research

Turkey

The first information on the mammals inhabiting present-day Turkey is found in the book by the Arabian aristocrat Usáma ibn Munkiz (1096–1188) who described his observations of some larger species in the vicinity of Diyarbakir and from the present Turkish-Syrian border *(cf.* Schumann, 1905; Usáma ibn Munkiz, 1971). For the next seven centuries only incidental observations by various travellers are available (for a review see Kumerloeve, 1975a).

Scientific mammalogical activities started only when K. E. Abbott collected mammals between 1833–1837 in north-eastern Turkey and committed them to the collections of the Zoological Society of London. His attempts resulted in a descriptions by E. T. Bennett, W. Martin and G. Waterhouse of several species of small mammals not known to science until then. Abbott was followed by other early collectors who started visiting the Ottoman Empire: F. R. Chesney, W. F. Ainsworth, Th. Kotschy, and P. Čichačev (P. de Tchihatcheff). By far the most important were two expeditions held by C. G. Danford in 1875–76 and 1878–79, who explored southern Turkey between the Aegean Sea and the Euphrates and also visited Central and north-western Anatolia. Danford's collections were published in two papers (Danford & Alston, 1887, 1880) containing a survey of the then known Turkish mammalian fauna as well as descriptions of two new species: *Apodemus mystacinus* and *Microtus guentheri*.

The last years of the 19th century witnessed the initiation of a period of hectic descriptions and naming of new taxa. Mammals collected in 1905 by A. C. Bailward and R. B. Woosnam during their journey from Persia across Van and Erzurum to Trabzon, and rich material obtained in 1905 and 1906 by A. Roberts south of Trabzon, mainly from the vicinity of Sumela (= Meryemana), considerably enriched the Turkish collection in the British Museum of Natural History. The small mammals in London were mainly elaborated by O. Thomas who between 1897 and 1920 described more than 15 taxa, among them *Talpa levantis*, *Chionomys roberti*, *Microtus majori*, *Ellobius lutescens* and *Allactaga williamsi* that are still considered as species in their own right. Several taxa were also described by G. S. Miller *(e.g. Neomys teres)*, G. E. H. Barrett-Hamilton, G. Allen and W. Blackler; Blackler also named several new carnivores and ungulates. In the 19th century, the mammalian fauna of Turkey attracted the attention of German zoologists from Berlin. Thus, A. Nehring published several papers on mustelids and rodents between 1896 and 1903 and P. Matschie between 1900 and 1919 proposed new names for *Hyena*, *Capra* and *Spalax*, but all of which are now considered to represent subspecies. Approximately in the same period, between 1898 and 1912, the Russian mammalogist K. Satunin studied Turkish mammals from the Museum in Tbilisi (Georgia). He published numerous papers on the mammals from the Russian-Turkish border and also named several taxa from present-day Turkey *(e.g. Spalax nehringi)*. In his monograph on mole rats, the Hungarian mammalogist L. v. Méhely (1909) based four new names on Turkish material. Additional small mammals obtained early in the 20th century by Russian collectors in north-eastern Turkey, were later recognised as new to science and named by M. V. Šidlovskij (Shidlovskij), and by S. I. Ognev (*Sorex satunini*). Carnivores in the British Museum of Natural History were elaborated by R. Pocock between 1930–1938. In 1932 B. Aharoni (Palestine) described a subspecies of *A. terrestris* from the currently drained lake Amik Gölü in Hatay. At this time of fragmentary studies, G. Neuhäuser performed two field trips in 1933–1934 to northern and south-western Turkey and collected rich material in numerous localities. Her contributions (Neuhäuser, 1936a, b), which also include specimens in the museum collections of London, Bonn, Berlin, Vienna, and Moscow, are still the classic works on the taxonomy of Turkish rodents. This period also coincided with the first mammalogical publications by Turkish scientists. In 1931 A. Wahby (Vehbi) briefly reported on the biology of the wild goat, *Capra aegagrus*, and few years later M. Tolunay & S. Tuncok (1938) published a booklet on insectivores and rodents, also describing the methods of rodent control.

World War II not only suppressed the activities by European mammalogists in the Near East but also postponed work on the alpha taxonomy on Turkish mammals. Thus, between 1936 when Neuhäuser named eight new rodents and 1964, not a single new name was proposed for a mammal from Turkey.

In the post-war period the Turkish collection in the

British Museum was included into a thorough taxonomic revision of the genus *Meriones* by J. Chaworth-Musters & J. Ellerman (1947), and into an important determination key of rodents from south-western Asia (Ellerman, 1948). Now, Turkish zoologists, noticeably Ö. K. Gülen and M. Çağlar, also became more engaged in the mammalian research of their country. Çağlar started publishing in 1953 and continued her research on various mammalian taxa, bats in particular, until the early 1970s. Similarly, S. Huş, engaged in the research and protection of game mammals, published a series of papers and two books (Huş, 1963, 1974) between 1951 and 1981.

In 1953, the German ornithologist H. Kumerloeve started with an extensive research of Turkish birds from the Museum A. Koenig in Bonn. During his numerous expeditions to various parts of Turkey, Kumerloeve observed and also collected mammals. Between 1934 - his first visit to Turkey had already been in 1933 - and 1986 Kumerloeve published almost 30 contributions on Turkish mammals. Among them, the most comprehensive is a paper dealing with the distribution of carnivores, ungulates, and large rodents (Kumerloeve, 1967c). His outstanding contribution is also a compilation summing up the then available knowledge about mammals, including a list of mammalian species and subspecies described from Turkey and a complete bibliography dating back to the Middle Ages (Kumerloeve, 1975a). He also showed an interest in the history of mammalian research in Turkey (Kumerloeve, 1967c, 1975a, 1982). A complete mammalogical and ornithological bibliography covering not only Turkey but also the adjacent regions was published separately (Kumerloeve, 1986). Large mammals gathered by Kumerloeve during his ornithological expeditions were studied in detail by E. v. Lehmann from the Museum A. Koenig in Bonn, who published several papers on this topic, including two comprehensive ones (Lehmann, 1966, 1969).

In 1955 X. Missone (Bruxelles, Belgium) collected small mammals in semidesert regions south of Urfa and confirmed for the first time the presence of three rodents, *Allactaga euphratica, Tatera indica, Eliomys melanurus*, unknown until then in Turkey (Missone, 1957). Shortly afterwards (1958–1960) an American mammalogist D. J. Osborn undertook several expeditions throughout most of the country which resulted in representative material of insectivores and rodents; voucher specimens were deposited in the United States National Museum of Natural History, Washington D.C. and the Field Museum, Chicago. Between 1961 and 1965 Osborn published his results in seven papers. In 1960 H. Kahmann (Munich, Germany) started a research on Turkish small mammals, bats in particular, in collaboration with M. Çağlar, and published five faunistic papers between 1960 and 1962.

At the beginning of the 1960s B. Mursaloğlu initiated a mammal collection at Ankara University which soon became the most comprehensive collection of Turkish mammals. Between 1963 and 1981 she published a series of papers, mostly on rodents.

In 1961 F. Spitzenberger (Naturhistorisches Museum Wien) and H. Steiner (Hochschule für Bodenkultur, Vienna) started a series of collecting trips to Turkey and from 1965 on, H. Felten, G. Storch, D. Kock and F. Malec collected for the Forschungsinstitut und Natur-Museum Senckenberg, Frankfurt a. M., Germany. Consequently, mammal collections in Vienna and Frankfurt were enriched by a great number of Turkish mammals, mostly insectivores, bats, and rodents. This Austrian-German collaboration resulted in a detailed treatise of the small mammals of Western Anatolia by H. Felten, F. Spitzenberger and G. Storch (Felten *et al.*, 1971, 1973, 1977). An extensive study on the systematics and ecology of voles of northern Turkey and adjacent regions of Iran were simultaneously published by Steiner (1972). These activities also led to a description of several new mammalian taxa: *Dryomys laniger* (Felten & Storch, 1968), *Crocidura arispa* (Spitzenberger, 1971) and *Acomys cilicicus* (Spitzenberger, 1978b).

Bat studies progressed from the 1960s onwards. This was partly due to the elaboration of the material collected by the above mentioned Austrian and German field trips in 1960s (Felten *et al.*, 1977), but also by contributions of other students from abroad (*e.g.*, A. F. DeBlase, O. v. Helversen, J. Gaisler, A. Nadachowski, *etc.*). The main contributions, however, were by İ. Albayrak (Ankara University) who between 1985 and 1993 published a series of papers with a number of new records from all over Turkey. All these attempts, together with the newly acquired material in 1990s by several Czech expeditions, resulted in a comprehensive review of the distributional status of 31 Turkish bats by Benda & Horáček (1998).

Knowledge on the history of distribution of carni-

vores, ungulates, and also of some rodents was extended by German archaeologists J. Boessneck and A. v. d. Driesch who published their results between 1974 and 1981. Turan N. (1984) compiled knowledge on Turkish game species, also providing tentative distributional maps.

Since the 1970s the bulk of mammalogical research by Turkish scientists has been performed at three universities. At Trakya University in Edirne, C. Kurtonur was engaged mainly in the rodent fauna of European Turkey. His attempts, together with those of B. Özkan, also resulted in grid distributional maps incorporated into the Atlas of European Mammals (Mitchell-Jones *et al.*, 1999). At the Ondokuz Mayıs University in Samsun, S. Doğramacı was engaged in taxonomic and karyological studies of various small mammals; this work is continued by H. Kefelioğlu. Ankara University remains the traditional centre of Turkish mammalogical studies. E. Kıvanç, who continued the work by B. Mursaloğlu, attracted a number of younger students, E. Çolak, N. Yiğit, M. Sözen, R. Verimli. New centres of mammological activities appeared in the 1990s as a result of the increased number of new universities opening all over the country. One should mention in particular the University of Gazi in Kirşehir (Ş. Özkurt), University of Dicle in Diyarbakir (Y. Coşkun), and Erciyes University in Kayseri (Ç. Tez). Publishing activities increased significantly and well over 50 papers dealing with the mammals of Turkey appeared between 1995 and 2000, many of them in the Turkish Journal of Zoology. Recently, Demirsoy (1996) also provided a synthesis on the Mammals of Turkey (in Turkish) with tentative maps.

Cyprus

Despite its unique zoogeographical position, Cyprus received little mammalogical attention when compared with the western Sea. The first scientific information on the mammalian fauna is in the book by Unger & Kotschy (1865), where T. Kotschy provided a synopsis of eight free living species. However, some of them *(e.g. Erinaceus europaeus* and *Lepus timidus)* were undoubtedly confused with related species (respectively *Hemiechinus auritus* and *Lepus europaeus*), while the correct identification of some others, *(e.g. Rattus norvegicus* which is reported as *Mus decumanus)* remained questionable. Günther (1879) added another two species to the list of Cyprus' mammals: *Pipistrellus kuhlii* and *Rattus rattus*. The first attempt at a complete elaboration of Cypriotic mammal fauna was by Miss D. Bate, a British scientist who visited the island at the beginning of the 20th century. She gives 15 mammal species (Bate, 1903a), also describing the native spiny mouse as *Acomys nesiotes* (Bate, 1903b). Simultaneously, Mitchell (1903) published a short note on the spiny mouse, while Barrett-Hamilton (1903) named a new hare, *Lepus cyprius*, now considered to be a subspecies of the European brown hare *Lepus europaeus cyprius*.

In the course of the next seven decades only four more bat species were established for Cyprus. Kahmann & Çağlar (1960) report without any details *Rhinolophus mehelyi* and *Myotis capaccinii*, consequently the localities for these two were reported later by Kock (1974) and Felten *et al.* (1977), respectively. A specimen of *Pipistrellus savii* was already collected in 1911 and deposited in the British Museum (Natural History) but was only published by Harrison in 1961. The occurrence of *Rhinolophus euryale* was first indicated by Harrison (1964) but since at that time he did not distinguish *R. euryale* from *R. mehely*, the first unambiguous report of *R. euryale* was by Boye *et al.* (1990; Harrison & Bates, 1991). During this period, collections of non-volant mammals were only exceptional, for example the trapping of *Acomys* for karyological analyses (Zahavi & Wahrmann, 1956).

In 1972 and 1973 F. Spitzenberger (Naturhistorisches Museum Wien, Vienna), accompanied by several other Austrian collectors, visited Cyprus and sampled the entirety of the mammalian fauna living there. This material provided the basis for two fundamental papers on the mammals of the island (Spitzenberger, 1978, 1979) which today are still the only modern comprehensive studies. Four species - one shrew *(Suncus etruscus)* and three bats *(Myotis blythi, Eptesicus serotinus, Nyctalus noctula)* were reported from Cyprus for the first time. In the 1970s mammals attained attention from the archeozoological and palaeontological points of view (e. g. Boekschoten & Sondaar, 1972; Schwartz, 1973; Lehmann & Nobis, 1979).

In the 1980s zoologists from Switzerland (F. Catzeflis, P. Vogel, T. Maddalena) and Israel (S. Hellwing) were attracted by the white-toothed shrew already described by Bate (1903b) as *Crocidura russula cypria*, and demonstrated that *Crocidura suaveolens* is in ques-

tion (Catzeflis, 1983; Catzeflis *et al.*, 1985; Vogel *et al.*, 1986). The type of *C. s. cypria* was redescribed by Vesmanis & Vesmanis (1982). Shortly afterwards, Reumer & Oberli (1988), while studying shrew remnants from Bronze Age deposits, recognised the ancestor of the modern *C. s. cypria* and described it as a new subspecies *C. suaveolens praecypria*.

Recently, P. Boye (Bonn, Germany) and co-workers updated the list of mammals, adding also two more bats: *Myotis nattereri* and *Plecotus austriacus* (Boye, 1990, 1991; Boye *et al.* 1990). Other simultaneous papers dealing with the mammals of Cyprus, mainly treat them within a broader taxonomic or faunal framework: *Mus macedonicus* (Harrisson & Bates, 1991), *Mus (musculus) domesticus* (Chondropoulos *et al.*, 1995), small mammals from owl pellets (Nadachowski *et al.*, 1990), *Acomys nesiotes* (Zima *et al.*, 1999), and *Dama dama* (Masseti, 1999). Sfikas (1996) provides a popular booklet on the mammals of Cyprus, which, however is incomplete and lacks scientific information.

Annotated checklist of the Mammals of Turkey and Cyprus

The aim of this list is to update previous taxonomic and geographic compilations for the region. Cypriot mammals have been reviewed in detail by Spitzenberger (1978a, 1979), but the situation for Turkey is more complex. Kumerloeve (1975a) is still the most complete and relevant source for this extensive and diverse region, although there are two more recent compilations: Doğramacı (1989a) and Demirsoy (1996). A number of studies, mainly the result of blooming research activity in the Turkish universities, justify the preparation of this list. In comparison with Kumerloeve (1975a) and Doğramacı (1989), its main advantage is perhaps that it provides a complete listing of all available names of specific and subspecific taxa. The shifting borders of Turkey in the last two centuries also necessitate a careful redefinition of some of the type localities from bordering regions, particularly in Thrace and the Caucasus. Taxonomic nomenclature follows Wilson & Reeder (1993), whilst the main sources for type localities were Ellerman & Morrison-Scott (1966), Corbet (1978), Wilson & Reeder (1993), and Pavlinov & Rossolimo (1987, 1998). Geographical names have often changed (sometimes several times) since they were first used; consequently we also provide current spellings in parentheses. When appropriate, type localities are given more precisely than when first published to increase the accuracy of their location in the field.

Human activities have had a strong impact on the mammal fauna of Turkey and Cyprus for millennia, and this is reflected in the present species composition. Cyprus, with its extirpated indigenous and endemic island mammals, is an extreme case (see Simmons, 1999). In our opinion, it is highly important to define time scales, so we only considered for this publication species that have been known to be present in the last century. During the 19th century, Turkey evidently lost at least four mammals: the European beaver *Castor fiber* Linnaeus, 1758, the cheetah *Acinonyx jubatus* (Schreber, 1775), the Asiatic lion *Panthera leo* (Linnaeus, 1758) (Harper, 1945), and the Mesopotamian fallow deer *Dama mesopotamica* (Brooke, 1875) (Harrison & Bates, 1991). The onager *Equus onager* Boddaert, 1785, the Syrian elephant *Elephas maximus* Linnaeus, 1758, and the aurochs *Bos primigenius* Bojanus, 1827, were already exterminated before modern times (Harper, 1945; Kumerloeve, 1975a).

Key references are only provided in the checklist. When reviews are available for higher taxa, references to the species within such a group were cited only when unavoidable. Species' distributions are tentatively given (mainly) according to regions (as shown in Fig. 5). We do not consider borders separating biogeographical units as narrow lines, so we did not always make an attempt to check particularly whether some of the records cross such a border or not. This principle was followed as long as violation of the biogeographical border did not affect the pattern of distribution.

In total, we list 142 species (including the recently extirpated tiger), of which 141 are terrestrial whilst one (the monk seal) is marine (Table 2). At least two species have been deliberately introduced (*Myocastor coypus* and *Oryctolagus cuniculus*). The fauna of Cyprus is a typical island fauna (Spitzenberger, 1979) with bats contributing over half of the species (54%). The number of bats reported thus far is unlikely to be final, and more detailed field surveys (including mist netting and ultrasound work) will provide new faunal records for the island. There are also feral donkeys *Equus asinus* Linnaeus, 1758 on the Island of Cyprus (Reid *et al.*, 1997).

Order	Thrace	Anatolia	Turkish Total	Cyprus	Area Total
Insectivora	9	14	17	3	17
Chiroptera	23	34	34	14	34
Carnivora*	10	18	19	1	19
Artiodactyla	4	9	9	2	9
Lagomorpha	1	2	2	1	2
Rodentia	20	55	59	5	60
Total	67	132	140	26	141

* Not including monk seal.

Table 2: Taxonomic breakdown of the mammals of Turkey and Cyprus, by order (numbers of species).

The great majority of species occurring in Cyprus also occur in Turkey (except the Cyprus' endemic spiny mouse). The majority of Turkish mammals are found in Anatolia (132 out of 141; *i.e.* 93.6%). At least 67 species live in Thrace, and only eight were prevented from spreading to Anatolia by the Bosphorus and the Dardanelles: *Sorex araneus*, *S. minutus*, *Talpa*

europaea, *Sciurus vulgaris*, *Spermophilus citellus*, *Apodemus agrarius*, *Nannospalax leucodon*, *Mustela putorius* and, possibly, *Micromys minutus*. A number of species reached Turkey from one of the four major neighbouring biogeographic centres of species richness (Fig. 6). As a result they are known from only very restricted areas along the Turkish border. In easternmost Anatolia these marginal species are *Talpa caucasica*, *Prometheomys schaposchnikovi*, *Microtus daghestanicus* and *Sicista caucasica* from the Caucasian region, and *Ellobius lutescens*, *Meriones persicus*, *M. vinogradovi*, *M. meridianus* and *Allactaga elater* from the Iranian highlands. The arid parts of south-eastern Anatolia and the adjacent regions of Hatay and Adana are reached by Arabian, or even African desert mammals: *Taphozous nudiventris*, *Rousettus aegyptiacus*, *Otonycteris hemprichi*, *Gazella* spp., *Mesocricetus auratus*, *Tatera indica*, *Meriones lybicus*, *M. crassus*, *Gerbillus dasyurus*, *Allactaga euphratica* and *Eliomys melanurus*. The impact of Europe is evident from above. Five small mammals are endemic to Anatolia: *Crocidura arispa*, *Microtus dogramaci*, *M. anatolicus*, *Acomys cilicicus* and *Dryomys laniger*. The major distributional area of another six species is within Turkey, but extends across its political borders: *Talpa davidiana*, *Spermophilus xanthoprymnus*, *Mesocricetus brandti*, *Nannospalax nehringi*, *Myomimus roachi* and *Allactaga williamsi*.

Rodents are by far the most species rich order, representing 43% of all mammal species in Turkey, followed by bats (24%), carnivores (13.5%) and insectivores (12%).

Order: Insectivora

Comments. Reviewed in this work.

Family: Erinaceidae Fischer von Waldheim, 1817
Subfamily: Erinaceinae Fischer von Waldheim, 1817
Genus: *Erinaceus* Linnaeus, 1758

1. *Erinaceus concolor* Martin, 1838
   Erinaceus concolor Martin, 1838. Type loc.: near Trebizond (= Trabzon), Turkey.
   Distribution: Widespread in Turkey, but of marginal occurrence in south-eastern Anatolia.

Genus: *Hemiechinus* Fitzinger, 1866

2. *Hemiechinus auritus* (Gmelin, 1770)
   Erinaceus auritus Gmelin, 1770. Type loc.: Astrachan Region, Russia.
   Erinaceus calligoni Satunin, 1901. Type loc.: Aralık, Kars, Turkey.
   Hemiechinus auritus dorotheae Spitzenberger, 1978. Type loc.: River Pouzis, 14 km east of Mazotos, Larnaca, Cyprus.
   Distribution: south-east and (marginally) eastern Anatolia; widespread in Cyprus.

Family: Soricidae Fischer von Waldheim, 1817
Subfamily: Soricinae Fischer von Waldheim, 1817
Genus: *Sorex* Linnaeus, 1758

3. *Sorex minutus* Linnaeus, 1766
   Sorex minutus Linnaeus, 1766. Type loc.: Krasnojarsk, Western Siberia, Russia.
   Distribution: Thrace.

4. *Sorex volnuchini* Ognev, 1921
   Sorex minutus volnuchini Ognev, 1921. Type loc.: Kiša River, Adygejskaja Autonomous Region, north-western Caucasus, Russia.
   Distribution: Black Sea Mts; an isolate in East Anatolia.

5. *Sorex araneus* Linnaeus, 1758
   Sorex araneus Linnaeus, 1758. Type loc.: Uppsala, Sweden.
   Sorex caucasicus sultanae Şimşek, 1986. Type loc.: Velika Bridge (= *ca.* 5 km south-east to Velika köy), Demirköy, Kırklareli, Thrace, Turkey.
   Distribution: Thrace.

6. *Sorex satunini* Ognev, 1921
   Sorex araneus satunini Ognev, 1921. Type loc.: Goele, Kars region, Turkey.
   Distribution: Black Sea Mts and adjacent East Anatolia; Marmara.

7. *Sorex raddei* Satunin, 1895
   Sorex raddei Satunin, 1895. Type loc.: neighbourhood of Kutais, Georgia.
   Sorex batis Thomas, 1913. Type loc.: Sumela (= Meryemana), Trabzon, Turkey.
   Distribution: eastern Black Sea Mts.

Genus: *Neomys* Kaup, 1829

8. *Neomys anomalus* Cabrera, 1907
Neomys anomalus Cabrera, 1907. Type loc.: San Martin de la Vega, Madrid, Spain.
Distribution: contiguous in Thrace and Marmara, scattered elsewhere in other Asiatic Turkey but absent in much of the Black Sea Mts.

9. *Neomys teres* Miller, 1908
Neomys teres Miller, 1908. Type loc.: 25 miles north of Erzurum, Turkey.
Distribution: Black Sea Mts; also vicinity of Van, East Anatolia.

Subfamily: Crocidurinae Milne-Edwards, 1872
Genus: *Crocidura* Wagler, 1832

10. *Crocidura leucodon* (Hermann, 1780)
Sorex leucodon Hermann, 1780. Type loc.: vicinity of Strasbourgh, Bas Rhin, France.
Crocidura leucodon lasius Thomas, 1906. Type loc.: Scalita (= Altindere), Trabzon, Turkey.
Distribution: widespread in Turkey except for south-east Anatolia.

11. *Crocidura suaveolens* (Pallas, 1811)
Sorex suaveolens Pallas, 1811. Type loc.: Khersones, near Sevastopol, Crimea, Russia.
Crocidura russula cypria Bate, 1904. Type loc: Cyprus.
Crocidura russula monacha Thomas, 1906. Type loc.: Scalita (= Altindere), Trabzon, Turkey.
Crocidura russula aralychensis Satunin, 1914. Type loc.: marshy shores of River Karasu, near Aralyk (= Aralık), Turkey.
Crocidura suaveolens praecypra Reumer & Oberli, 1988. Type loc.: Kouklia, Cyprus.
Distribution: widespread in Turkey and Cyprus.

12. *Crocidura arispa* Spitzenberger, 1971
Crocidura pergrisea arispa Spitzenberger, 1971. Type loc.: 20 km east-south-east of Ulukişla, Niğde, Turkey.
Distribution: Taurus Mts.

Genus: *Suncus* Ehrenberg, 1832

13. *Suncus etruscus* (Savi, 1822)
Sorex etruscus Savi, 1822. Type loc.: Pisa, Italy.
Distribution: scattered records across Turkey (except Thrace, central Anatolia and Black Sea Mts); Cyprus.

Family: Talpidae Fischer von Waldheim, 1817
Subfamily: Talpinae Fischer von Waldheim, 1817
Genus: *Talpa* Linnaeus, 1758

14. *Talpa europaea* Linnaeus, 1758
Talpa europaea Linnaeus, 1758. Type loc.: Engelholm, Kristianstad, Sweden.
Distribution: Thrace.

15. *Talpa caucasica* Satunin, 1908
Talpa caeca caucasica Satunin, 1908. Type loc.: Stavropol, Russia.
Distribution: eastern Black Sea Mts.

16. *Talpa levantis* Thomas, 1906
Talpa caeca levantis Thomas, 1906. Type loc.: Scalita (= Altindere), Trabzon, Turkey.
Distribution: Thrace, Marmara, Black Sea Mts, Bitlis.

17. *Talpa davidiana* (Milne-Edwards, 1884)
Scaptochirus davidianus Milne-Edwards, 1884. Type loc.: Meydanekbez (= Akbes), south-west of Gaziantep, Turkey.
Distribution: eastern Anatolia (Hakkari, Van); a single record from south-east Anatolia.

Order: Chiroptera

Comments: bats of Turkey are reviewed by Benda and Horáček (1998); those of Cyprus by Spitzenberger (1979) as completed by Boye *et al.* (1990).

Family: Pteropodidae Gray, 1821
Subfamily: Pteropodinae Gray, 1821
Genus: *Rousettus* Gray, 1821

18. *Rousettus aegyptiacus* (Geoffroy, 1810)
Pteropus egyptiacus Geoffroy, 1810. Type loc.: Giza, Egypt.
Distribution: Taurus Mts; Cyprus.

Family: Emballonuridae Gervais, 1856
Genus: *Taphozous* E. Geoffroy, 1818

19. *Taphozous nudiventris* Cretzschmar, 1830
Taphozous nudiventris Cretzschmar, 1830. Type loc.: Giza, Egypt.
Distribution: a single record from 6 km south-west of Nizip, south-east Anatolia (Sachanowicz *et al.*, 1999).

Family: Rhinolophidae Gray, 1825
Subfamily: Rhinolophinae Gray, 1825
Genus: *Rhinolophus* Lacepede, 1799

20. *Rhinolophus ferrumequinum* (Schreber, 1774)
Vespertilio ferrum-equinum Schreber, 1774. Type loc.: France.
Distribution: widespread in Turkey; Cyprus.

21. *Rhinolophus hipposideros* (Bechstein, 1800)
Vespertilio hipposideros Bechstein, 1800. Type loc.: France.
Distribution: possibly widespread with hardly any records from central or south-east Anatolia; Cyprus.

22. *Rhinolophus euryale* Blasius, 1853
Rhinolophus euryale Blasius, 1853. Type loc.: Milano, Italy.
Distribution: Thrace, Marmara, Aegean, Taurus, eastern Black Sea Mts, eastern Anatolia; Cyprus.

23. *Rhinolophus mehelyi* Matschie, 1901
Rhinolophus mehelyi Matschie, 1901. Type loc.: Bucharest, Rumania.
Distribution: Thrace, Marmara, central Anatolia, Taurus, eastern Anatolia.

24. *Rhinolophus blasii* Peters, 1866
Rhinolophus blasii Peters, 1866. Type loc.: Trieste, Italy.
Distribution: Thrace, Marmara, Aegean, Taurus, a single record from the western Black Sea Mts; Cyprus.

Family: Vespertilionidae Gray, 1821
Subfamily: Vespertilioninae Gray, 1821
Genus: *Myotis* Kaup, 1829

25. *Myotis mystacinus* (Kuhl, 1817)
Vespertilio mystacinus Kuhl, 1817. Type loc.: Hessen, Germany (see Benda & Tsytsulina, 2000).
Comments: a recent review, based entirely on morphological characters, results in the splitting of *M. mystacinus* into several independent species (Benda & Tsytsulina, 2000), three of which (*M. mystacinus s. str.*, *M. aurascens*, and *M. nipalensis)* are also recognised from Turkey. The occurrence of *M. hajastanicus* Argyropulo, 1939 (Type loc.: Šordža, eastern bank of Lake Sevan at 2,000 m asl, Armenia) is also possible in Turkey; this species is said to be endemic for the Lake Sevan region (Benda & Tsytsulina, 2000). We adopt this new view of the taxonomy of the *M. mystacinus* group, although we believe that it will change with the accumulation of new data (see also comments under *M. aurascens)*. Bats from the *M. mystacinus* group are widespread in Turkey and hitherto are only unrecorded in south-east Anatolia; not surprisingly, distributional details for the newly recognised taxa are scarce.
Turkish specimens of *M. mystacinus s. str.* were classified as the newly described *M. m. caucasicus* Tsytsulina, 2000 (in Benda & Tsytsulina, 2000; type locality: Kiša foresters' lodge, northern Caucasus State Reserve, Krasnodar region, Russia).
Distribution: eastern Anatolia (districts of Van and Kars; Benda & Tsytsulina, 2000).

26. *Myotis aurascens* Kusjakin, 1935
Myotis mystacinus aurascens Kusjakin, 1935. Type loc.: Kurkužin village, near Vladikavkaz, the Caucasus Mts, Russia.
Comments: see under *M. mystacinus*. This species is possibly a senior synonym of *M. alcathoe* Helversen, Heller, Meyer, Nemeth, Volleth & Gombkötö, 2001, described recently from Greece (type locality is near the village of Kleistos, Nomos Evritanias). Namely, Benda & Tsytsulina (2000) found *M. aurascens* to be widespread in Greece. *M. alcathoe* differs clearly from *M. mystacinus* and *M. brandtii* in two mitochondrial genes (ND1 and 12S rRNA; Helversen *et al.*, 2001).
Distribution: presumably widespread, except in south-east Anatolia (Benda & Tsytsulina, 2000).

27. *Myotis nipalensis* (Dobson, 1871)
Vespertilio nipalensis Dobson, 1871. Type loc.: Kathmandu, Nepal.
Comments: see under *M. mystacinus*.
Distribution: known from two records from Kars district, eastern Anatolia (Benda & Tsytsulina, 2000).

28. *Myotis brandtii* (Eversmann, 1845)
Vespertilio brandtii Eversmann, 1845. Type loc.: Spasskoe, Bolšoj Ik River, southern Ural Mts, Russia.
Distribution: eastern Black Sea Mts.

29. *Myotis emarginatus* (Geoffroy, 1806)
Vespertilio emarginatus Geoffroy, 1806. Type loc.: Charlemont, Givet, Ardennes, France.
Distribution: Thrace; there are also scattered Anatolian records from coastal regions and the Euphrates Valley, in the Marmara, Aegean, Taurus, and Black Sea Mts regions.

30. *Myotis nattereri* (Kuhl, 1817)
Vespertilio nattereri Kuhl, 1817. Type loc.: Hessen, Germany.
Distribution: Thrace, Marmara, Aegean, Taurus, eastern Anatolia, eastern Black Sea Mts; Cyprus.

31. *Myotis bechsteini* (Kuhl, 1817)
Vespertilio bechsteini Kuhl, 1817. Type loc.: Hessen, Germany.
Distribution: records are few and widely scattered: Thrace, eastern Black Sea Mts, Taurus.

32. *Myotis myotis* (Borkhausen, 1797)
Vespertilio myotis Borkhausen, 1797. Type loc.: Thuringia, Germany.
Distribution: widespread in Turkey.

33. *Myotis blythii* (Tomes, 1857)
Vespertilio blythii Tomes, 1857. Type loc.: Nasirabad, Rajputana, India.
Distribution: widespread, except in south-eastern Turkey; Cyprus.

34. *Myotis daubentonii* (Kuhl, 1817)
Vespertilio daubentonii Kuhl, 1817. Type loc.: Hessen, Germany.
Distribution: Thrace, Marmara, eastern Black Sea Mts.

35. *Myotis capaccinii* (Bonaparte, 1837)
Vespertilio capaccinii Bonaparte, 1837. Type loc.: Sicily, Italy.
Distribution: Thrace, Marmara, Aegean, Taurus; Cyprus.

Genus: *Vespertilio* Linnaeus, 1758

36. *Vespertilio murinus* Linnaeus, 1758
Vespertilio murinus Linnaeus, 1758. Type loc.: Sweden.
Distribution: single record from the western Black Sea Mts, plus two records from eastern Anatolia based on skeletal material.

Genus: *Eptesicus* Rafinesque, 1820

37. *Eptesicus serotinus* (Schreber, 1774)
Vespertilio serotinus Schreber, 1774. Type loc.: France.
Distribution: widespread in Turkey but records from south-eastern Anatolia are lacking; Cyprus.

38. *Eptesicus bottae* (Peters, 1869)
Vespertilio bottae Peters, 1869. Type loc.: Yemen.
Eptesicus anatolicus Felten, 1971. Type loc.: Alanya, Antalya, Turkey.
Distribution: Aegean and the Taurus Mts; a single record from the Euphrates Valley is based on skeletal material.

Genus: *Nyctalus* Bowdich, 1825

39. *Nyctalus leisleri* (Kuhl, 1817)
Vespertilio leisleri Kuhl, 1817. Type loc.: Hessen, Germany.
Distribution: Thrace, Black Sea Mts.

40. *Nyctalus noctula* (Schreber, 1774)
Vespertilio noctula Schreber, 1774. Type loc.: France.
Distribution: Thrace, plus two records each from the Taurus Mts and the Euphrates Valley; Cyprus.

41. *Nyctalus lasiopterus* (Schreber, 1780)
Vespertilio lasiopterus Schreber, 1780. Type loc.: northern Italy (uncertain).
Distribution: a single record from Marmara.

Genus: *Pipistrellus* Kaup, 1829

42. *Pipistrellus pipistrellus* (Schreber, 1774)
Vespertilio pipistrellus Schreber, 1774. Type loc.: France.
Distribution: widespread in Turkey, but with hardly any records from central and south-eastern Anatolia.

43. *Pipistrellus nathusii* (Keyserling & Blasius, 1839)
Vespertilio nathusii Keyserling & Blasius, 1839. Type loc.: Berlin, Germany.
Distribution: Thrace and Marmara, plus an isolated record from Lake Van.

44. *Pipistrellus kuhlii* (Kuhl, 1817)
Vespertilio kuhlii Kuhl, 1817. Type loc.: Trieste, Italy.
Distribution: records are widely scattered in Turkey, but with only one from central Anatolia and none from the Aegean; Cyprus.

Genus: *Hypsugo* Kolenati, 1856
Comments: we accept the generic status of *Hypsugo* (Horáček & Hanák, 1986; Ruedi & Arlettaz, 1991).

45. *Hypsugo savii* (Bonaparte, 1837)
Vespertilio savii Bonaparte, 1837. Type loc.: Pisa, Italy.
Distribution: Marmara, Black Sea Mts, central Anatolia, Taurus Mts, south-east Anatolia, eastern Anatolia; Cyprus.

Genus: *Plecotus* Geoffroy, 1818

46. *Plecotus auritus* (Linnaeus, 1758)
Vespertilio auritus Linnaeus, 1758. Type loc.: Sweden.
Distribution: Thrace, central Anatolia, Taurus, eastern Anatolia, eastern Black Sea Mts.

47. *Plecotus austriacus* (Fischer, 1829)
Vespertilio auritus austriacus Fischer, 1829. Type loc.: Vienna, Austria.
Distribution: Thrace, Taurus, central Anatolia, eastern Anatolia, eastern Black Sea Mts; Cyprus.

Genus: *Barbastella* Gray, 1821
Comments: Benda & Horáček (1998) consider *Barbastella leucomelas* (Cretzschmar, 1826) as part of *B. barbastellus*.

48. *Barbastella barbastellus* (Schreber, 1774)
Vespertilio barbastellus Schreber, 1774. Type loc.: Burgundy, France.
Distribution: eastern Black Sea Mts, plus single records from Thrace, central Anatolia and the Euphrates Valley.

Genus: *Otonycteris* Peters, 1859

49. *Otonycteris hemprichi* Peters, 1859
Otonycteris hemprichi Peters, 1859. Type loc.: Nile Valley south of Asuan, Egypt.
Distribution: a single record from south-east Anatolia.

Subfamily: Miniopterinae Dobson, 1875
Genus: *Miniopterus* Bonaparte, 1837

50. *Miniopterus schreibersii* (Kuhl, 1817)
Vespertilio schreibersii Kuhl, 1817. Type loc.: Kolumbacs Cave, near Coronini, Banat, Rumania.
Distribution: localities are widely scattered across Turkey, but are (mainly) absent from central and south-east and eastern Anatolia; Cyprus.

Family: Molossidae Gervais, 1856
Genus: *Tadarida* Rafinesque, 1814

51. *Tadarida teniotis* (Rafinesque, 1814)
Cephalotes teniotis Rafinesque, 1814. Type loc.: Sicily, Italy.
Distribution: all regions of Turkey except Thrace and the eastern Black Sea Mts.

Order: Carnivora
Comments: the most comprehensive and detailed work on Turkish carnivores is still that of Kumer-

loeve (1967c). Turan (1984) and Demirsoy (1996) provide tentative distributional maps. Because of strong human impacts, many species ranges are likely to be historical. For the few Cypriot species see Spitzenberger (1979).

Family: Canidae Fischer, 1817
Genus: *Canis* Linnaeus, 1758

52. *Canis lupus* Linnaeus, 1758
Canis lupus Linnaeus, 1758. Type loc.: Sweden.
Distribution: Thrace and Anatolia - details not known.

53. *Canis aureus* Linnaeus, 1758
Canis aureus Linnaeus, 1758. Type loc.: Benna Mts, Laristan, Iran.
Distribution. Thrace; coastal regions of Anatolia, south-east Anatolia (Turan, 1984).

Genus: *Vulpes* Frisch, 1775

54. *Vulpes vulpes* (Linnaeus, 1758)
Canis vulpes Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Vulpes kurdistanica Satunin, 1906. Type loc.: Gelsk valley, Kars, Turkey.
Vulpes indutus Miller, 1907. Type loc.: Cape Pyla, Cyprus.
Vulpes vulpes anatolica Thomas, 1920. Type loc.: Smyrna (=İzmir), Turkey.
Distribution: widespread in Turkey; Cyprus.

Family: Ursidae Fischer, 1817
Subfamily: Ursinae Fischer, 1817
Genus: *Ursus* Linnaeus, 1758

55. *Ursus arctos* Linnaeus, 1758
Ursus arctos Linnaeus, 1758. Type loc.: northern Sweden.
Distribution: Marmara, Black Sea Mts, Taurus Mts, eastern Anatolia (Turan, 1984).

Family: Mustelidae Fischer, 1817
Subfamily: Mustelinae Fischer, 1817
Genus: *Martes* Pinel, 1792

56. *Martes martes* (Linnaeus, 1758)
Mustela martes Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Distribution: Marmara, Black Sea Mts, Aegean, Taurus Mts, eastern Anatolia.

57. *Martes foina* (Erxleben, 1777)
Mustela foina Erxleben, 1777. Type loc.: Germany.
Distribution: widespread in Turkey, including Thrace (Turan, 1984).

Genus: *Mustela* Linnaeus, 1758

58. *Mustela nivalis* Linnaeus, 1766
Mustela nivalis Linnaeus, 1766. Type loc.: Westrobothnia, Sweden.
Distribution: Thrace, Marmara, Taurus Mts, central Anatolia, Black Sea Mts, eastern Anatolia (Kasparek, 1988). Lehmann & Nobis (1979) report subfossil skulls (Bronze Age) also from Cyprus.

59. *Mustela putorius* Linnaeus, 1758
Mustela putorius Linnaeus, 1758. Type loc.: Sweden.
Distribution: Thrace (Kurtonur *et al.*, 1994), and Turan (1984) also states that the species is present in Marmara.

Genus: *Vormela* Blasius, 1884

60. *Vormela peregusna* (Güldenstaedt, 1770)
Mustela peregusna Güldenstaedt, 1770. Type loc.: Banks of the River Don, Rostov Region, Russia.
Distribution: Thrace, Aegean, Taurus Mts, central Anatolia, Black Sea Mts, eastern Anatolia.

Subfamily: Melinae Bonaparte, 1838
Genus: *Meles* Boddaert, 1785

61. *Meles meles* (Linnaeus, 1758)
Ursus meles Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Meles meles ponticus Blackler, 1916. Type loc.: Scalita (= Altindere), Trabzon, Turkey.
Distribution: widespread in Turkey.

Subfamily: Lutrinae Bonaparte, 1838
Genus: *Lutra* Bruennich, 1771

62. *Lutra lutra* (Linnaeus, 1758)
Mustela lutra Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Distribution: records are from all regions of Turkey except south-east Anatolia.

Family: Herpestidae Bonaparte, 1845
Subfamily: Herpestinae Bonaparte, 1845
Genus: *Herpestes* Illiger, 1811

63. *Herpestes ichneumon* (Linnaeus, 1758)
Viverra ichneumon Linnaeus, 1758. Type loc.: Egypt.
Distribution: Aegean, east Taurus Mts and south-east Anatolia.

Family: Hyaenidae Gray, 1821
Subfamily: Hyaeninae Gray, 1821
Genus: *Hyaena* Bruennich, 1771

64. *Hyaena hyaena* (Linnaeus, 1758)
Canis hyaena Linnaeus, 1758. Type loc.: Benna Mts, Laristan, Iran.
Distribution: Marmara (marginal), Aegean, Taurus Mts, south-east Anatolia.

Family: Felidae Fischer, 1817
Subfamily: Felinae Fischer, 1817
Genus: *Felis* Linnaeus, 1758

65. *Felis silvestris* Schreber, 1777
Felis (Catus) silvestris Schreber, 1777. Type loc.: Germany.
Felis silvestris trapezia Blackler, 1916. Type loc.: Khotz (= Çosandere), Trabzon, Turkey.
Distribution: widespread in Turkey (Kumerloeve, 1967c).

66. *Felis chaus* Güldenstaedt, 1776
Felis chaus Güldenstaedt, 1776. Type loc.: Terek River, north of the Caucasus, Dagestan.
Distribution: scattered in the Aegean, central Anatolia, eastern Taurus Mts and south-east Anatolia, Black Sea Mts (Turan, 1984).

Genus: *Lynx* Kerr, 1792

67. *Lynx lynx* (Linnaeus, 1758)
Felis lynx Linnaeus, 1758. Type loc.: near Uppsala, Sweden.
Distribution: Kumerloeve (1967c) reports records from all over Anatolia, except south-east Anatolia; whilst Turan (1984) maps it for Marmara, the Black Sea Mts, the Taurus Mts and eastern Anatolia.

Fig. 28: Leopard Panthera pardus, *is perhaps the most charismatic mammal in Turkey. The above specimen was killed by Hasan Mantolu from the village of Şirince on Görüme Dağı near Kuşada, Aegean Anatolia. From Banoğlu (1953).*

Genus: *Caracal* Gray, 1843

68. *Caracal caracal* (Schreber, 1776)
Felis caracal Schreber, 1776. Type loc.: Table Mt., Cape Town, South Africa.
Distribution: extremely rare, recorded in the Aegean and in eastern Anatolia (Kumerloeve, 1967a).

Subfamily: Pantherinae Pocock, 1917
Genus: *Panthera* Oken, 1816

69. *Panthera pardus* (Linnaeus, 1758)
Felis pardus Linnaeus, 1758. Type loc.: Egypt.
Felis tulliana Valenciennes, 1856. Type loc.: Ninfi, 40 km east of İzmir, Turkey.
Distribution: Aegean, Taurus Mts, south-east Anatolia, eastern Anatolia.

70. *Panthera tigris* (Linnaeus, 1758)
Felis tigris Linnaeus, 1758. Type loc.: Bengal, India.
Comments: survived until recently in eastern Anatolia where it is believed to have been extirpated before 1950 (Kock, 1990a).

Family: Phocidae Gray, 1821
Genus: *Monachus* Fleming, 1822

71. *Monachus monachus* (Hermann, 1779)
Phoca monachus Hermann, 1779. Type loc.: Dalmatia, Croatia.
Distribution: by 1990s still present in the Black Sea and the Aegean and Mediterranean seas (Marchessaux, 1989; Moutou & Rollin, 1990; Kıraç & Savaş, 1996).

Order: Artiodactyla

Comments: the most comprehensive and detailed work on Turkish ungulates is still Kumerloeve (1967c). Turan (1984) and Demirsoy (1996) provide tentative distribution maps. Because of strong human impacts, many species' ranges are likely to be only historical.

Family: Suidae Gray, 1821
Subfamily: Suinae Gray, 1821
Genus: *Sus* Linnaeus, 1758

72. *Sus scrofa* Linnaeus, 1758
Sus scrofa Linnaeus, 1758. Type loc.: Germany.
Sus libycus Gray, 1868. Type loc.: Xanthus, near Günek, south-west Turkey.
Distribution: widespread in Turkey.

Family: Cervidae Goldfuss, 1820
Subfamily: Cervinae Goldfuss, 1820
Genus: *Dama* Frisch, 1775

73. *Dama dama* (Linnaeus, 1758)
Cervus dama Linnaeus, 1758. Type loc.: Sweden.
Distribution: Thrace, Marmara, Aegean, Taurus Mts, south-east Anatolia, eastern Anatolia; Cyprus (Masseti, 1999).

Genus: *Cervus* Linnaeus, 1758

74. *Cervus elaphus* Linnaeus, 1758
Cervus elaphus Linnaeus, 1758. Type loc.: southern Sweden.
Distribution: Kumerloeve (1967c) gives records for all regions of Anatolia. The species' actual range reflects human manipulations (introductions *etc.*). Turan (1984) maps it for Thrace, Marmara, Black Sea Mts, Taurus Mts and eastern Anatolia.

Subfamily: Odocoileinae Pocock, 1923
Genus: *Capreolus* Gray, 1821

75. *Capreolus capreolus* (Linnaeus, 1758)
Cervus capreolus Linnaeus, 1758. Type loc.: Sweden.
Capreolus capreolus armenius Blackler, 1916. Type loc.: Sumela (= Meryemana), near Trabzon, Turkey.
Capreolus capreolus whittalli Barclay, 1936. Type loc.: near Alemdagh, 15 miles from Moda, İstanbul, Turkey.
Distribution: Thrace, Marmara, Black Sea Mts, Taurus Mts, and scattered records in eastern Anatolia.

Family: Bovidae Gray, 1821
Subfamily: Antilopinae Gray, 1821
Genus: *Gazella* de Blainville, 1816
Comments: Harrison & Bates (1991) indicate the presence of both gazelle species in Turkey, but Turan (1984) lists only *G. subgutturosa*.

76. *Gazella subguttturosa* (Gueldenstaedt, 1780)
Antilope subgutturosa Gueldenstaedt, 1780. Type loc.: steppes of eastern Transcaucasia, Azerbaijan.
Distribution: south-east Anatolia and adjacent Taurus Mts (Hatay, Adana), as well as easternmost Anatolia (Turan, 1984).

77. *Gazella dorcas* (Linnaeus, 1758)
Capra dorcas Linnaeus, 1758. Type loc.: Lower Egypt.
Distribution: south-east Anatolia and adjacent Taurus Mts (Hatay, Adana), plus easternmost Anatolia (Harrison & Bates, 1991). Distribution range in the eastern Mediterranean is in need of thorough revision.

Subfamily: Caprinae Gray, 1821
Genus: *Rupicapra* de Blainville, 1816

78. *Rupicapra rupicapra* (Linnaeus, 1758)
Capra rupicapra Linnaeus, 1758. Type loc.: Switzerland.
Rupicapra tragus asiatica Lydekker, 1908. Type loc.: Trabzon, Turkey.
Distribution: eastern Black Sea Mts, eastern Anatolia.

Genus: *Capra* Linnaeus, 1758

79. *Capra aegagrus* Erxleben, 1777
Capra aegagrus Erxleben, 1777. Type loc.: Daghestan District of the Caucasus, south-eastern Russia.
Capra florstedti Matschie, 1907. Type loc.: Bulghar (= Bolkar) Dağları, Turkey.
Capra cilicica Matschie, 1907. Type loc.: Bulghar (= Bolkar) Dağları, Turkey.
Distribution: Taurus Mts, central Anatolia (marginal), eastern Anatolia, eastern Black Sea Mts.

Genus: *Ovis* Linnaeus, 1758

80. *Ovis orientalis* Gmelin, 1774
Ovis orientalis Gmelin, 1774. Type loc.: eastern Elbruz Mts, Iran.
Ovis gmelinii Blyth, 1841. Type loc.: Erzurum, Turkey (probably erroneous; see Ellerman & Morrison-Scott, 1966).
Ovis anatolica Valenciennes, 1856. Type loc.: Bulghar (= Bulgar) Dağ, Cilician Taurus, Turkey.
Ovis ophion armeniana Nasonov, 1919. Type loc.: Ağrı Dağı, near Doğubayazıt, Turkey.
Distribution: central Anatolia, Taurus Mts, eastern Anatolia; Cyprus.

Order: Lagomorpha
Family: Leporidae Fischer, 1817
Genus: *Lepus* Linnaeus, 1758

81. *Lepus europaeus* Pallas, 1778
Lepus europaeus Pallas, 1778. Type loc.: Poland.
Lepus cyprius Barrett-Hamilton, 1903. Type loc.: Cyprus.
Distribution: the entirety of Turkey (Osborn, 1964b) and Cyprus (Spitzenberger, 1979).

Genus: *Oryctolagus* Lilljeborg, 1873

82. *Oryctolagus cuniculus* (Linnaeus, 1758)
Lepus cuniculus Linnaeus, 1758. Type loc.: Germany.
Distribution: feral on some islands offshore Turkey.

Order: Rodentia
Comments: reviews by Osborn (1962, 1964b, 1965a) are now out of date for some taxa.

Family: Sciuridae Hemprich, 1820
Subfamily: Sciurinae Hemprich, 1820
Genus: *Sciurus* Linnaeus, 1758

83. *Sciurus vulgaris* Linnaeus, 1758
Sciurus vulgaris Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Distribution: Thrace (Kurtonur, 1975) and introduced to the easternmost Black Sea Mts (Mursaloğlu, 1973a).

84. *Sciurus anomalus* Gueldenstaedt, 1785
Sciurus anomalus Gueldenstaedt, 1785. Type loc.: Sabeka, 25 km south-west of Kutais, Georgia.
Distribution: all the parts of Anatolia (Osborn, 1964b; own observations), the Island of Gökçeada (Özkan, 1999a) and introduced to Belgrad Forest near İstanbul (Kurtonur, *pers. comm.*).

Genus: *Spermophilus* Blasius, 1884

85. *Spermophilus citellus* (Linnaeus, 1766)
Mus citellus Linnaeus, 1766. Type loc.: Wagram, Austria.
Citellus citellus thracius Mursaloğlu, 1964. Type loc.: south-eastern slope of Murattepe near Yenibedir, Lüleburgaz, Turkey.
Distribution: Thrace.

86. *Spermophilus xanthoprymnus* (Bennett, 1835)
Citillus xanthoprymna Bennett, 1835. Type loc.: Erzurum, Turkey.
Citellus schmidti Satunin, 1908. Type loc.: Diğor, Kars, Turkey.
Citellus citellus gelengius Mursaloğlu, 1965. Type loc.: 5 km east of Koçaş, Aksaray, Turkey.
Distribution: central Anatolia, eastern Anatolia, marginally in the Black Sea Mts (Osborn, 1964b; Mursaloğlu, 1965).

Family: Muridae Illiger, 1815
Subfamily: Arvicolinae Gray, 1821
Genus: *Ellobius* Fischer, 1814

87. *Ellobius lutescens* Thomas, 1897
Ellobius lutescens Thomas, 1897. Type loc.: near Van Gölü, Turkey.
Distribution: vicinity of Lake Van in eastern Anatolia (Çoşkun, 1997).

Genus: *Prometheomys* Satunin, 1901

88. *Prometheomys schaposchnikovi* Satunin, 1901
Prometheomys schaposchnikovi Satunin, 1901. Type loc.: Gudaur, south of Krestovyj Pass, Dušeti District, Georgia.
Distribution: easternmost Black Sea Mts (Spitzenberger & Steiner 1964, Çolak *et al.*, 1999).

Genus: *Clethrionomys* Tilesius, 1850

89. *Clethrionomys glareolus* (Schreber, 1780)
Mus glareolus Schreber, 1780. Type loc.: Island of Lolland, Denmark.
Evotomys ponticus Thomas, 1906. Type loc.: Sumela (= Meryemana), Trabzon, Turkey.
Distribution: Marmara, Black Sea Mts (Çolak & Kıvanç, 1991).

Genus: *Arvicola* Lacepede, 1799

90. *Arvicola terrestris* (Linnaeus, 1758)
Mus terrestris Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Microtus terrestris armenius Thomas, 1907. Type loc.: near Van Gölü, Turkey.
Arvicola terrestris hintoni Aharoni, 1932. Type loc.: Amik Gölü, Antakya, Turkey.
Distribution: Thrace, Black Sea Mts, central Anatolia, Taurus, eastern Anatolia (Osborn, 1962).

Genus: *Microtus* Schrank, 1798

91. *Microtus subterraneus* (de Sélys Longchamps, 1836)
Arvicola subterraneus de Sélys Longchamps, 1836. Type loc.: Waremme, Liége, Belgium.
Pitymys majori fingeri Neuhäuser, 1936a. Type loc.: Karadere, Bolu, Turkey.
Distribution: Thrace, Marmara, Black Sea Mts, Taurus Mts (Felten *et al.*, 1971; Çolak *et al.*, 1997c; own data).

92. *Microtus majori* Thomas, 1906
Microtus (Pitymys) majori Thomas, 1906. Type loc.: Sumela (= Meryemana), Trabzon, Turkey.
Microtus (Arbusticola) rubelianus. Shidlovsky, 1919. Type loc.: Mountains of Transcaucasia, near Trabzon, Turkey.
Distribution: eastern Black Sea Mts (Çolak *et al.*, 1997c).

93. *Microtus daghestanicus* Shidlovsky, 1919
Microtus (Arbusticola) rubelianus daghestanicus Shidlovsky, 1919. Type loc.: Near Khiso, Daghestan, Caucasus.
Distribution: eastern Black Sea Mts (Steiner, 1972).

94. *Microtus socialis* (Pallas, 1773)
Mus socialis Pallas, 1773. Type loc.: probably Inderskij Region, Gur'ev District between Volga and Ural Rivers, Kazakhstan.
Distribution: central and eastern Anatolia, Hatay and adjacent parts of south-east Anatolia (Kryštufek & Kefelioğlu, 2001a).

95. *Microtus guentheri* (Danford & Alston, 1880)
Arvicola guentheri Danford & Alston, 1880. Type loc.: Maraş, Asia Minor.
Microtus lydius Blackler, 1916. Type loc.: İzmir, Turkey.
Microtus (Sumneriomys) güntheri shevketi Neuhäuser, 1936a. Type loc.: Tarsus, Adana, Turkey.
Distribution: Species not satisfactorily defined and with poorly understood eastern distributional border. Occurs in Thrace and is possibly widely distributed in Anatolia (except the eastern Black Sea Mts).

96. *Microtus dogramaci* Kefelioğlu & Kryštufek, 1999
Microtus dogramaci Kefelioğlu & Kryštufek, 1999. Type loc.: Boyali köyü, Sulova, Amasya, Turkey.
Comments: Çolak *et al.* (1997b) report voles from Kilis (south-east Anatolia) with a diploid chromosome number of 2N = 46 and ascribe these to *M. irani* which, however, is evidently restricted to its type locality near Shiraz, Iran (Kryštufek & Kefelioğlu, 2001b). The voles from Kilis are possibly close to the chromosomally polymorphic *M. dogramaci*.
Distribution: central Anatolia (Kefelioğlu & Kryštufek, 1999).

97. *Microtus anatolicus* Kryštufek & Kefelioğlu, 2001
Microtus anatolicus Kryštufek & Kefelioğlu, 2001b *(in press)*.
Distribution: known only from type locality.

98. *Microtus obscurus* Eversmann, 1845
Hypudaeus obscurus Eversmann, 1845. Type loc.: probably near Čujskij trakt (a road), Altai Mts, Siberia.
Distribution: eastern Anatolia (Kefelioğlu, 1995; reported as *M. arvalis* (Pallas, 1779)).

99. *Microtus rossiaemeridionalis* Ognev, 1924
Microtus arvalis rossiaemeridionalis Ognev, 1924. Type loc.: Novij Kurlak, Bobrov District of Voronež Govt., Russia.
Microtus arvalis muhlisi Neuhäuser, 1936b. Type loc.: Bartin, Turkey.
Microtus arvalis relictus Neuhäuser, 1936b. Type loc.: Inevi (= Cihanbeyli), Turkey.
Distribution: Thrace, Marmara, Black Sea Mts, central and eastern Anatolia (Kefelioğlu, 1995).

Genus: *Chionomys* Miller, 1908
Comments: reviewed by Kryštufek (1999).

100. *Chionomys nivalis* (Martins, 1842)
Arvicola nivalis Martins, 1842. Type loc.: Faulhorn, Bernese-Oberland, Switzerland.
Microtus pontius Miller, 1908. Type loc.: 25 miles north of Bayburt, Turkey.
Microtus (Chionomys) nivalis olympius Neuhäuser, 1936a. Type loc.: Mt. Uludağ, Bursa, Turkey.
Microtus (Chionomys) nivalis cedrorum Spitzenberger, 1973. Type loc.: Kohu Dağ, Antalya, Turkey.
Chionomys nivalis spitzenbergerae Nadachowski, 1990. Type loc.: south of Maden Köy, Middle Taurus Mts, Turkey.
Distribution: records are widely scattered across Anatolia except for south-east Anatolia.

101. *Chionomys roberti* (Thomas, 1906)
Microtus roberti Thomas, 1906. Type loc.: Sumela (= Meryemana), Trabzon, Turkey.
Distribution: eastern Black Sea Mts.

102. *Chionomys gud* (Satunin, 1909)
Microtus gud Satunin, 1909. Type loc.: Gudaur, near Krestovskii Pass, Georgia, Caucasus.
Microtus (Chionomys) gud lasistanius Neuhäuser, 1936a. Type loc.: Varsambeg Dağ, Rize, Turkey.
Distribution: eastern Black Sea Mts.

Subfamily: Cricetinae Fischer, 1817
Genus: *Cricetulus* Milne-Edwards, 1867

103. *Cricetulus migratorius* (Pallas, 1773)
Mus migratorius Pallas, 1773. Type loc.: Inderskij Region, Gur'ev District, Western Kazakhstan.
Cricetulus migratorius vernula Thomas, 1917. Type loc.: Khotz (= Çosandere), Trabzon, Turkey.
Distribution: Thrace, Marmara, Aegean, Taurus, central and eastern Anatolia (Osborn, 1965a).

Genus: *Mesocricetus* Nehring, 1898
Comments: reviewed by Doğramacı *et al.* (1994) and Yiğit *et al.* (2000).

104. *Mesocricetus auratus* (Waterhouse, 1839)
Cricetus auratus Waterhouse, 1839. Type loc.: Aleppo, Syria.
Distribution: south-east Anatolia.

105. Mesocricetus brandti (Nehring, 1898)
Cricetus brandti Nehring, 1898. Type loc.: near Tbilisi, Georgia.
Distribution: central and east Anatolia, Black Sea Mts (Spitzenberger, 1972).

Subfamily: Gerbillinae Gray, 1825
Genus: *Tatera* Lataste, 1882

106. *Tatera indica* (Hardwicke, 1807)
Dipus indicus Hardwicke, 1807. Type loc.: between Benares and Hardwar, United Provinces, India.
Distribution: a single record from Urfa region, south-east Anatolia (Yiğit *et al.*, 2001a).

Genus: *Meriones* Illiger, 1811
Comments: six species were reported so far for Turkey (*e.g.* Demirsoy, 1996), however, Yiğit *et al.* (1997b) and Yiğit & Çolak (1999) confirmed the presence of five only: *M. vinogradovi*, *M. tristrami*, *M. meridianus*, *M. crassus* and *M. persicus*.

107. *Meriones persicus* (Blanford, 1875)
Gerbillus persicus Blanford, 1875. Type loc.: Kohrud (= Quohrud), 72 miles north of Isfahan, Iran (Lay, 1967).
Distribution: known only from Oltu, north-east of Erzurum, in eastern Anatolia (Neuhäuser, 1936b; Yiğit & Çolak, 1999).

108. *Meriones vinogradovi* Heptner, 1931
Meriones vinogradovi Heptner, 1931. Type loc.: Tabriz, Persian Azerbaijan, Iran.
Distribution: Aralık Region in eastern Anatolia (Yiğit *et al.*, 1997b).

109. *Meriones tristrami* Thomas, 1892
Meriones tristrami Thomas, 1892. Type loc.: Dead Sea Region, Israel.
Meriones blackleri Thomas, 1903. Type loc.: İzmir, Turkey.
Meriones blackleri lycaon Thomas, 1919. Type loc.: Karadağ, *ca.* 80 km south-east of Konya, Turkey.
Meriones blackleri intraponticus Neuhäuser, 1936a. Type loc.: Tosya, Kastamonu, Turkey.
Meriones tristrami kilisensis Yiğit & Çolak, 1998. Type loc.: 15 km north-east of Kilis, Gaziantep, Turkey.
Distribution: Aegean, Taurus, central, south-east and eastern Anatolia (Kock & Nader, 1983; Yiğit *et al.*, 1998a).

110. *Meriones lybicus* Lichtenstein, 1823
Meriones lybicus Lichtenstein, 1823. Type loc.: Near Alexandria, Egypt.
Distribution: only reported at Harran near Şanlıurfa, south-east Anatolia by Missone (1957) and not confirmed by Yiğit *et al.* (2001b).

111. *Meriones meridianus* (Pallas, 1773)
Mus meridianus Pallas, 1773. Type loc.: Dosang, Krasnojarsk Region, Astrachan District, Russia.
Distribution: Aralık Region in eastern Anatolia (Yiğit *et al.*, 1998b).

112. *Meriones crassus* Sundevall, 1842
Meriones crassus Sundevall, 1842. Type loc.: Fons Moses (Ain Musa), Sinai.
Distribution: Şanlıurfa Province in south-east Anatolia (Yiğit *et al.*, 1998b).

Genus: *Gerbillus* Desmartes, 1804

113. *Gerbillus dasyurus* (Warger, 1842)
Meriones dasyurus Warger, 1842. Type loc.: Sinai.
Distribution: Kilis in south-east Anatolia (Yiğit *et al.*, 1997a).

Subfamily: Murinae Illiger, 1815
Genus: *Micromys* Dehne, 1841

114. *Micromys minutus* (Pallas, 1771)
Mus minutus Pallas, 1771. Type loc.: Simbirsk (= Uljanovsk), Russia.
Distribution: Thrace (Kurtonur 1975). A report by Zeybek & Tokay (1990; not seen) for the Ankara area needs confirmation.

Genus: *Apodemus* Kaup, 1829
Comments: for a review of subgenus *Sylvaemus* see Filippucci *et al.* (1996) and Mácholan *et al.* (in

press). Distributions are completed from our own data.

115. *Apodemus mystacinus* (Danford & Alston, 1877)
Mus mystacinus Danford & Alston, 1877. Type loc.: Zebil, Bulgar Dağ, Turkey.
Mus mystacinus smyrnensis Thomas, 1903. Type loc.: Smyrna (= İzmir), Turkey.
Apodemus mystacinus euxinus Allen, 1915. Type loc.: Scalita (= Altindere), Trabzon, Turkey.
Distribution: Marmara, Black Sea Mts, Aegean, Taurus, central and eastern Anatolia (Kock *et al.*, 1972).

116. *Apodemus flavicollis* (Melchior, 1834)
Mus flavicollis Melchior, 1834. Type loc.: Sielland, Denmark.
Apodemus flavicollis saturatus Neuhäuser, 1936b. Type loc.: Kurayiseba, Vilayet Rize, north-east Turkey (tentatively).
Distribution: Thrace, Marmara, Black Sea Mts, Aegean, Taurus, central Anatolia and the Island of Gökçeada (Özkan & Kryštufek, 1999).

117. *Apodemus sylvaticus* (Linnaeus, 1758)
Mus sylvaticus Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Distribution: Thrace, possibly Marmara and western Black Sea Mts.

118. *Apodemus uralensis* (Pallas, 1811)
Mus sylvaticus var. *uralensis* Pallas, 1811. Type loc.: Troick Region, Čeljabinsk District, Southern Ural Mts, Russia.
Distribution: Marmara, Black Sea Mts.

119. *Apodemus iconicus* Heptner, 1948
Mus sylvaticus tauricus Barrett-Hamilton, 1900. Type loc.: Zebil, Bulgar Dagh (= Bolkar Dağları), south Turkey.
Comments: *Mus sylvaticus tauricus* Barrett-Hamilton, 1900 is a senior synonym of *Apodemus hermonensis* Filippucci, Simson & Nevo, 1989 (type loc.: Mt. Hermon, Israel), however, it is preoccupied by *Mus sylvaticus* var. *tauricus* Pallas 1811 (type locality: mountains of Crimea). The oldest available name is thus *Apodemus sylvaticus iconicus* Heptner, 1948, which has been proposed to replace *tauricus* Barrett-Hamilton (Corbet, 1978; *cf.* Kryštufek, in press).
Distribution: widely distributed in Anatolia, and on the Island of Bozcaada (Özkan & Kryštufek, 1999).

120. *Apodemus agrarius* (Pallas, 1771)
Mus agrarius Pallas, 1771. Type loc.: Simbirsk (= Uljanovsk), banks of the Volga, Russia.
Distribution: Thrace (Osborn, 1965a)

Genus: *Rattus* Fischer, 1803

121. *Rattus rattus* (Linnaeus, 1758)
Mus rattus Linnaeus, 1758. Type loc.: Uppsala, Sweden.
Mus latipes Bennett, 1835. Type loc.: Erzurum, north-east Turkey.
Distribution: Thrace, Marmara, Black Sea Mts, Aegean, central Anatolia, Taurus Mts (Osborn, 1965a; Yiğit *et al.*, 1998c) as well as the islands of Gökçeada and Bozcaada (Özkan, 1999a); Cyprus (Spitzenberger, 1978a).

122. *Rattus norvegicus* (Berkenhout, 1769)
Mus norvegicus Berkenhout, 1769. Type loc.: Great Britain.
Distribution: possibly widespread in Turkey. Records are available from Thrace, Black Sea Mts, central Anatolia, Taurus Mts, south-east Anatolia (Osborn, 1965a; Yiğit *et al.*, 1998c; own data) and the island of Gökçeada (Özkan, 1999a); Cyprus (Harrison & Bates, 1991).

Genus: *Mus* Linnaeus, 1758
Comments: this genus is in need of thorough revision in Turkey and Cyprus. The presence of two species in the region is beyond doubt, but their distribution ranges are poorly known, although both species are possibly widespread. Özkan (1999a) reports *M. musculus* (as *M. domesticus)* from the Island of Bozcaada and *M. macedonicus* for Gökçada. It seems that diagnostic characters became unreliable in Cyprus; despite this, Harrison & Bates (1991) mapped both species on the island.

123. *Mus musculus* Linnaeus, 1758
Mus musculus Linnaeus, 1758. Type loc.: Uppsala, Sweden.

Mus abbotti Waterhouse, 1837. Type loc.: Trabzon, Turkey.
Distribution: see above.

124. *Mus macedonicus* Petrov & Ružić, 1982
Mus hortulanus macedonicus Petrov & Ružić, 1982. Type loc.: Valandovo, Macedonia.
Distribution: see above.

Genus: *Acomys* Geoffroy, 1838
Comments: although both species listed here differ from the chromosomally highly polymorphic *A. cahirinus*, as well as between themselves by unique combinations of diploid and fundamental chromosomal numbers (Macholán *et al.*, 1995), differences are weak and *A. cilicicus* hybridises readily with *A. cahirinus* in captivity (Frynta & Sadlova, 1998).

125. *Acomys nesiotes* Bate, 1903
Acomys nesiotes Bate, 1903. Type loc.: Dikomo, Kernyia Hills, Cyprus.
Distribution: Cyprus (Spitzenberger, 1978a).

126. *Acomys cilicicus* Spitzenberger, 1978
Acomys cilicicus Spitzenberger, 1978. Type loc.: 17 km east of Silifke, Mersin, Turkey.
Distribution: known from the type locality and its immediate vicinity (Taurus).

Subfamily: Spalacinae Gray, 1821
Genus: *Nannospalax* Palmer, 1903
Comments: the taxonomy of the three species follows Topachevskii (1976), and might be an oversimplified summary of a more complex reality, as is particularly suggested by chromosomal divergence (Nevo *et al.*, 1995; Ivanitskaya *et al.*, 1997; Sözen *et al.*, 1999). The genus was revised in Turkey by Kıvanç (1988) who recognised only two species: *Spalax ehrenbergi* and the highly polymorphic *S. leucodon*. The arrangement proposed here is mainly based on Kıvanç *(loc. cit.)* and our own unpublished data.

127. *Nannospalax leucodon* (Nordmann, 1840)
Spalax typhlus leucodon Nordmann, 1840. Type loc.: Near Odessa, Ukraine.
Spalax monticola turcicus Méhely, 1909. Type loc.: Makri-Koi, Constantinople (possibly Makri, Alexandropoulis, Greece).
Comments: Kıvanç (1988) pooled mole rates form Thrace and Marmara into a single subspecies, *N. l. turcicus*. We saw no specimens from Marmara, however, those from the islands of Gökçeada and Bozcaada belong to the Anatolian species (see under *N. nehringi*).
Distribution: Thrace and possibly Marmara.

128. *Nannospalax nehringi* (Satunin, 1898)
Spalax nehringi Satunin, 1898. Type loc.: Kasikoporan (= Kaskoparan köyü), Kars, Turkey.
Spalax typhlus xanthodon Nordmann, 1840. Type loc.: Smyrna (= İzmir), Turkey.
Spalax monticola cilicicus Méhely, 1909. Type loc.: Bulgar-Maden (= Madenköy), Cilician Taurus, Turkey.
Spalax monticola anatolicus Méhely, 1909. Type loc.: Burnabad (= Bornova), near İzmir, Turkey.
Spalax monticola armeniacus Méhely, 1909. Type loc.: near Göl (= Göle), Kars, Turkey.
Spalax labaumei Matschie, 1919. Type loc.: Eshischehir (= Eskişehir), Turkey.
Spalax monticola corybantium Hinton, 1920. Type loc.: Murat Dağı, Uşak, Turkey.
Spalax monticola captorum Hinton, 1920. Type loc.: Kanghri (= Çankiri), Turkey.
Distribution: widespread in Anatolia, but allopatric with the next species. Also occurs on the islands of Gökçeada and Bozcaada.

129. *Nannospalax ehrenbergi* (Nehring, 1898)
Spalax ehrenbergi Nehring, 1898. Type loc.: Jaffa, Palestine.
Spalax nehringi tuncelicus Coşkun, 1996. Type loc.: Gömemiş village, 16 km north-east of Tunceli, Turkey.
Spalax nehringi nevoi Coşkun, 1996. Type loc.: Sargüllük, 6 km west of Gaziantep, Turkey.
Distribution: south-east Anatolia and the adjacent Hatay and Adana regions.

Family: Gliridae Thomas, 1897
Subfamily: Glirinae Thomas, 1897
Genus: *Glis* Brisson, 1762

130. *Glis glis* (Linnaeus, 1766)
Sciurus glis Linnaeus, 1766. Type loc.: Idrija, Slovenia.
Myoxus glis orientalis Nehring, 1903. Type loc.: near Scutari (= Üsküdar), Alan Dağ (= Alem Dağı), Turkey.
Glis glis spoliatus Thomas, 1906. Type loc.: Khotz (= Çosandere), Trabzon, Turkey.
Distribution: Thrace, Marmara, Black Sea Mts (Osborn, 1964b).

Genus: *Muscardinus* Kaup, 1829

131. *Muscardinus avellanarius* (Linnaeus, 1758)
Mus avellanarius Linnaeus, 1758. Type loc.: Sweden.
Muscardinus trapezius Miller, 1908. Type loc.: Khotz (= Çosandere), Trabzon, Turkey.
Muscardinus avellanarius abanticus Kıvanç, 1983. Type loc.: Aban Gölü, Bolu, Turkey.
Distribution: Marmara, Black Sea Mts (Kıvanç, 1983).

Subfamily: Leithiinae Lydekker, 1896
Genus: *Dryomys* Thomas, 1906
Comments: reviewed by Spitzenberger (in Felten *et al.*, 1973).

132. *Dryomys nitedula* (Pallas, 1779)
Mus nitedula Pallas, 1779. Type loc.: Tatar Autonomous Republic, Russia.
Dryomys nitedula phrygius Thomas, 1907. Type loc.: Uşak, Murat Dağı, Turkey.
Comments: Mursaloğlu (1973b) proposed specific status for dormice from Hakkari (eastern Anatolia) under the name *D. pictus* (Blanford, 1875) (type loc.: Qohrud, Isfahan, Iran).
Distribution: Thrace (Kurtonur, 1975), Marmara, Black Sea Mts, Taurus, central and eastern Anatolia (Felten *et al.*, 1973; own data)

133. *Dryomys laniger* Felten & Storch, 1968
Dryomys laniger Felten & Storch, 1968. Type loc.: Cığlıkara, Bey Mts, Antalya, Turkey.
Distribution: Taurus Mts (Felten *et al.*, 1973) and eastern Anatolia (Mursaloğlu, 1973b).

Genus: *Eliomys* Wagner, 1840

134. *Eliomys melanurus* Wagner, 1840
Eliomys (Myoxus) melanurus Wagner, 1840. Type loc.: Mt. Sinai, Sinai.
Distribution: recorded only from Harran, south of Urfa, south-east Anatolia (Missone, 1957).

Genus: *Myomimus* Ognev, 1924

135. *Myomimus setzeri* Rossolimo, 1976
Myominus setzeri Rossolimo, 1976. Type loc.: 4 km west of Bane, Kurdistan, Iran.
Distribution: eastern Anatolia (Obuch, 2000).

136. *Myomimus roachi* (Bate, 1937)
Philistomys roachi Bate, 1937. Type loc.: Tabun Cave, Mt. Carmel, Israel (Pleistocene).
Distribution: Thrace (Kurtonur & Özkan 1991), Marmara, Aegean (Mursaloğlu, 1973a) and Antalya Province in the Taurus Mts (subfossil; Corbet & Morris, 1967).

Family: Dipodidae Fischer, 1817
Subfamily: Allactaginae Vinogradov, 1925
Genus: *Allactaga* Cuvier, 1837
Comments: reviewed by Çolak *et al.* (1994).

137. *Allactaga elater* (Lichtenstein, 1825)
Dipus elater Lichtenstein, 1825. Type loc.: Inderskij Region, Gur'ev District, western Kazakhstan.
Allactaga aralychensis Satunin, 1901. Type loc.: Aralık, Ağrı Dağı, Turkey.
Distribution: Aralık in eastern Anatolia (Çolak *et al.*, 1997a).

138. *Allactaga euphratica* Thomas, 1881
Allactaga euphratica Thomas, 1881. Type loc.: Iraq.
Allactaga euphratica kivanci Çolak & Yiğit, 1998. Type loc.: Çaylıkköyü, Urfa, Turkey.
Distribution: south-east Anatolia.

139. *Allactaga williamsi* Thomas, 1897
Allactaga williamsi Thomas, 1897. Type loc.: near Van Gölü, Turkey.
Allactaga williamsi laticeps Nehring, 1903. Type loc.: Gökçekısık - Eskişehir, Konya, Turkey (Çolak *et al.*, 1997a).
Distribution: central and eastern Anatolia.

Subfamily: Sicistinae Allen, 1901
Genus: *Sicista* Gray, 1827

140. Sicista caucasica Vinogradov, 1925
Sicista caucasica Vinogradov, 1925. Type loc.: Majkop, Krasnodar Region, Caucasus, Russia.
Distribution: Kars and Ardahan in the eastern Black Sea Mts (Yiğit *et al.*, 2001b).

Family: Hystricidae Fischer, 1817
Genus: *Hystrix* Linnaeus, 1758

141. *Hystrix indica* Kerr, 1792
Hystrix cristata var. *indica* Kerr, 1792. Type loc.: India.
Hystrix hirsutinostrix mersinae Müller, 1911. Type loc.: Mersina (= Mersin), Turkey.
Distribution: Marmara, Aegean, Taurus, south-east and eastern Anatolia (Kumerloeve, 1967a).

Family: Myocastoridae Ameghino, 1904
Genus: *Myocastor* Kerr, 1792

142. *Myocastor coypus* (Molina, 1782)
Mus coypus Molina, 1782. Type loc.: Rio Maipo, Santiago Prov., Chile.
Distribution: exotic species reported from Thrace (Özkan 1999b) and eastern Anatolia (Mursaloğlu, 1973b).

Species Erroneously recorded from Turkey

1. *Procavia capensis* (Pallas, 1766)
Schlitter (1993) lists the hyrax for Turkey, which is certainly erroneous; see the distribution map in Harrison & Bates (1991). Asiatic hyraxes are frequently regarded as a separate species *Procavia syriaca* (Schreber, 1784) (see Nowak, 1999).

2. *Cuon alpinus* (Pallas, 1811)
Serez & Eroğlu (1994) report several killed dholes in the district of Rize, north-eastern Anatolia; voucher specimens are said to be deposited in the Faculty of Forestry, Karadeniz Technical University, Trabzon. The appearance of *Cuon alpinus* in north-eastern Turkey was connected to its supposed presence in the Caucasus. However, although the dhole *Cuon* sp. did occur in the Caucasus during the Middle and the Upper Pleistocene (Vereshchagin, 1959; Gromov & Baranova, 1981; Baryshnikov, 1996), it does not live in this region anymore and the closest records are to the east of *ca.* 70° of longitude east of Greenwich (Heptner & Naumov, 1967).

3. *Mustela erminea* Linnaeus, 1758
Demirsoy (1996) mapped the ermine for Thrace and the majority of Anatolia. Although Spassov & Barichnikov (1986) report ermine for Georgia, there seems to be lack of any information from Turkey itself.

4. *Felis ornata* Gray, 1830
Demirsoy (1996) reports *F. ornata* (the authority is erroneously given as Gray, 1932) from south-east Anatolia and adjacent regions of Turkey and mapped its range as partly sympatric with that of *Felis silvestris* (Schreber, 1777). Corbet (1978) and Wozencraft (1993) consider *F. ornata* to be a junior synonym of *F. silvestris*.

5. *Lynx pardinus* (Temminck, 1827)
Demirsoy (1996) mapped the Iberian lynx, in addition to *Lynx lynx* (Linnaeus, 1758) for northern Anatolia, as well as for Thrace. As understood today, *Lynx pardinus* is endemic to the Iberian peninsula (Mitchell-Jones *et al.*, 1999).

6. *Nesokia indica* (Gray & Hardwicke, 1832)
Demirsoy (1996) mapped the short-tailed bandicoot rat for south-east Anatolia. This might be based on the nearby records from Syria: 60 km to the south-east of Tell Abyad (Tell el Abyad; Missone, 1957) and Tell Abu Heurera (Kock & Nader, 1983). To our best knowledge, no records are available so far from Turkey (*cf.* Harrison & Bates, 1991).

7. *Eliomys quercinus* (Linnaeus, 1766)
Demirsoy (1996) mapped the garden dormouse for the Aegean and western part of central Anatolia. No matter which taxonomic division of the genus *Eliomys* is accepted (*cf.* Filippucci *et al.*, 1988; and Kryštufek & Kraft, 1997), there is no evidence of the occurrence of an *Eliomys* dormouse in this part of Turkey (*e.g.* Panteleyev, 1998).

Material and Methods

This review is based on three main sources of information: (i) published data, (ii) existing voucher specimens in museum collections, and (iii) own material and data collected in the field.

Published data. Published data on the mammals of Turkey are widely scattered in various journals, books and reports. Albeit we made every attempt to include all the papers available on insectivores, we are well aware that our reference list is far from being complete. The most complete bibliographic list of the mammals of Turkey and its neighbouring countries is by Kumerloeve (1986) who already stated that "the number of authors and publications /related to the region/ multiplied to such an extent, that a critical appraisal seems to become more and more necessary ..." A brief search in the database of secondary zoological literature (*e.g.* "Zoological Record") reveals on even more rapid accumulation of new references since Kumerloeve's bibliographic review.

Wherever possible, we checked published information by examining voucher specimens.

Voucher specimens. Voucher specimens were examined by B.K in ten mammal collections in Europe, Turkey and the United States of America. The institutions and corresponding abbreviations (in parentheses) are as follows:

- Natural History Museum London, London, U.K (BMNH)
- Naturhistorisches Museum Wien, Vienna, Austria (NMW)
- Biology Department, Ondokuz Mayıs University, Samsun, Turkey (OMU)
- Field Museum of Natural History, Chicago, USA (FMNH)
- Forschungsinstitut und Natur-Museum Senckenberg, Frankfurt a. M., Germany (SMF)
- Institut de Zoologie et d'Ecologie animale, Université de Lausanne, Switzerland (IZEA)
- United States National Museum of Natural History, Washington, D.C., USA (NMNH)
- Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn, Germany (ZFMK)
- Department of Zoology, National Museum (Natural History), Prague, Czech Republic (NM)
- Private collection of Ing. Ján Obuch, Botanical Garden of the Comenius University in Bratislava, Blatnica, Slovakia (JOC; owl pellet material).

In the majority of cases, examined specimens were standard museum skins and/or skulls; the rest of the material was conserved either in alcohol or in a 4% solution of formaldehyde. External measurements were recorded from the specimen tags and cranial parameters were scored by a vernier calliper (see below). Drawings of skulls and/or dentition were done using a *camera lucida* or scored by the Pixera Visual Communication Suite (Version 2.0). Linear measurements were scored (to the nearest 0.1 mm) for skulls, mandi-

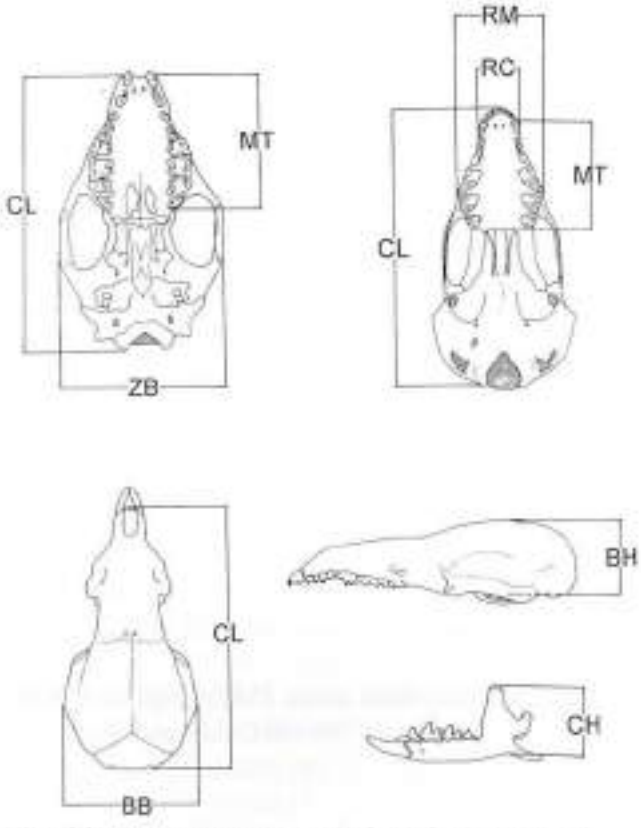

Fig. 29: Dimensions measured on the insectivore skull (dental measurements are not shown). Top left: hedgehog skull in ventral view; top right: mole skull in ventral view; bottom: shrew skull in dorsal (left) and lateral (right up) views and mandible in lateral view (bottom right). CL - condylobasal length of skull; ZB - zygomatic breadth of skull; BB - braincase breadth; RM - rostral breadth across molars; RC - rostral breadth across canines; MT - maxillary tooth row length; BH - height of braincase; CH - coronoid height of mandible.

bles and posteranial elements to roughly describe these structures by numerical means, thus allowing further comparisons. See Fig. 29 for definitions of cranial and mandibular parameters. Dental measurements were taken on a stereomicroscope fitted with an eyepiece graticule.

Various types of teeth in the heterodontous mammalian set are designated by letters. Capitals are used to indicate the upper teeth and small letters for the mandibular teeth; the position in the tooth-row (anterior → posterior) is indicated by the relevant number. *E.g.*: M1 and m3 denote the 1st upper and the 3rd lower molar, respectively. Abbreviations are as follows:

- I/i upper/lower incisors
- C/c upper/lower canines
- P/p upper/lower premolars
- M/m upper/lower molars

For details on teeth of insectivores see also Fig. 36. Single pointed teeth between large hooked I1 and P4 are called unicuspids in shrews.

Of the type material, we examined nine type specimens (collection's acronyms and preserved material are in parentheses):

- *Erinaceus concolor* (BMNH; skin and a skull with a damaged occipital region)
- *Hemiechinus auritus dorotheae* (NMW; skin and skull)
- *Sorex batis* (BMNH; skin and skull)
- *Neomys teres* (BMNH; skin and skull)
- *Crocidura leucodon lasius* (BMNH; skin and skull)
- *Crocidura russula cypria* (BMNH; skin and skull)
- *Crocidura russula monacha* (BMNH; skin and skull)
- *Crocidura pergrisea arispa* (NMW; skin and skull)
- *Talpa caeca levantis* (BMNH; skin and skull)

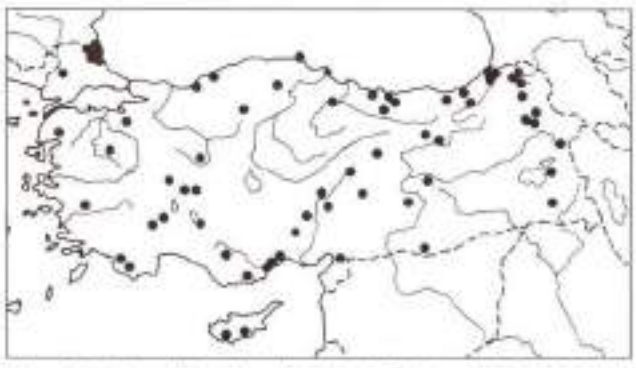

Fig. 30: Sampling localities in Turkey (1993-1995) and on Cyprus (1999).

In addition, we had the opportunity to examine the photograph of the type skull of *Scaptochirus davidianus* (Muséum National d'Histoire Naturelle, Paris, France).

Own material and data collected in the field. We frequently travelled to Turkey for field work between 1993 and 1995 for at least one month/visit. In addition, the material collected on various expeditions to the Near East by students of the Charles University was at our disposal. This material is housed in the mammal collection of the Department of Zoology, Charles University, Prague, Czech Republic. Cyprus was visited in 1999 (Fig. 30). Several shorter trips were restricted to visits of the mammal collections in Samsun and Edirne.

Animals were caught using snap traps (commercial kill traps and a modified version of the museum special break back traps; Fig. 31) as well as live traps (Elliot, Chmela, Rödl). Traps were invariably set in the late afternoon or in the evening and collected next morning; in exceptional cases they were left during the day. Our aim was to obtain representative samples of the local small mammal fauna. Consequently traps were placed where captures were likely to occur. Traps were usually arranged in lines and spaced *ca.* 3–7 m. Cotton wick roasted with a mixture of sunflower oil and flour or a mixture of tinned fish and oat flakes was used as bait. Moles were caught with commercial traps for fossorial small mammals, and hedgehogs were occasionally picked up by hand during the night; road kills also contributed voucher specimens. Specimens were measured and then either prepared immediately

Fig. 31: Majority of specimens used in this study were collected by a modified version of the museum special kill traps. Photo: B. Kryštufek.

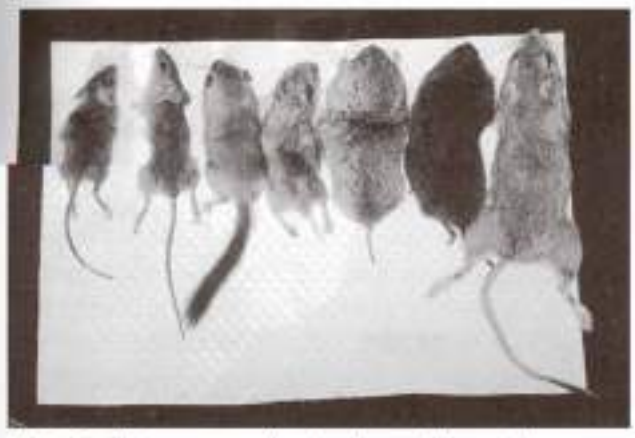

Fig. 32: Rodents usually dominated in small mammal samples, particularly so in the arid regions of Turkey. Species rich sample from the estuary of the Cendik River, central Anatolia (altitude ca. *850 m asl). From right to left:* Meriones tristrami, Microtus rossiaemeridionalis, M. guentheri, Cricetulus migratorius, Dryomys nitedula, Apodemus iconicus, *and* Mus macedonicus. *Photo: B. Kryštufek.*

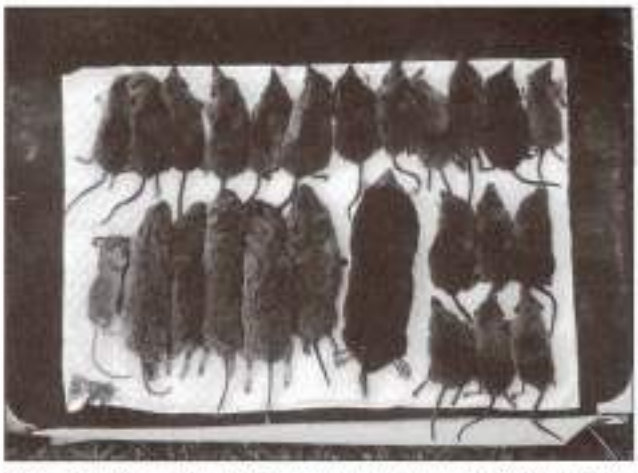

Fig. 33: Very few small mammal samples had a high proportion of shrews, as was the case in the above collection from Kürtler near Samsun, the Black Sea coast (close to the sea level): Crocidura suaveolens, Talpa levantis, Microtus rossiaemeridionalis, *and* Mus macedonicus. *Photo: B. Kryštufek.*

in the field or stored in a 4% solution of formaldehyde or ethanol for later laboratory proceeding. Skulls were cleaned by *Dermestes* beetle larvae.

Part of the material was karyotyped; chromosomes were prepared directly from the bone marrow of colchicine-treated animals and flame dried (Ford & Hamerton, 1956). Tissue samples were stored in liquid nitrogen or in alcohol for subsequent ellectrophoretic and molecular studies.

The following measurements were taken:

- H&B – head and body length (from the snout to the anus)
- TL – tail length (from the anus; terminal hair excluded)
- HF – hind foot length (claws excluded)
- E – ear length (terminal hair excluded)
- W – weight

The measurements were taken to the nearest millimetre (H&B, TL) or to the nearest 0.1 mm (HF, E); weight was scored to the nearest gram.

All specimens were examined for their reproductive condition. In males we checked position of the testes (scrotal or abdominal). Females were inspected for the presence of nipples and the condition of the uterus and number and size of embryos were recorded.

When collecting small mammals in Turkey and Cyprus it seemed that there was a great variation in the trapping success among regions. During our field research, population densities were high in Thrace, in the Black Sea Mts, in the Marmara and the Aegean regions and in Central Anatolia, but mainly low in the Taurus Mts. As a rule, rodents dominated over insectivores. Among 2,327 small mammals collected in Turkey between 1993 and 1995, only 310 were shrews (*i.e.* 13.3%), and nearly one third of the trapping sites (30.7%; N = 88) revealed only rodents (Figs. 32, 33). Of the 61 samples (= trapping sites), 27 included only crocidurines and 25 only soricines; nine samples contained members of both subfamilies. Wherever the two subfamilies co-occurred, the genus *Crocidura* was

	N	Median	Lower Quartile	Upper Quartile	Mean	Maximum
Crocidurinae	36	15.0	9.4	27.6	21.5	69.7
Soricinae	34	7.7	3.4	15.4	10.4	33.3

Table 3: Summary statistics for the percentage of crocidurines and soricines in 61 small mammal samples from Turkey. Considered were only samples with shrews. See also Fig. 34.

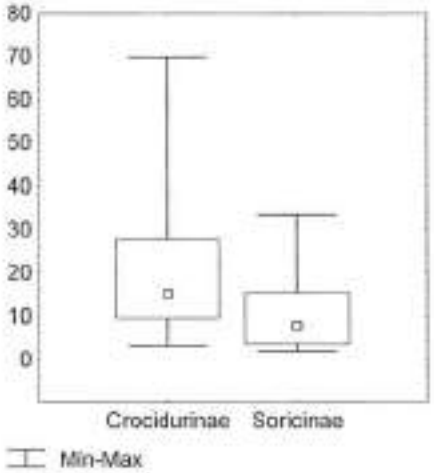

Fig. 34: Box and whisker plot for the per cent of crocidurines and soricines in a small mammal sample. Only samples including also shrews were considered. See also Table 3.

sympatric with *Neomys*, but never with *Sorex*. On average soricines were less abundant than crocidurines (Table 3, Fig. 34). The only three trapping sites with a high proportion of shrews (*ca.* one half of captures) were from disturbed habitats; again, crocidurines were the bulk of the shrews caught. The share of crocidurines in a small mammal sample increased more rapidly with the increase of sample size than it was the

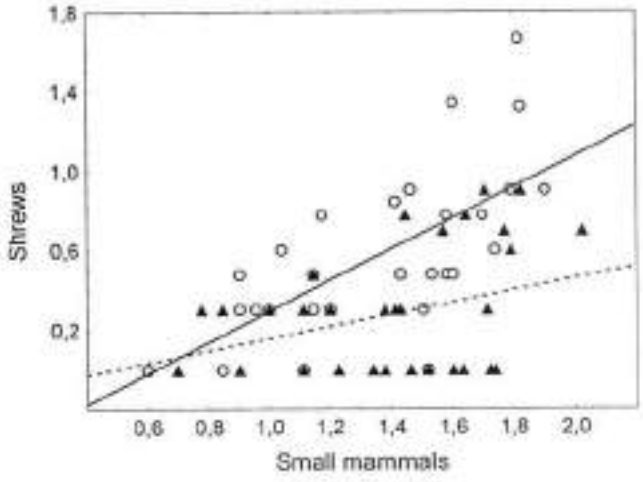

Fig. 35: Bivariate plot of the number of shrews in a sample against the total sample size for 61 geographic samples from Turkey. Note that both scales are logarithmic (Log_{10}). Considered were only samples which included at least one shrew. Circles are crocidurines and triangles are soricines. Least square regression lines are also plotted, separately for crocidurines (heavy line; $y = 0.485 + 0.778x$) and soricines (broken line; $y = -0.145 + 0.302x$). The slopes differ significantly at $p < 0.05$.

case with soricines (Fig. 35); the difference between the two regression slopes is significant (ANCOVA; F value = 12.92, $p = 0.0007$).

Order: Insectivora

Insectivores are primitive eutherian mammals with a long snout and a low braincase. The teeth are primitive and many members retain the complete dental set of early eutherians, *i.e.* 44 teeth (Fig. 36). The deciduous teeth are rarely functional and may be lost before birth. There are five fingers. Insectivores are widespread in tropical, temperate and boreal ecosystems, whether humid or arid. The majority of species are unspecialised terrestrial predators of small invertebrates, or omnivores; some are strictly fossorial or predominantly semi-aquatic. They are widespread throughout much of both hemispheres, namely in the Holarctic, Oriental, Ethiopian and northern Neotropical regions. Seven families with *ca.* 430 species are known. Three families occur in Turkey and Cyprus.

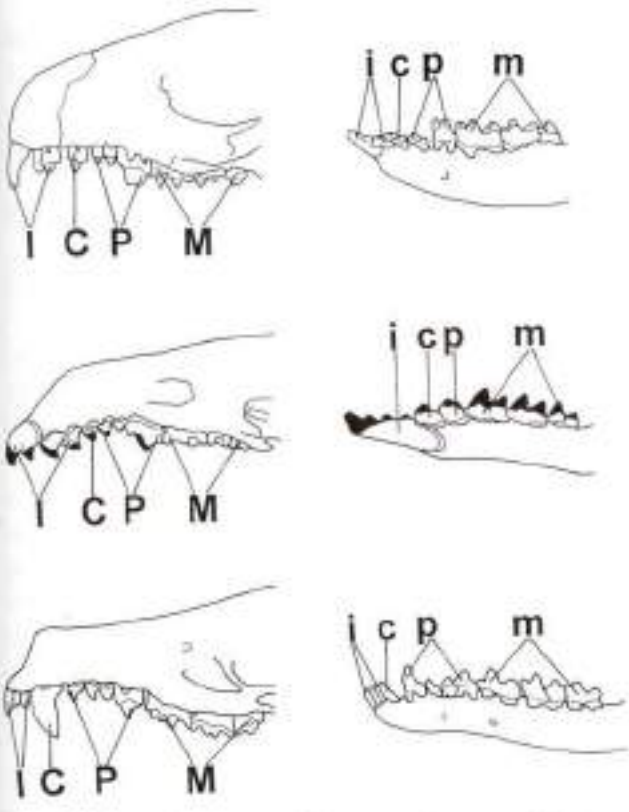

Fig. 36: Dental pattern of the anterior part of the rostrum (left column) and the anterior part of the mandible (right column) in three families of insectivores from Turkey. From top to bottom: hedgehogs (Erinaceidae), shrews (Soricidae), moles (Talpidae). I/i - upper/lower incisors; C/c - upper/lower canines; P/p - upper/lower premolars; M/m - upper/lower molars. Not to scale.

Insectivores have received considerable attention in the study area, and consequently their taxonomic and faunal status is fairly well known. Fifteen new names have been proposed from Turkey and Cyprus, six of which represent valid species. The first comprehensive revisions of Turkish insectivores, provided by Osborn (1964a, 1965b), was later upgraded by Spitzenberger (1968, 1970a, 1971) for shrews, and by Doğramacı (1989d) for moles. Spitzenberger (1978a) revised the status of Cypriot insectivores. The taxonomic positions of eleven species (of the 17 recognised here) have also been defined by karyotype analysis (see references in the subsequent text under corresponding genera or species). Electrophoretic and molecular data are scarcer, and available for only four of the seven genera occurring in the study area. Little is known about interlocality variation at the molecular, cytogenetic or morphological levels. Life history trait data are also scarce.

The following general works deal with insectivores from the regions adjacent to Turkey and Cyprus:

Europe. Niethammer & Krapp (1990): Comprehensive review of all European species with detailed descriptions, measurements and drawings of skulls and dentition; distributional maps; biological data (in German). Mitchell-Jones *et al.* (1999): Distributional atlas with species accounts and drawings of animals (in English).

Bulgaria. Markov (1957): Comprehensive faunal review covering all Bulgarian insectivores; with descriptions and measurements, drawings of skulls; colour plates; distributional maps; biological data, although out of date in some respects (in Bulgarian with summaries in German and Russian).

The Caucasus. Sokolov & Tembotov (1989): Comprehensive treatise on all the insectivores of the Caucasus with detailed descriptions and measurements; karyotypes; detailed maps and distributional data; biological information (in Russian).

Georgia. Bukhnikashvili & Kandaurov (1998): Rare and threatened species of Georgia with descriptions, biological data and distributional maps (in English).

Iran. Lay (1967): Report on the Street Expedition of 1962–63; descriptions, distributional and biological data (in English). Etemad (1980): descriptions,

drawings of skulls & photographs of animals and habitats. Distribution maps (in Farsi with summary in English).

ARABIA. Harrison & Bates (1991): Detailed and comprehensive work dealing with all insectivores of the Arabian Peninsula and covering also parts of Turkey; keys, descriptions, photographs and drawings of animals, skulls, dentition, and habitats; biological information; maps. Shrews were reviewed by Hutterer & Harrison (1988) (in English).

EASTERN MEDITERRANEAN REGION. Attalah (1977): Descriptions, biological and distributional data; measurements. The area covers the Mediterranean coasts just south of Turkey and to the north of Sinai. Qumsiyeh (1996): Detailed and comprehensive treatment of all the insectivores of the "Holy land" *(i.e.* Israel and Jordan with adjacent parts of Syria and Saudi Arabia) with descriptions; photographs of animals; information on biology, local status and genetics; distribution maps (in English).

KEY TO FAMILIES

1 Size large; condylobasal length of skull more than 38 mm; back covered with spines
Erinaceidae

1* Size smaller; condylobasal length of skull less than 37 mm; soft hair on the back
2

2 Appearance mouse-like; tail longer than 40% of head and body length; 1st upper incisor I1 larger than the upper canine (Fig. 36); zygomatic arches absent
Soricidae

2* Body cylindrical and stout; tail shorter than 30% of head and body length; I1 smaller than upper canine (Fig. 36); zygomatic arches present
Talpidae

FAMILY: ERINACEIDAE FISCHER VON WALDHEIM, 1817

Hedgehogs are medium sized to large insectivores, and plantigrade with clawed fingers. The skull is elongate, with wide zygomatic arches and incomplete bullae. The first and second upper molars are low-cusped and quadrate. Hedgehogs are restricted to the Old World, where they populate tropical and temperate habitats, both humid and arid. Seven genera with 21 species are known. Two genera occur in the study area; the larger *Erinaceus* is widespread in Turkey but absent from Cyprus, whilst *Hemiechinus* is common in Cyprus and of very marginal occurrence in Turkey.

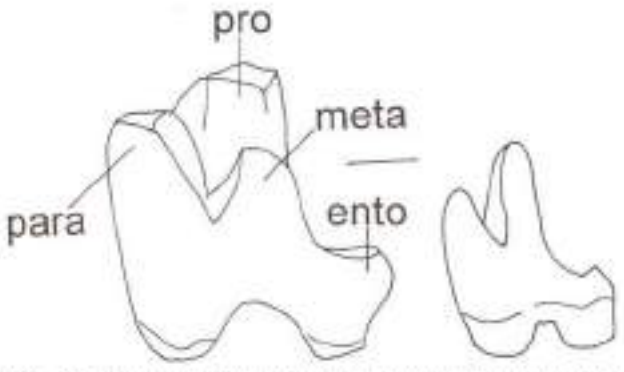

Fig. 37: Lingual side of the last lower premolar (p4) in Erinaceus concolor *(left; from Konya district) and* Hemiechinus auritus *(right; from Gaziantep district). Anterior is to the left. Abbreviations: pro = protoconid, para = paraconid, meta = metaconid, ento = entoconid. Scale bar = 1 mm.*

KEY TO GENERA

1 Size large: head and body more than 190 mm, condylobasal length of skull more than 50 mm; ears short, not protruding above the spines; 2nd lower premolar p2 usually with a metaconid (Fig. 37)
Erinaceus

1* Size smaller: head and body less than 190 mm, condylobasal length of skull less than 50 mm; ears long, protruding above the spines; metaconid missing on p2 (Fig. 37)
Hemiechinus

GENUS: *ERINACEUS* LINNAEUS, 1758

Large hedgehogs with spines along back and flanks (Fig. 38); when threatened they roll up to a ball exposing the spines. There are five pairs of mammae (1 pectoral, 2 abdominal, 2 inguinal). Dental formula: 3/2, 1/1, 3/2, 3/3 = 36. Three species are recognised traditionally, but recent molecular studies suggest that the true number may be higher. Hedgehogs are of common occurrence in the temperate Palaearctic.

Fig. 38: Eastern hedgehog Erinaceus concolor. *Drawing: S. Polak.*

Eastern Hedgehog - *Erinaceus concolor*

Erinaceus concolor Martin, 1838. Type loc.: near Trabzon, Turkey.

Taxonomy

The genus *Erinaceus* is considered to include two species in the western Palaearctic which differ in karyotype (Král, 1967) and osteological characteristics (Neithammer & Krapp, 1990). Recent allozyme work (Filippucci & Simson, 1996) and mtDNA sequences (Santucci *et al.*, 1998) provide evidence on further phylogenetic divergence within the Eastern hedgehog. Populations from Europe are genetically rather distant from those in the Near East (four loci fixed in the latter; Filippucci & Simson, 1996) and the difference is probably of taxonomic importance. The European genotype occurs, not only in the species' European range, but also in north-western Anatolia. The majority of Asian Turkey is inhabited by another genotype, which also spreads into Iran, Syria, Lebanon and Israel. The Caucasus seemingly act as an effective barrier between the two genotypes, preventing the spreading of the European type into Asia. The two genotypes also differ in general skull morphology (as derived from multivariate statistical analyses; Kryštufek, *in press*) and in the morphology of the rostrum. In the Near East, however, morphological characters alone do not allow allocation of each specimen to the appropriate genotype.

Description

Large hedgehog (Table 4) with moderately long ears which, however, do not protrude above the spines. The snout is pointed and the eyes are fairly large. The tail is short; the front legs are stronger than the hind ones and all bear long claws. The back and flanks are cov-

	N	*Mean*	*min–max*
Head and body	68	262.5	197–297
Tail	68	30.8	20–39
Hind foot	68	49.8	39–57
Ear	68	29.5	20–35
Weight	39	775.2	550–1500
Condylobasal lenght	73	57.2	53.0–64.3
Zygomatic breadth	67	35.4	31.6–39.2
Maxillary tooth-row	39	29.1	26.9–31.5

Table 4: External and cranial dimensions of Erinaceus concolor (concolor *morphotype) from Asiatic Turkey. Based on Doğramacı & Gündüz (1993), specimens in BMNH, MAK, SMF, NMNH, FMNH and own data.*

Fig. 39: Eastern hedgehog E. concolor *from 2 km east of Beylidze, near Sakarya. This specimen is of the* roumanicus *morphotype and genotype. Photo: B. Kryštufek.*

Fig. 40: Variation in size and shape of the ventral white patch in the Eastern hedgehog Erinaceus concolor *from Turkey.*

ered with spines, but a spineless medial tract occurs on the front (Fig. 39). The spines usually have one terminal and one basal dark band, normally with one or two dark bands in between. However, this pattern is subject to much individual and regional variation. The face has an obscure mask, with the snout being darker than the front. The extremities are dark, and the hair on the underside and flanks is long and coarse. There is a white patch of variable size on the throat and chest, spreading to the belly (Fig. 40); in pale hedgehogs from arid regions this patch tends to be indistinct. The rest of the underside is brown, with individual grey or white hair (Plate X.1).

The skull is fairly robust with strong, arched zygomatic arches (Fig. 41). The crown area of the largest upper molar is quadrate in outline, and the first incisor is larger than the remaining two.

Diploid number of chromosomes is 2N = 48, fundamental number of the autosomal chromosomal arms is NFa = 90; the X chromosome is large metacentric, the Y chromosome is small and metacentric. The karyotype is stable throughout Turkey and does not differ from that described from Europe (Doğramacı & Gündüz, 1993).

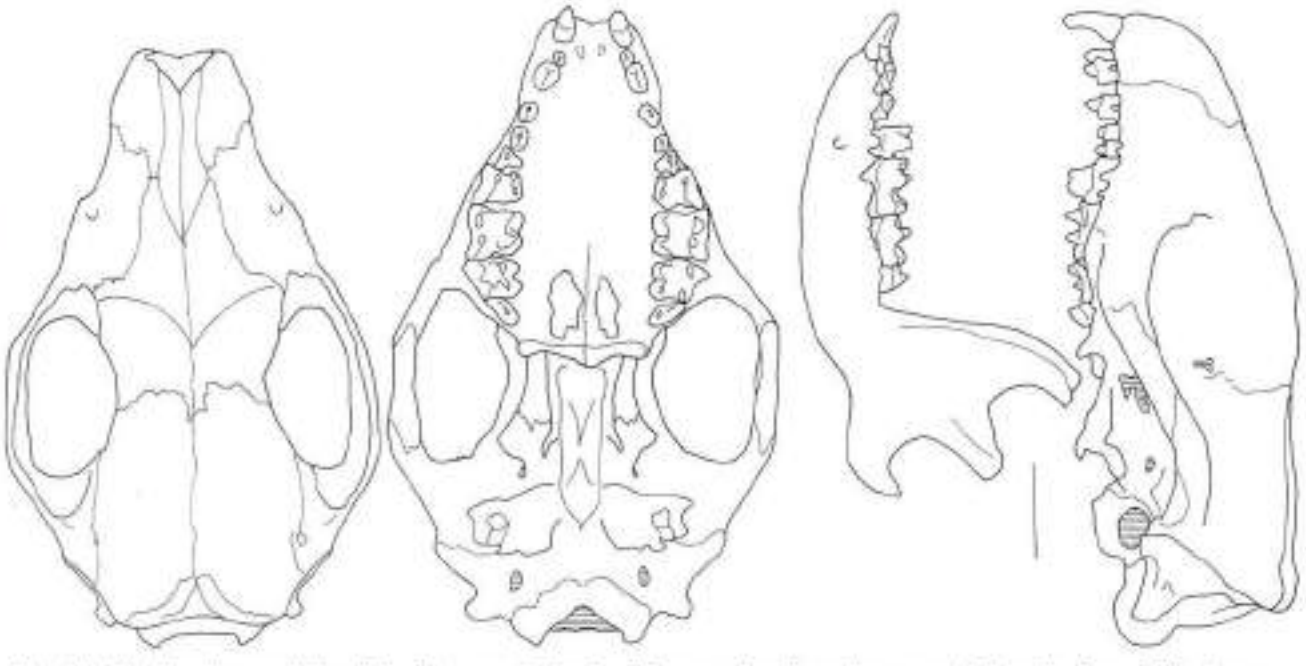

Fig. 41: Skull and mandible of the Eastern hedgehog E. concolor, *based on an adult male from Gökcimen, Konya district. Scale bar = 10 mm.*

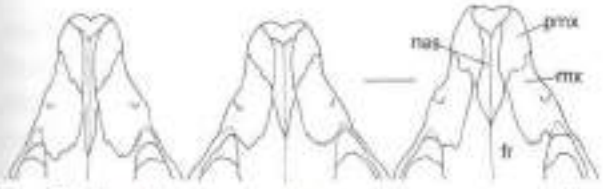

Fig. 42: Variation in the shape of the naso-maxillary suture in the Eastern hedgehog Erinaceus concolor *from Anatolia. Specimen on the right is from Konya district and the remaining two are from Mersin district. Left hedgehog is of the* roumanicus *morphotype and the right specimen is of the* concolor *type. Note also that the left premaxillary contacts the frontal bone in the Konya specimen (see text for explanation). Abbreviations: pmx = premaxillary, mx = maxillary, nas = nasal, fr = frontal. Scale bar = 10 mm.*

Variation

Interlocality variation affects colour, size and cranial characteristics. The largest hedgehogs are from Thrace, and those from the Black Sea Coast are the darkest (Doğramacı & Gündüz, 1993). On this basis, Doğramacı & Gündüz (1993) recognise three subspecies:

- *E. c. drozdovski* Martino, 1933 (type loc.: Kočani, Macedonia), proposed by Giagia-Athanasopoulou & Markakis (1996) as a synonym of ssp. *bolkayi* Martino, 1930 (type loc.: Cetinje, Montenegro, Federal Republic of Yugoslavia). Average condylobasal length of skull 62.4 mm; average body mass 894 g (range 600–1200); ventral white patch large. Range: European Turkey.
- *E. c. concolor* Martin, 1838. Average condylobasal length of skull 54.8 mm; average body mass 730 g (range 550–850); ventral white patch small. Range: Black Sea region.
- *E. c. transcaucasicus* Satunin, 1905 (type loc.: Ordubad on the Araxes River, Transcaucasia). Average condylobasal length of skull 56.3 mm; average body mass 772 g (range 600–1500); ventral white

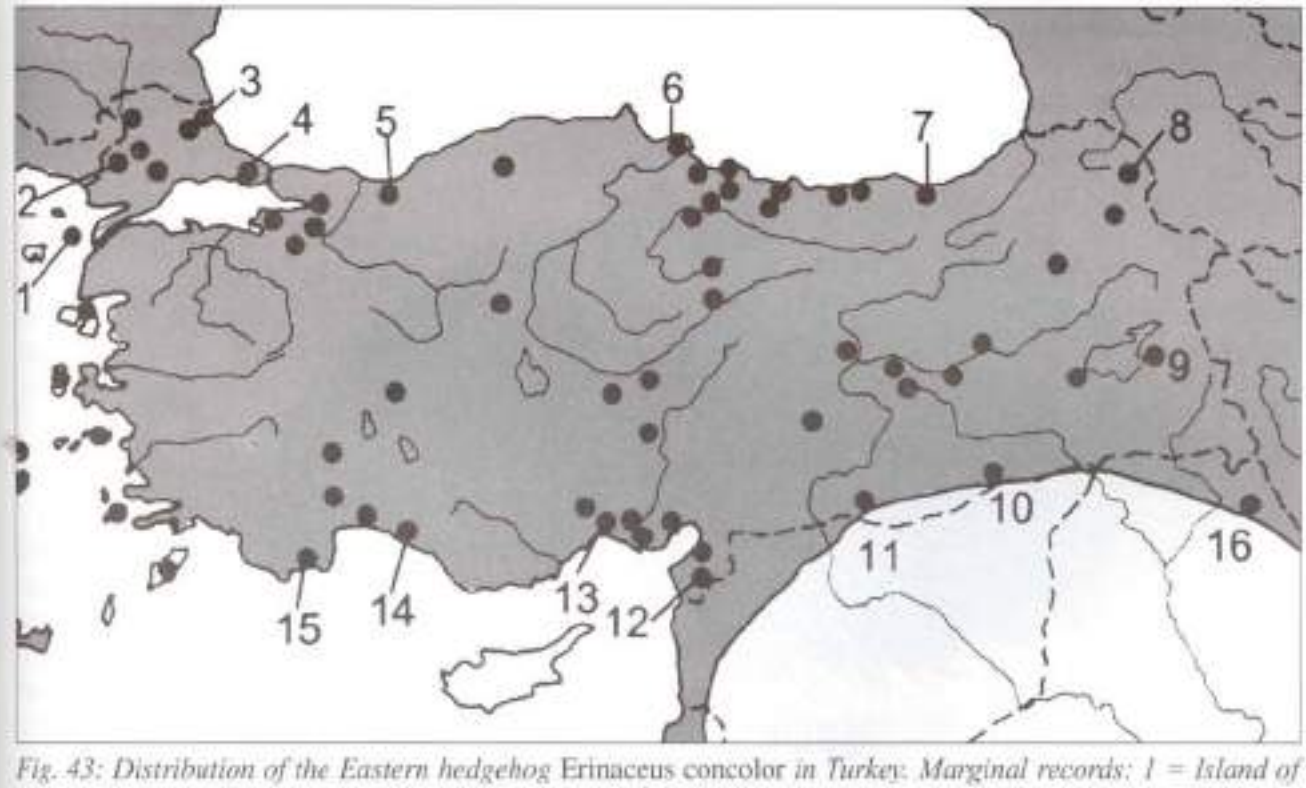

Fig. 43: Distribution of the Eastern hedgehog Erinaceus concolor *in Turkey. Marginal records: 1 = Island of Gökçeada; 2 = Edirne, Kurthey; 3 = Demirköy; 4 = İstanbul, Bebek; 5 = Beylidze; 6 = Bafra; 7 = Trabzon; 8 = Kars; 9 = Van; 10 = Mardin; 11 = Urfa; 12 = Belen; 13 = Mersin; 14 = 8 km west of Manavgat; 15 = 50 km south-west of Elmali, Iraq; 16 = Salahuddin. Corresponding references: Adelsen (1993): 1. Doğramacı & Gündüz (1993): 2, 3, 6, 7, 10, 13. Osborn (1965b): 4. Obuch (1994): 12. Felten* et al. *(1973): 14, 15. FMNH: 9, 11, 16; own data: 5, 8.*

patch large. Range: Asiatic Turkey except the Black Sea region.

Cranially, two morphotypes can be distinguished, which seemingly correspond with the two genotypes mentioned above. The *roumanicus* morphotype has a long naso-maxillary suture, and the *concolor* morphotype has a short naso-maxillary suture (usually less than *ca.* 1 mm) or even lacks it due to the direct contact between the premaxillary and frontal bones (Fig. 42). The former morphotype occurs in European Turkey and north-western Anatolia, whilst the latter is widespread across Asiatic Turkey.

Distribution

Central and eastern Europe, east of the line from the northern Adriatic to the River Odra (Oder), across Russia and west Siberia to the River Ob in the east; also in Ukraine, the Caucasus, Turkey, the Near East and north-western Iran. Occurs on many Adriatic, Ionian, and Aegean islands.

The Eastern hedgehog is widespread in Turkey, but its southern border most likely does not cross the arid regions of eastern Turkey and roughly coincides with the Turkish: Syrian border (Fig. 43). It occurs on the island of Gökçeada (Adelsen, 1993), which is not surprising since it is also common on other islands off the western Anatolian coast (Holz & Niethammer, 1990; Giagia-Athanasopoulou & Markakis, 1996).

Habitat

Highly variable, from woodland (Plate V.2) to steppe (Plate I.1) and semiarid regions (Fig. 17). Common in cultivated areas near human settlements, and also entering urban environments. Lay (1967) states that in Iran it is also common in vineyards and gardens. Specimens have been recorded up to 1,350 m asl in the Taurus Mts (Felten *et al.*, 1973); Obuch (1994) found the Eastern hedgehog in owl pellets at 1,500 m at Demir Kaziköy, at 1,800 m in Sarikamiş, and at 1,900 m in Muradiye. This hedgehog does not dig burrows, but seeks shelter among vegetation, especially along the base of shrubs or stone walls, or in rock piles (Atallah, 1977; Lay, 1967). Although hedgehogs hibernate in the temperate regions of Europe, they do not become lethargic in the Near East (Atallah, 1977; Qumsiyeh, 1996).

Hedgehogs are omnivorous, as already suggested by the shape of their cheek teeth. In the Near East,

Fig. 44: Long-eared hedgehog Hemiechinus auritus. *Drawing: S. Polak.*

Atallah (1977) found their stomachs to contain lizards, feathers, beetles, grasshoppers and vegetable matter. Along the Turkish coast young were collected from early June until early November.

Genus: *Hemiechinus* Fitzinger, 1866

Genus *Hemiechinus* consists of small, long eared hedgehogs (Fig. 44) from the arid southern Palaearctic region. They clearly differ from their larger relatives by their much longer ears and the lack of a spineless medial tract on the front. There are eight to ten mammae. Six species are currently recognised, but only one occurs in the study area. Dental formula: 3/2, 1/1, 3/2, 3/3 = 36.

Long-eared hedgehog *Hemiechinus auritus*

Erinaceus auritus Gmelin, 1770. Type loc.: Astrachan region, south Russia.

Erinaceus calligoni Satunin, 1901. Type loc.: Aralık, Kars, Turkey.

Hemiechinus auritus dorotheae Spitzenberger, 1978. Type loc.: River Pouzis, 14 km east of Mazotos, Larnaca, Cyprus.

Description

The smallest hedgehog in the area, with large ears which clearly protrude above the spines. The crown of head has no median spineless tract. The belly is uniformly white, sometimes buff or greyish but with no pattern; hair on the belly are soft (rough in *Erinaceus*). The head, particularly the snout, is darker. The ears are dusky, and the extremities are pale, greyish brown; the tail is dark; the mystacial vibrissae are black. Spines are grey-brown with a darker band and whitish tips (Plate X.2). The penis of *H. a. dorotheae* is figured by Boye (1991), and that of *H. a. calligoni* by Çolak *et al.* (1998b).

The skull is delicate for hedgehogs, and narrower across the zygomatic arches than in *Erinaceus* and with a shallower rostrum (Fig. 45). The teeth are basically as in *Erinaceus*, but relatively larger; the upper canine and the first two premolars are crowded; the last lower premolar (p2) lacks a metaconid (Fig. 37) and the first upper incisor protrudes further forwards.

The diploid number of chromosomes in Turkish long-eared hedgehogs is 2N = 48. Opinions differ regarding fundamental number of chromosomal arms: NFa = 90 (Kefelioğlu, 1998) or NFa = 92 (Çolak *et al.*, 1998a); disagreement concerns one of the smallest chromosomes which has been reported as biarmed by Çolak *et al.* (1998a,b) or acrocentric by Kefelioğlu (1997). There is no evidence of between-locality variation in Turkey, however, the karyotype of the Turkish population is unique (Kefelioğlu, 1997).

Variation

Turkey's *H. a. calligoni* is smaller than *H. a. dorotheae* from Cyprus (Table 5).

Ear tip is frequently white and dental anomalies are common in the island race; Boye (1991) found the normal dental pattern in only four out of 22 specimens of *H. a. dorotheae* that he examined.

	H. a. dorotheae			*H. a. calligoni*		
	N	*mean*	*min–max*	*N*	*mean*	*min–max*
Head and body	18	155.1	140–182	6	155.0	152–160
Tail	20	17.3	12–24	19	18.0	17–21
Hind foot	20	31.2	30–33	22	30.4	27–34
Ear	21	35.5	29.5–40.7	22	35.6	33–44
Weight	8	265.5	215–330	19	173.8	110–275
Condylobasal lenght	16	45.4	43.8–47.1	13	40.3	38.2–41.6
Zygomatic breadth	16	26.4	22.8–28.0	8	22.9	21.6–24.3
Maxillary tooth-row	26	22.6	21.2–23.7	8	20.0	19.2–21.1

Table 5: External and cranial dimensions of the two subpsecies of Hemiechinus auritus *occurring in Turkey and Cyprus. Data on* H. a. dorotheae *are from Spitzenberger (1978), Boye (1991), specimens in MAK, BMNH, and our own material. Data on* H. a. calligoni *are based on Çolak* et al. *(1998b) and on specimens from Syria and Turkey in SMF and MAK.*

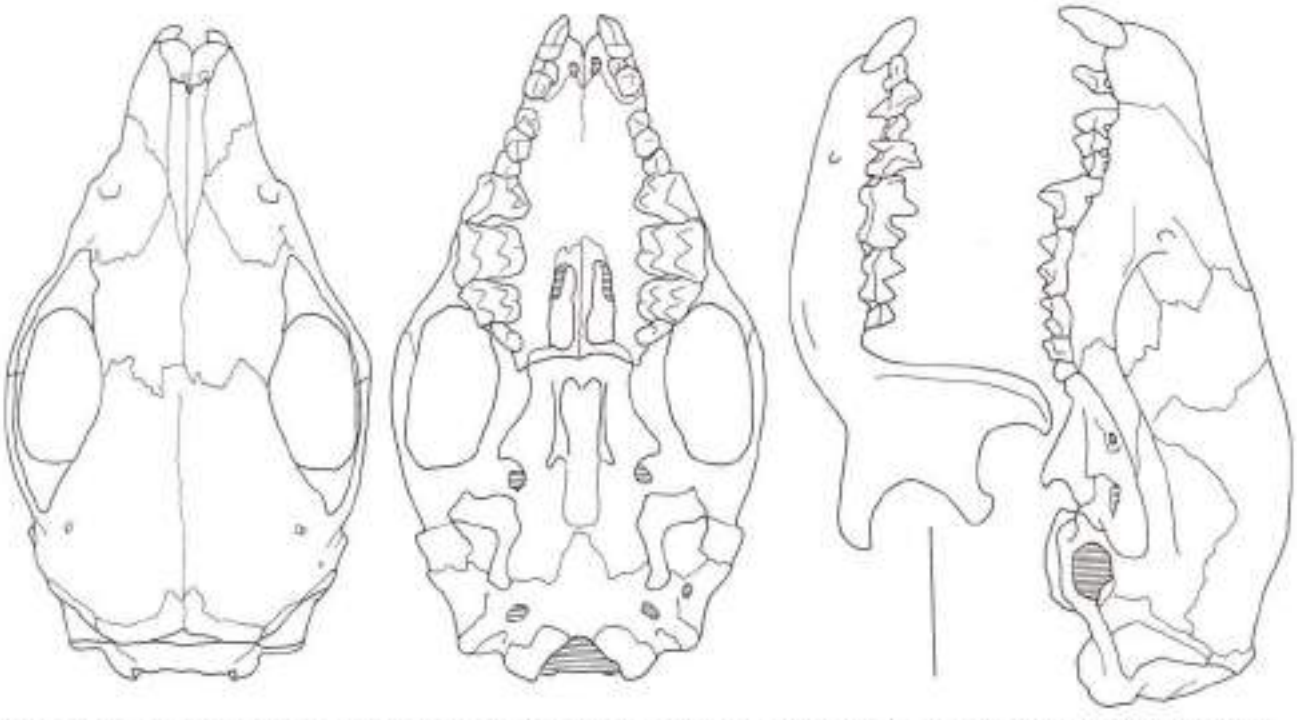

Fig. 45: Skull and mandible of the long-eared hedgehog Hemiechinus auritus, *based on an adult male from the vicinity of Larnaca, Cyprus. Scale bar = 10 mm.*

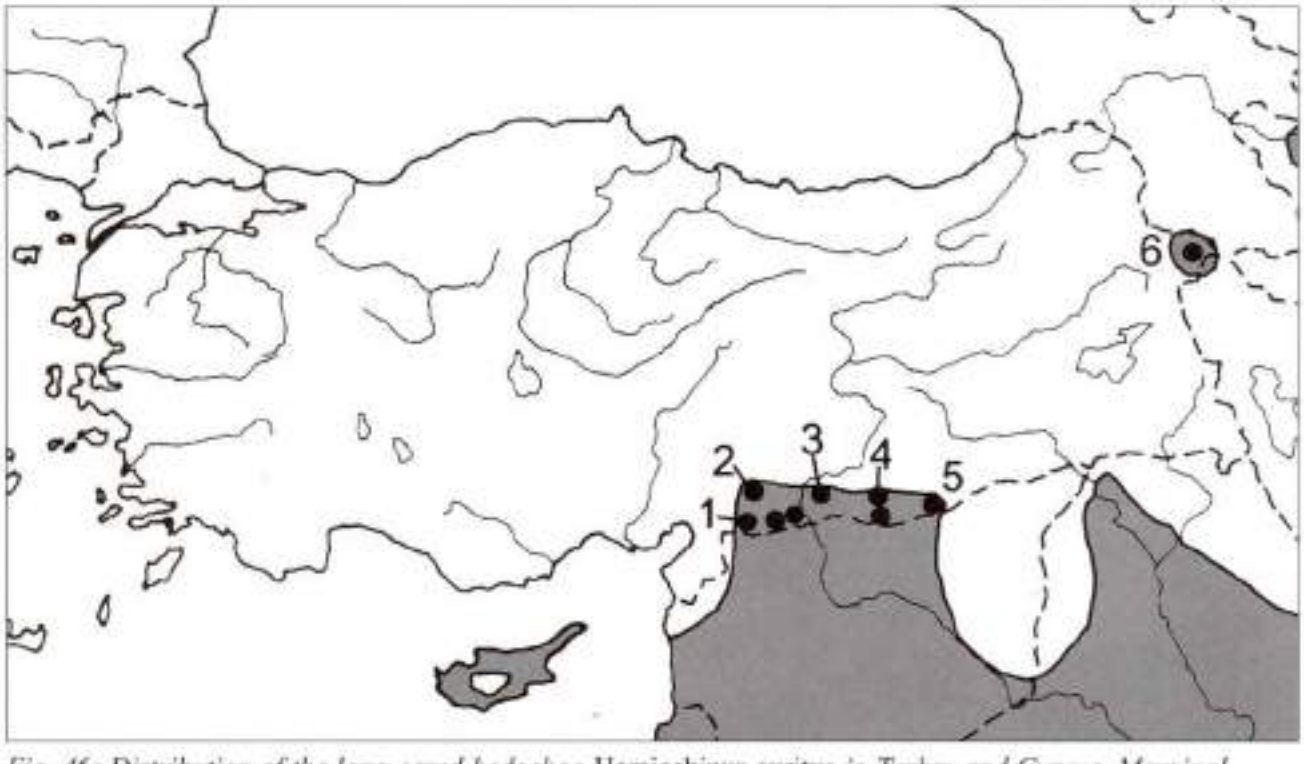

Fig. 46: Distribution of the long-eared hedgehog Hemiechinus auritus *in Turkey and Cyprus. Marginal records: 1 = Kilis; 2 = Gaziantep; 3 = Birecik; 4 = Viranşehir; 5 = Ceylanpınar; 6 = Aralık. Localities in Cyprus are so numerous that they are not detailed (see details in Boye, 1991). Corresponding references: Çolak* et al. *(1998b): 1, 5. Kefelioğlu (1997): 2, 6. Kumerloeve (1975a): 3. MAK: 4.*

Distribution

The Mediterranean zones of Libya, Egypt and the Middle East; the basins of the Euphrates and Tigris, trans- and cis-Caucasia; across central Asia as far east as Mongolia and Xinkiang; also occurs in Iran, Pakistan and north-west India, although of very marginal occurrence in Turkey (Fig. 46). A single locality is known from eastern Turkey (*i.e.* Aralık) and this, together with a few records from around Yerevan (Sokolov & Tembotov, 1989), form a small isolate, separated by a gap of *ca.* 100 km from the species' range along the Kura River further east. Another Turkish population is restricted to a narrow strip along the Syrian border. The long-eared hedgehog is widespread in Cyprus, where its presence is probably the result of a comparatively recent introduction (Boye, 1991).

Habitat

The long-eared hedgehog is common on Cyprus, where it prefers cultivated areas (vineyards, citrus and carob plantations, vegetable gardens) to Mediterranean shrub (maquis) and urban settlements (villages and towns). All records are from altitudes below 900 m. The species is nocturnal, hiding during the day in stone walls and under trees or bushes. Activity is reduced during the winter months (Boye, 1991); in southern Cyprus one of us (B.K.) found not a single dead hedgehog on the road around Christmas time.

Dry steppes are the species' main habitat in Turkey (Çolak *et al.*, 1998b; Plate VIII.2), where this hedgehog is considered rare. Lay (1967) did not find it to be abundant anywhere in Iran either. In Arabia, it inhabits the buffer zone between the more mesic *Erinaceus concolor* and the desert adapted *Paraechinus aethiopicus* (Harrison & Bates, 1991), and is most common in semi-arid steppes and in cultivated land (Atallah, 1977). *Hemiechinus auritus* is active all the year round in the Near East, with short periods of lethargy (Quimsiyeh, 1996).

This hedgehog is strictly nocturnal and a fast runner. In contrast to genus *Erinaceus*, it digs simple burrows at shrub or rock bases. Although being predominantly carnivorous (insects, small mammals, birds, lizards) it will also take vegetable food (Atallah, 1977). One female from south-eastern Turkey gave birth to four cubs on June 20 (Çolak *et al.*, 1998b). In Cyprus, reproduction starts in May (Boye, 1991).

Family: Soricidae Fischer, 1817

Shrews are small, mouse-like insectivores with a long, pointed snout and small eyes. They are predominantly terrestrial and polyphasically active. The anterior-most incisors are large, functioning like forceps, and the upper canine is small. The skull lacks zygomatic arches. Geographic ranges mainly coincide with the distribution of the order. Shrews are common in tropical, temperate and boreal ecosystems, but prefer humid environments. Soricidae are the largest family of insectivores, with *ca.* 335 species in 23 genera - four of these occur in the region.

Key to genera

1 Tail with sparse long tactile hair; teeth entirely white; cutting edge of 1st lower incisor i1 not cusped 2

1* Tail densely hairy, also with a keel of stiff hair along its ventral side, but without sparse long hair; tooth tips reddish; cutting edge of i1 cusped 3

2 Larger: head and body more than 55 mm, hind foot more than 10 mm, coronoid height more than 4.0 mm; three unicuspids in the upper jaw (Figs. 75, 76) ..... *Crocidura*

2* Smaller: head and body less than 45 mm, hind foot less than 9 mm, coronoid height less than 3.5 mm; four unicuspids in the upper jaw (Fig. 76) ..... *Suncus*

3 Fringe of stiff hair along the sides of the hind feet; four upper unicuspids (Fig. 66) ..... *Neomys*

3* No fringe of stiff hair along the sides of the hind feet; five upper unicuspids (Fig. 48) ..... *Sorex*

Genus: *Sorex* Linnaeus, 1758

Terrestrial shrews with reddish tips to the tooth crowns. The pelage is soft and dense, dark brown or blackish. The ears are short and hidden by hair, the eyes are small. The tail terminates in a short pencil that is frequently worn off in over-wintered animals (Fig. 47). There are three inguinal pairs of nipples. The skull is narrow, relatively long and delicate. There are five unicuspids in the upper jaw (Fig. 48). Dental formula: 3/1, 1/1, 3/1, 3/3 = 32. *Sorex* is a Holarctic genus of *ca.* 72 species, five of which occur in Turkey. Two pairs of sibling species *(S. araneus / satunini and S. minutus / volnuchini)* make identification difficult, however, siblings are always allopatric. The two species which occur in Thrace are of broader Palaearctic occurrence, while the remaining three, all from the Black Sea Mts, are more restricted and also occur in the Caucasus (Dannelid (1990) considers their distribution to be relict). The genus *Sorex* occupied a broader distribution in the Middle Plesitocene and then reached south-central Anatolia (Emirkaya-2 near Seydisehir; Sen *et al.*, 1991; Montuire *et al.*, 1994). All Turkish species prefer mesic habitats.

Key to species

1 In Asia Minor 2

1* In Thrace 4

2 Size small: condylobasal length less than 17 mm, coronoid height less than 4 mm; metaconid on 1st upper molar M1 not pigmented ..... *S. volnuchini*

2* Size larger: condylobasal length at least 17 mm, coronoid height more than 4 mm; metaconid on M1 pigmented (Fig. 49) 3

3 Belly dark brown or blackish; pelage uniformly dark; condylobasal length at least 18.5 mm; 1st upper incisor I1 with no median tines (Fig. 50) ..... *S. raddei*

3* Belly greyish; pelage bi- or tricoloured, belly evidently paler than back; condylobasal length less than 18,5 mm; I1 with median tines (Fig. 50) ..... *S. satunini*

4 Size small: condylobasal length less than 16.5 mm; medial tines on I1 ill defined, situated on the upper half of pigmented area (Fig. 50) ..... *S. minutus*

4* Size large: condylobasal length more than 18 mm; medial tines on I1 large, situated on the lower half of pigmented area (Fig. 50) ..... *S. araneus*

Fig. 47: Red-toothed shrew Sorex *sp. Drawing: S. Polak.*

Fig. 49: First left lower molar in Sorex raddei *(Tamdere, Giresun Dağları). m = metaconid. Anterior is to the left, lingual is above. Scale bar = 1 mm.*

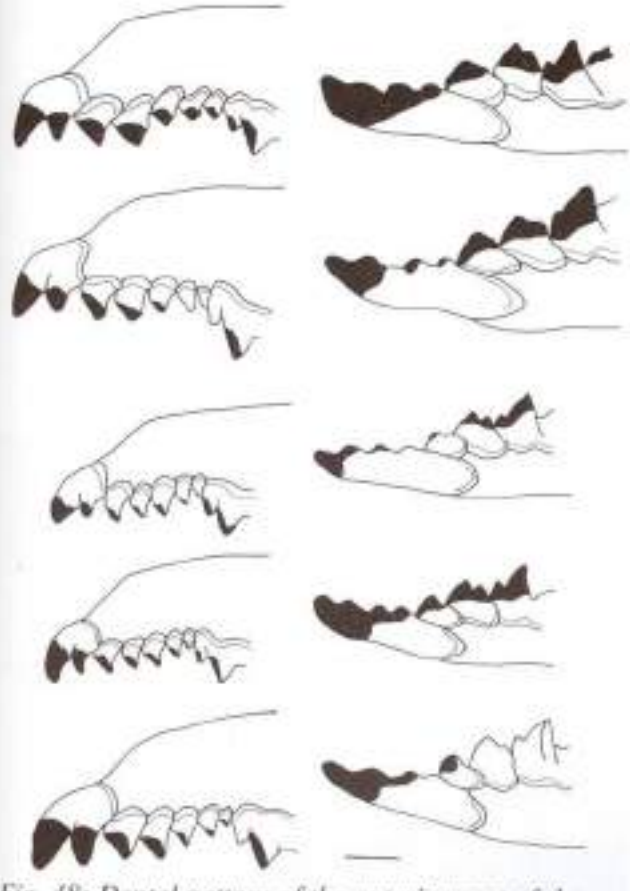

Fig. 48: Dental pattern of the anterior part of the rostrum (left column) and the anterior part of the mandible (right column) in five Sorex *shrews from Turkey. From top to bottom:* S. raddei *(Trabzon district),* S. araneus *(Mt. Istranca),* S. minutus *(Mt. Istranca),* S. volnuchini *(Trabzon district), and* S. satunini *(Kars district). Scale bar = 1 mm.*

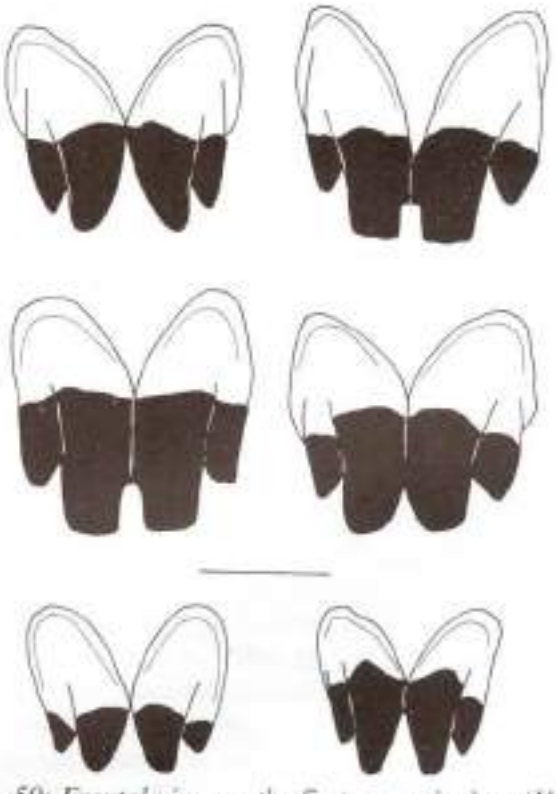

Fig. 50: Frontal view on the first upper incisor (I1) in Turkish Sorex *shrews. From left to right, upper row:* S. raddei *(Trabzon district),* S. araneus *(Mt. Istranca); middle row:* S. satunini *from Kars district and from Güzyurdu, respectively; lower row:* S. minutus *(Mt. Istranca),* S. volnuchini *(Trabzon district). Scale bar = 1 mm.*

Pygmy Shrew - *Sorex minutus*

Sorex minutus Linnaeus, 1766. Type loc.: Krasnojarsk, Western Siberia, Russia.

Description

A small, red-toothed shrew (Table 6) that is morphologically indistinguishable from the Caucasian pygmy shrew. The back is uniformly brown, the belly greyish and there is no sharp demarcation line along the flanks. The tail is thick and relatively long (70–82% of head and body; 74.4% on average) and indistinctly bi-coloured (ventral side is pale brownish, dorsal side is dark brown; Plate XI).

The skull is delicate, with a narrow rostrum and a brain case that is relatively bigger than in the sympat-

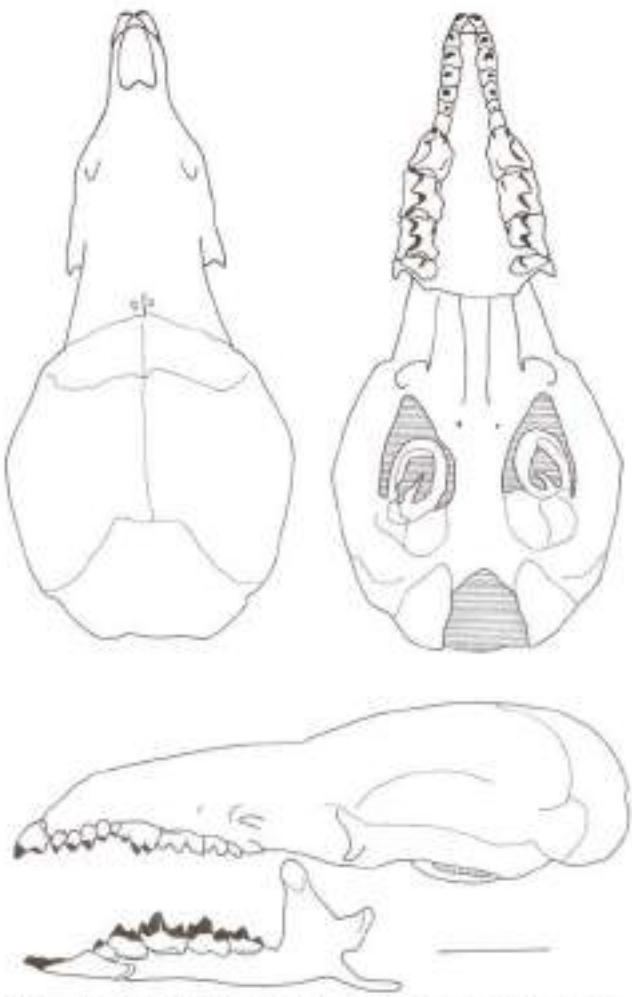

Fig. 51: Skull and mandible of Sorex minutus *from Velika köprüsü near Demirköy, the Istranca Mts, European Turkey. Scale bar = 3 mm.*

	N	*Mean*	*min–max*
Head and body	4	54.3	50–59
Tail	4	40.3	38–43
Hind foot	4	11.3	10.8–11.6
Weight	4	3.7	3.3–4.0
Condylobasal lenght	4	16.1	16.0–16.2
Braincase breadth	4	7.6	7.6–7.6
Coronoid height	7	3.37	3.3–3.4

Table 6: External and cranial dimensions of Sorex minutus *from the Istranca Mts, European Turkey (own data).*

Fig. 52: Deciduous forest (mainly beech Fagus orientalis*) in a river valley on Mt. Istranca, Turkish Thrace (altitude 650 m asl). Habitat of* Sorex minutus *and* S. araneus, *in addition to* Neomys anomalus, Sciurus vulgaris, Apodemus flavicollis, *and* Glis glis. *Photo: B. Kryštufek.*

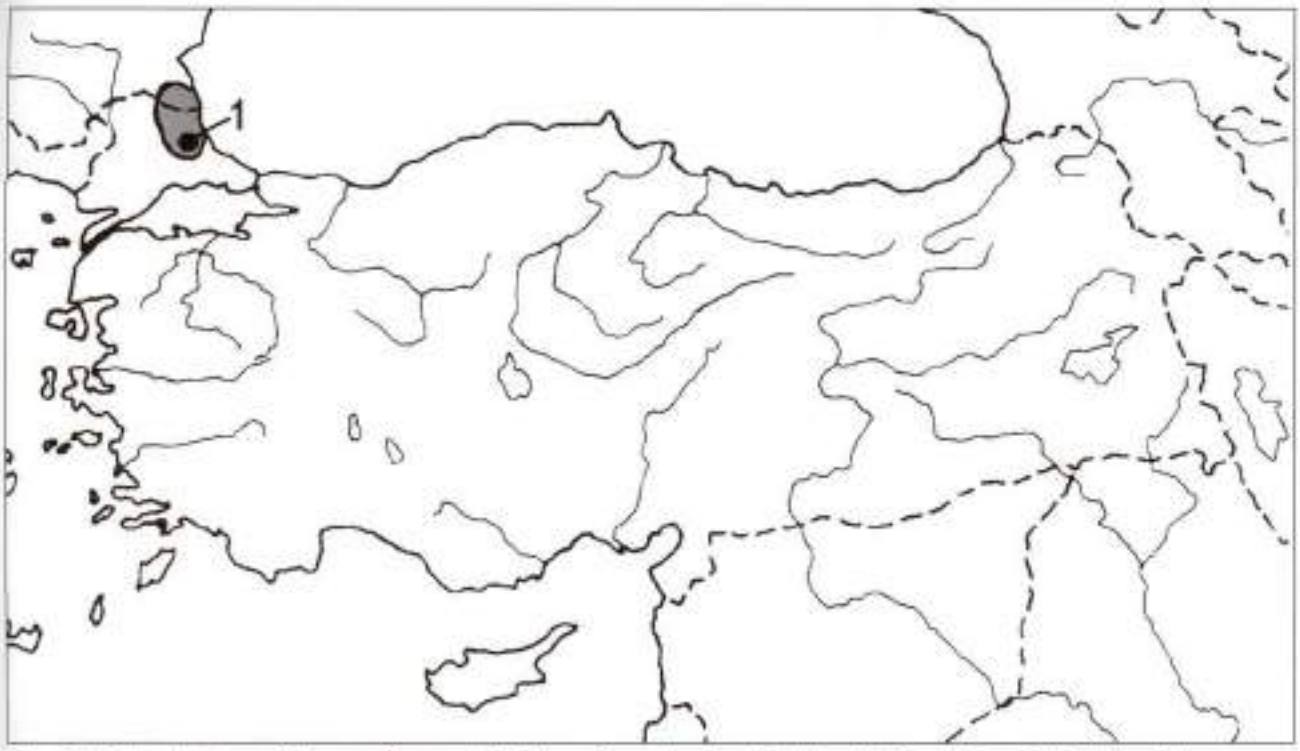

Fig. 53: Distribution of Sorex minutus *in Turkey. Records: 1 = Kırklareli, Demirköy, Velika köprüsü (Zima* et al., *1997).*

ric *S. araneus* (Fig. 51). The first upper incisor is sharply pointed and lightly to well pigmented; medial tines are situated in the upper half of the pigmented area, occasionally absent; the fifth unicuspid is medium to large and readily visible from the lingual side (Fig. 48).

The karyotype of the population from the Istranca Mts corresponds with that seen in the rest of the species' European range: 2N = 42 (Zima *et al.*, 1997).

Variation

Pygmy shrews from the southern Balkans are larger than their counterparts from central and northern Europe and fit the description of *S. m. gymnurus* Chaworth-Musters, 1932 (type locality is Mt. Olympus in Greece). The mean dimensions of a sample of 14 pygmy shrews from western Macedonia are (ranges in parentheses): head and body length 60.9 (52–70), tail length 41.6 (38–46), hind foot 11.05 (10.0–11.7), weight 5.0 (3–7), condylobasal length 16.1 (15.5–16.9), braincase breadth 7.6 (7.4–7.9) and coronoid height 3.49 (3.4–3.6).

Distribution

Forested zones between the Pyrenees and Lake Baykal (Baikal), also the British Isles. Goes as far north as the Polar Circle in Scandinavia, but also penetrates further south than the larger *S. araneus* in the Mediterranean zone. In Turkey the species is restricted to Thrace, where it is known from a single locality in the Istranca Mts; this population is probably an isolate (Fig. 53).

Habitat

Broad habitat selection observed across the species' wide geographic range. In European Turkey specimens were collected in the valley of a small river in a beech forest with abundant rhododendron shrubs (altitude 800 m; Fig. 52). Forests and mountain pastures are preferred habitats in the rest of the southern Balkan Peninsula.

Caucasian Pygmy Shrew - *Sorex volnuchini*

Sorex minutus volnuchini Ognev, 1921. Type loc.: Kiša River, Adygejskaya Autonomous Region, northwestern Caucasus, Russia.

Taxonomy

This species was long considered as conspecific with *S. minutus* (Corbet, 1978) and consequently has been reported as such from Turkey (Osborn, 1965b; Spitzenberger, 1968; Kumerloeve, 1975a; Felten *et al.*, 1973; Doğramacı, 1989a; Kock, 1990; Obuch, 1994). Although the two sibling shrews are seemingly morphologically indistinguishable (Hutterer, 1993) they clearly differ in their karyotypes (Zima & Král, 1984) and in a 1011 base pair cytochrome *b* sequence (Fumagalli *et al.*, 1999).

Description

The smallest red toothed shrew in Anatolia (Table 7). The back is uniformly brown to dark brown, and the belly is highly variable being pale greyish or brownish to slate brown. The tail is relatively long (63–88% of head and body; average 77%) and indistinctly bicoloured to almost uniformly dark. The fore and hind feet are pale brown (Plate XI).

The skull is delicate, with a narrow rostrum and relatively bigger brain case than the larger congenerics (Fig. 54). The first upper incisors are as in *S. minutus*, but pigment is always dark (Fig. 50); also the medial tines are situated in the middle of the pigmented area (higher in *S. minutus*). The fifth unicuspid is mainly large, but rarely medium or even sometimes dwarfed.

	N	*Mean*	*min–max*
Head and body	29	57.7	50–67
Tail	29	44.2	38–50
Hind foot	29	11.4	10.4–13.2
Weight	15	4.3	2.5–8.5
Condylobasal lenght	26	16.0	14.9–16.7
Braincase breadth	24	7.6	7.2–8.1
Coronoid height	28	3.41	3.2–3.7

Table 7: External and cranial dimensions of Sorex volnuchini *from Turkey east of İlgazdağ. Based on Osborn (1965b), specimens in NMW and BMNH and own data.*

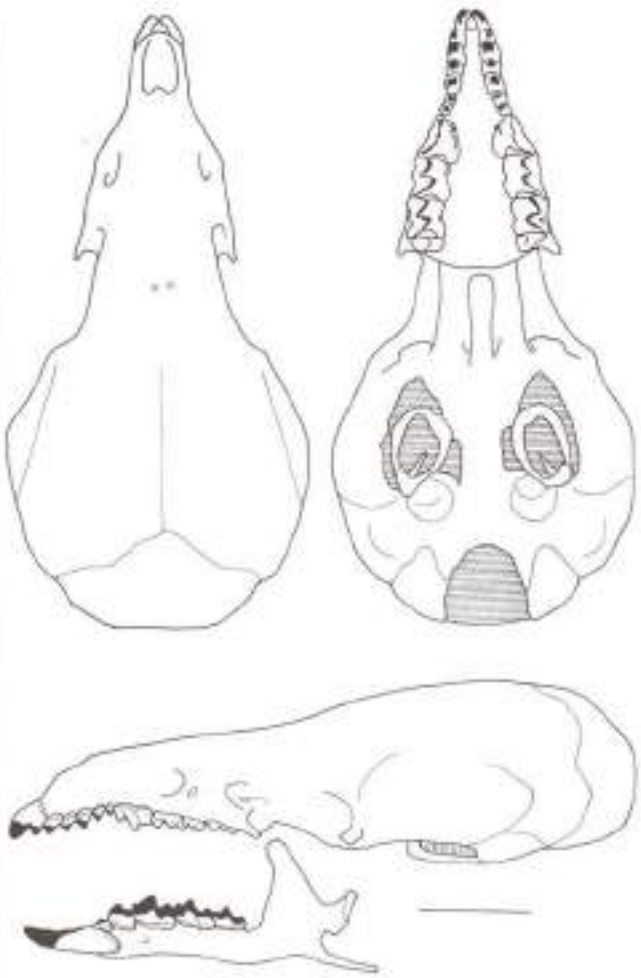

Fig. 54: Skull and mandible of Sorex volnuchini *from Meryemana near Trabzon, Turkey. Scale bar = 3 mm.*

The karyotype of the Caucasian specimens is 2n = 40, NF = 60 (Sokolov & Tembotov, 1989); the same karyotype is shared by shrews from Meryemana (J. Zima, *in litt.*).

Variation

Sokolov & Tembotov (1989) recognise two subspecies: the nominate form and the newly described *S. v. colchica* (type locality is in the vicinity of Lake Rica, Abkhazia, Georgia). The latter, supposed by Sokolov & Tembotov (1989) to also occur in Turkey, is said to be darker and larger. Turkish shrews are larger than their Caucasian conspecifics, and the single specimen available from Aban Gölü is particularly big and larger than the maximum values reported for populations to the east of İlgazdağ. This is particularly evident from cranial dimensions: condylobasal length 17.0; braincase

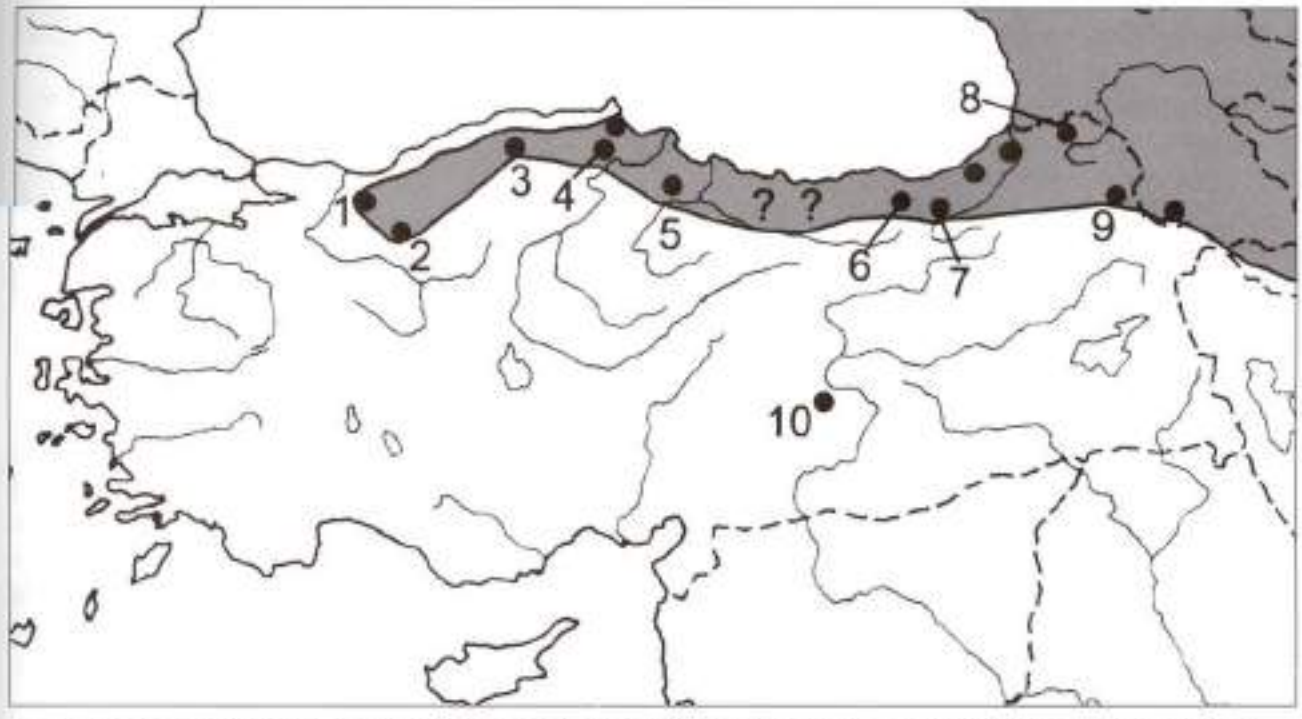

Fig. 55: Distribution of Sorex volnuchini *in Turkey. Marginal records: 1 = Balıklı, 42 km south of Düzce; 2 = Abant; 3 = İlgazdağ Geçidi; 4 = Sinop, Boyabat; 5 = Amasya, Seyfe; 6 = Meryemana; 7 = Rize, Çamlik; 8 = Kars, Yalnızçam; 9 = Kars, 5 km west of Bağdasan; 10 = Karadut. Corresponding references: Kock (1990): 1. Spitzenberger (1968): 4, 8. Fumagalli* et al. *(1995): 5. Osborn (1965b): 6. Obuch (1994): 10. MAK: 2. Own data: 3, 7, 9.*

breadth 8.3; coronoid height 3.7 mm. Osborn (1965b) also emphasised the larger dimensions of two specimens from Bürnük near Sinop, and provides the following external measurements: head and body 74 and 67, tail length 35 and 41, hind foot length 12 and 12.

Distribution

Endemic to the Caucasus and the adjacent Black Sea Mts of Turkey, but possibly also present in Iran (Hutterer, 1993). The species' northernmost localities are from the rivers Terek and Kuban in Russia; the southernmost are from western Armenia (Sokolov & Tembotov, 1989). In Turkey *S. volnuchini* is restricted to the narrow belt of the Black Sea Mts, as far west as Bolu district (Fig. 55). The Turkish range is probably in several fragments, as is also the case in Georgia (Bakhnikasvilli & Kandaurov, 1998). There is one isolated record in eastern Anatolia (Karadut) where a single specimen was found among 1,195 mammal remains from Eagle owl pellets (Obuch, 1994); Karadut is more than 200 km outside the contiguous range of the Caucasian pygmy shrew.

Habitat

Turkish records are from altitudes between 400–2,400 m (Spitzenberger, 1968) while the altitudinal range is even larger in the Caucasus (200–3,200 m asl; Sokolov & Tembotov, 1989). Preferred habitats in Turkey are humid forests (beech, fir, spruce) where the shrew seeks shelter in litter under rhododendron shrubs and among rocks (Plate VI.1). It is also frequent in forest clearings with dense shrub cover, and in wood edges with abundant herbs. Along streams it penetrates into subalpine meadows where it can be found among rocks. It is frequently found syntopicaly with *S. raddei*, and there is a single case of sympatry with *S. satunini* from 5 km west of Bağdasan (Kars), where the two shrews were collected on a rocky pasture at 2,600 m asl.

Common Shrew - *Sorex araneus*

Sorex araneus Linnaeus, 1758. Type loc.: Uppsala, Sweden.

Sorex caucasicus sultanae Şimşek, 1986. Type loc.: Velika Bridge (= *ca.* 5 km south-east of Velika köy), Demirköy, Kırklareli, Thrace, Turkey.

Description

The common shrew is externally very similar to *S. satunini* (Table 8), but is generally darker (the back is brown to dark brown and the ventrum is greyish). There is no clear demarcation line along the flanks. The three-coloured pattern is obscured in the majority of specimens but, when present, the dark brown back sharply contrasts with the paler flanks (Plate XI). This might reflect age variation with adults being three-coloured. The tail is uniformly brown or slightly paler ventrally (frequently distinctly bi-coloured in *S. satunini*). The hind foot is brown dorsally, and much darker than in *S. satunini*. The common shrew is readily distinguishable from the sympatric pygmy shrew by its larger size and relatively shorter tail (55–84% of head and body; average 65%).

	N	*Mean*	*min–max*
Head and body	18	63.4	55–78
Tail	18	40.8	37–46
Hind foot	18	12.3	11.8–12.9
Weight	18	7.3	5.9–11.5
Condylobasal lenght	7	19.1	18.9–19.3
Braincase breadth	9	9.6	9.5–9.9
Coronoid height	18	4.72	4.3–5.0

Table 8: External and cranial dimensions of Sorex araneus *from Istranca Mts, European Turkey. Based on own material.*

Cranially, *S. araneus* also resembles *S. satunini* (Fig. 56). The pigmentation of the first upper incisor is dark, and medial tines are situated in the lower half of the pigmented area (Fig. 50) (and consequently are often obscured in moderately worn teeth). The 5th unicuspid is of variable size, ranging from minute to large. The hypocone on M1 is pigmented in approximately half of all specimens, whilst it is usually pigmented in other *S. araneus* populations (Dannelid, 1989).

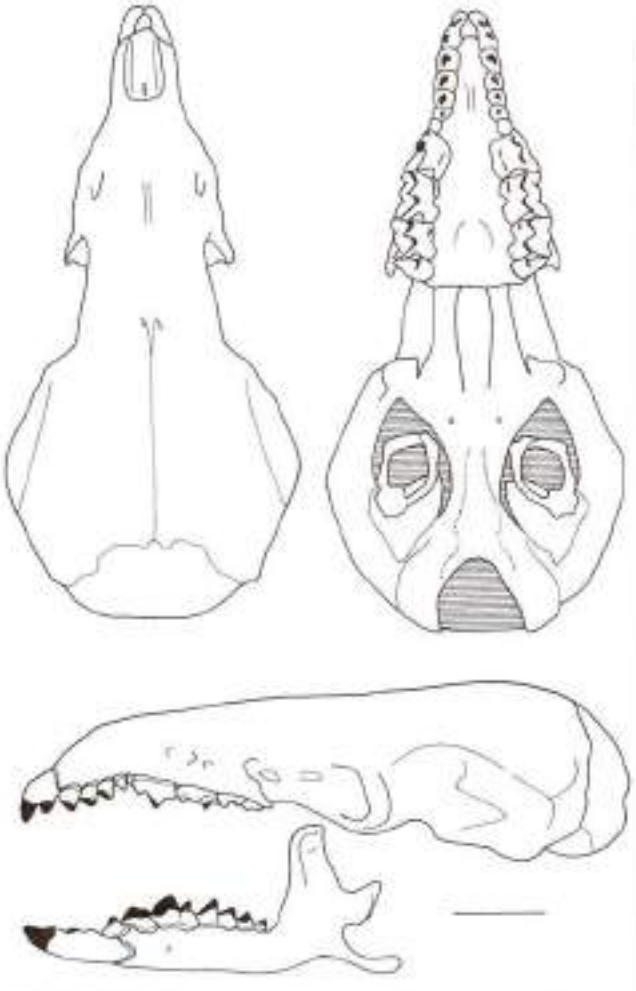

Fig. 56: Skull and mandible of Sorex araneus *from Velika köprüsü near Demirköy, the Istranca Mts, European Turkey. Scale bar = 3 mm.*

Variation

The population from the Istranca Mts is characterised by a diploid number 2N = 26 and possesses a unique composition of Robertsonian fused autosomes; it was thus described as the Istranca chromosomal race (Zima *et al.*, 1997).

Distribution

The species' range is contiguous in forested zones between eastern France (east of *ca.* 5 °E) and Lake Baikal. Isolates are known in France, the Pyrenees and the British Isles. It is absent from southern Europe and all Mediterranean islands. In Turkey the species is restricted to Thrace, where it is known from a single locality in the Istranca Mts (Fig. 57). This record is on the very southern margin of the species' range.

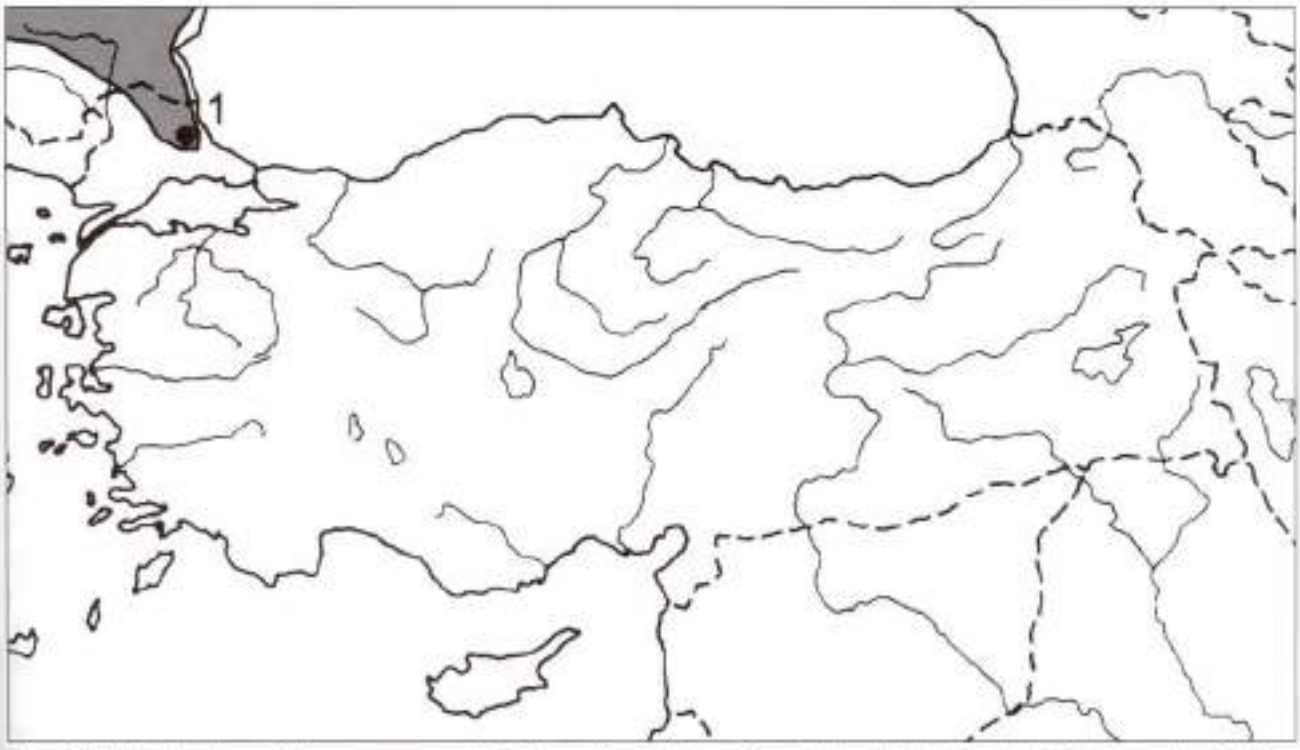

Fig. 57: Distribution of Sorex araneus *in Turkey. Record: 1 = Demirköy, Velika köprüsü (Zima* et al., *1997).*

Habitat

Occurs in humid beech *Fagus orientalis* woods with abundant rhododendron shrub undergrowth in the Istranca Mts (Fig. 52). All the specimens were evidently collected in the valley of a small river at *ca.* 800 m asl (*S. minutus* also occurred in the same site, but the common shrew was more abundant). In the Balkan Peninsula, where the common shrew attains the southern border of its range, it is mainly tied to higher altitudes (above 1,000 m asl) and humid broad-leaved and spruce / fir forests are its preferred habitats.

Caucasian Shrew - *Sorex satunini*

Sorex araneus satunini Ognev, 1921. Type loc.: Goele, Kars, Turkey.

Taxonomy

As long as the Turkish fauna is concerned, this shrew was first considered as a conspecific of *S. araneus* (Osborn, 1965b) and later, when recognised as a species on its own right, was reported under the name *S. caucasicus* (Kumerloeve, 1975a; Spitzenberger, 1968; Dolgov, 1985; Dannelid, 1990; Corbet, 1978; Kock, 1990). The last name is a junior synonym of *S. raddei* (Ellerman & Morrison-Scott, 1966; Pavlinov & Rossolimo, 1987). Osborn (1965b) evidently did not distinguish between *S. satunini* and *S. raddei*, consequently all his records referred to *S. araneus* from the eastern Pontic Mts (at least as suggested by the examination of material in the BMNH) are actually referable to *S. raddei*.

S. satunini differs from *S. araneus* in karyotype (Zima & Král, 1984) and electrophoretically: *S. araneus* is characterised by slower alleles of esterase-2 (Macholán *et al.*, 1999).

	N	*Mean*	*min–max*
Head and body	20	67.2	60–80
Tail	32	40.9	36–47
Hind foot	20	11.8	11.3–13.4
Weight	29	5.9	4–11
Condylobasal lenght	37	17.6	17.0–18.4
Braincase breadth	37	9.0	8.3–9.4
Coronoid height	41	4.45	4.2–4.9

Table 9: External and cranial dimensions of the Caucasian shrew Sorex satunini *from the Black Sea Mts of Turkey. Based on Spitzenberger (1968), Şimşek (1986) and own data.*

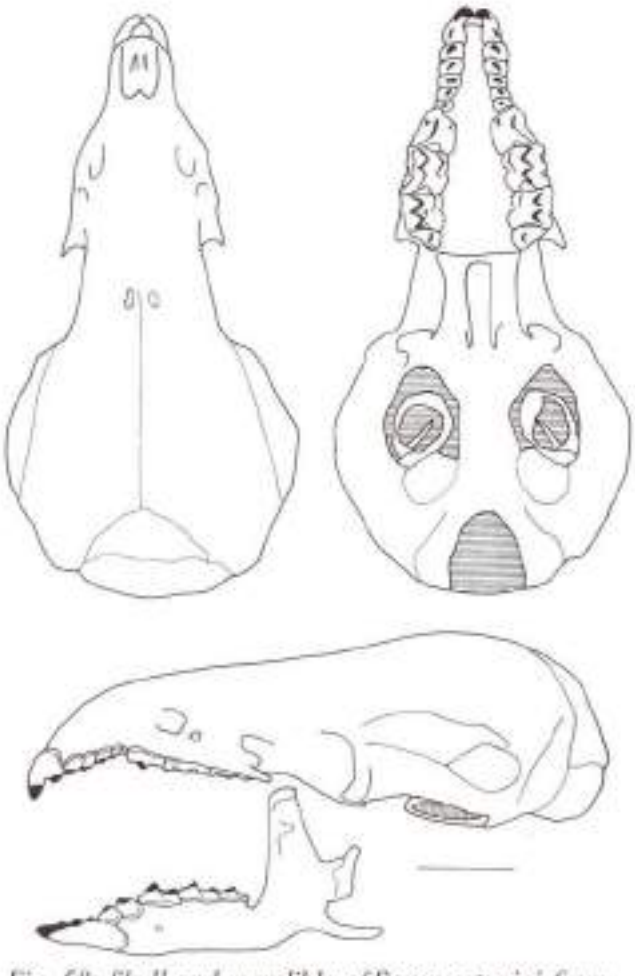

Fig. 58: Skull and mandible of Sorex satunini *from Yalnızçam-geçidi, Kars, Turkey. Scale bar = 3 mm.*

Description

Externally, *S. satunini* is hardly distinguishable from *S. araneus* (Table 9), however the latter is bigger. The back hair is brown, but does not attaining the deep, dark brown of Thracian *S. araneus*. The belly is clearly paler than that of Thracian *S. araneus*, being whitish grey, occasionally with yellowish tinges. Adults in their 2nd calendar year are three-coloured with a brown back, pale brown flanks and a grey belly. The hind feet are dorsally pale brownish to whitish, and the tail is distinctly bi-coloured (dark brown above and silvery grey bellow) and its tip and terminal pencil are dark (Plate XI). In size, *S. satunini* is clearly smaller than *S. raddei*, having also a shorter tail and a paler belly. The tail is 62% of head and body length (range 53–70%).

The skull is as in *S. araneus* (Fig. 58). The 1st upper incisor appears identical to the condition observed in *S. araneus*, however, medial tines are sometimes missing in *S. satunini* (Fig. 50). The fifth unicuspid is mainly small, rarely medium, but only exceptionally large or absent (Fig. 48). The hypocone of M1 is pigmented, and the lower canine is unicuspid and very exceptionally bicuspid (Fig. 48).

The diploid number of autosomes is 2Na = 22, and the fundamental number of autosomal arms is NFa = 42. Male sex chromosomes make up a XY_1Y_2 trivalent (Macholán, 1996).

Variation

Sokolov & Tembotov (1989) distinguish three subspecies from the Caucasus, two of them they describe as new (under the name *S. caucasicus*); differences amongst these subspecies are slight. The type locality of *S. c. armenica* Sokolov & Tembotov, 1989 (Covag'uh village near Lake Sevan, Armenia) is very close to the type locality of *S. satunini*, so the two may be identical.

Specimens from Ulu Dağ tend to be darker than their counterparts from the eastern Black Sea Mts, and also have a more obscure hind foot and less distinctly bi-coloured tail. It seems that the braincase is broader in Ulu Dağ shrews, and the average and range (in parentheses) for the three specimens are: condylobasal length 18.07 (17.4–18.5), braincase breadth 9.5 (9.3–9.8). Genetically (as scored by 36 allozyme loci), *S. satunini* samples from north-west Anatolia appear to be only slightly differentiated from their counterparts from the eastern Black Sea Mts (Macholán, 1996).

Distribution

Occurs in the Caucasus in Georgia, Armenia, Azerbaijan and Russia, as far north as the rivers Kuban and Terek, as well as in northern Turkey. Turkish localities stretch all along the Black Sea Mts as far west as the Marmara region (Fig. 59). The species' range in Turkey is fragmented, with three isolates in the mountains of Ulu Dağ and Domaniç (pts. 1 and 2 in Fig. 59), Abant (pt. 3) and Ilgaz (pt. 4). The range seems to be contiguous in the easternmost Pontic Mts, from which it continues into the Caucasus.

Habitat

Turkish localities are from high altitudes (between 1,000–2,600 m asl), although *S. satunini* descends down to the sea level in the Caucasus (Sokolov & Tem-

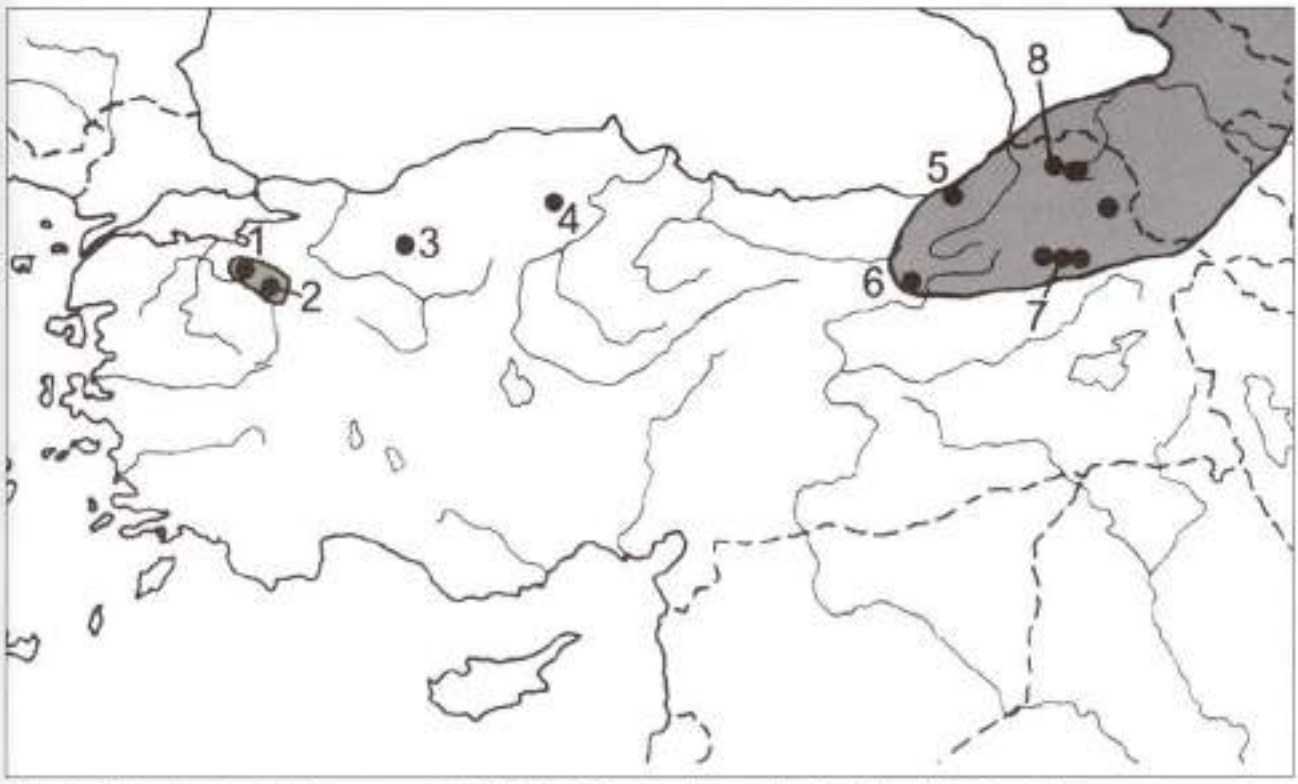

Fig. 59: Distribution of Sorex satunini *in Turkey. Marginal records: 1 = Ulu Dağ; 2 = 6 km north-east of Domaniç; 3 = Bolu, Abant; 4 = Kastamonu, Tosya; 5 = Ovitdağ Geçidi; 6 = Güzyurdu; 7 = Kars, Handere; 8 = Kars, Yalnızçam-geçidi. Corresponding references: Macholán* et al., *(1999): 1, 3, 6, 7. Kock (1990): 2. Spitzenberger (1968): 4, 8. Own data: 4.*

botov, 1989). Alpine meadows (both humid and dry) with rocky outcrops are preferred in the east Pontic Mts (Plates VI.2 and VII.1; Fig. 60); this shrew, however, avoids dry alpine meadows in the Caucasus (Sokolov & Tembotov, 1989). We collected specimens mainly amongst rocky outcrops, under juniper shrubs and in dense, lush herbaceous vegetation along streams. The larger *S. raddei* outcompetes *S. satunini* in mountain forests, both in the eastern Pontic Mts and the Caucasus (Sokolov & Tembotov, 1989). In Ulu Dağ, where *S. satunini* is the only *Sorex* species, it also lives in forests. Osborn (1965) collected one specimen alongside a stream at 1,400 m asl, whilst specimens come from an altitude of 2,000 m asl (in the Museum für Naturkunde der Humboldt-Universität, Berlin).

Fig. 60: Valley of the Aras River near Karadut, district of Kars (altitude at the bottom 1,800 m asl). Habitat of Sorex satunini *in addition to* Cricetulus migratorius, Mesocricetus brandti, *and* Apodemus iconicus. *Photo: M. Kaftan.*

Radde's Shrew - *Sorex raddei*

Sorex raddei Satunin, 1895. Type loc.: neighbourhood of Kutais, Georgia.
Sorex batis Thomas, 1913. Type loc.: Sumela (= Meryemana), Trabzon, Turkey.

Taxonomy

Bobrinskii *et al.* (1944, 1965 cited in Dolgov, 1985) and Ellerman & Morrison Scott (1966) and Osborn (1965b) treat *S. raddei* as conspecific of *S. araneus s. lat.* However, *S. raddei* is well characterised on the basis of external and penis morphology, by karyotype, and in its habitat requirements. Consequently, its position as an independent species, as already expressed by Chaworth-Musters (in Ellerman & Morrison-Scott, 1966) is no longer questioned (Spitzenberger & Steiner, 1962; Dolgov, 1985; Corbet, 1978; Hutterer, 1993; Wolsan & Hutterer, 1998). Spitzenberger (1968) underlined the similarities between *S. raddei* and the European *S. alpinus* and these are based on external morphology and habitat selection; genetically, the two are very distinct (Fumagalli *et al.*, 1999).

Description

A long-tailed, dark coloured shrew (Table 10). On average, the tail is 73.5% of head and body length (range 66–85%). The back is uniformly dark brown to blackish, and the belly is dark grey brown or blackish. The flanks are dark, with no demarcation line. Juvenile animals seem paler with more pronounced brownish tinges. The tail is uniformly dark brown to black, or indistinctly bi-coloured (Plate XI). The fore and hind feet are darker than in other Anatolian *Sorex* species. Radde's shrew differs from *S. volnuchini* in its larger size, and from *S. satunini* by its longer tail and darker

	N	*Mean*	*min–max*
Head and body	55	75.3	66–84
Tail	56	52.3	45–63
Hind foot	56	13.4	12.5–14.7
Weight	24	11.1	6.0–14.8
Condylobasal lenght	38	19.1	18.6–19.8
Braincase breadth	33	10.0	9.4–10.7
Coronoid height	48	4.86	4.6–5.1

Table 10: External and cranial dimensions of Sorex raddei *from Turkey. Based on Spitzenberger (1968), specimens in NMW and BMNH and own data.*

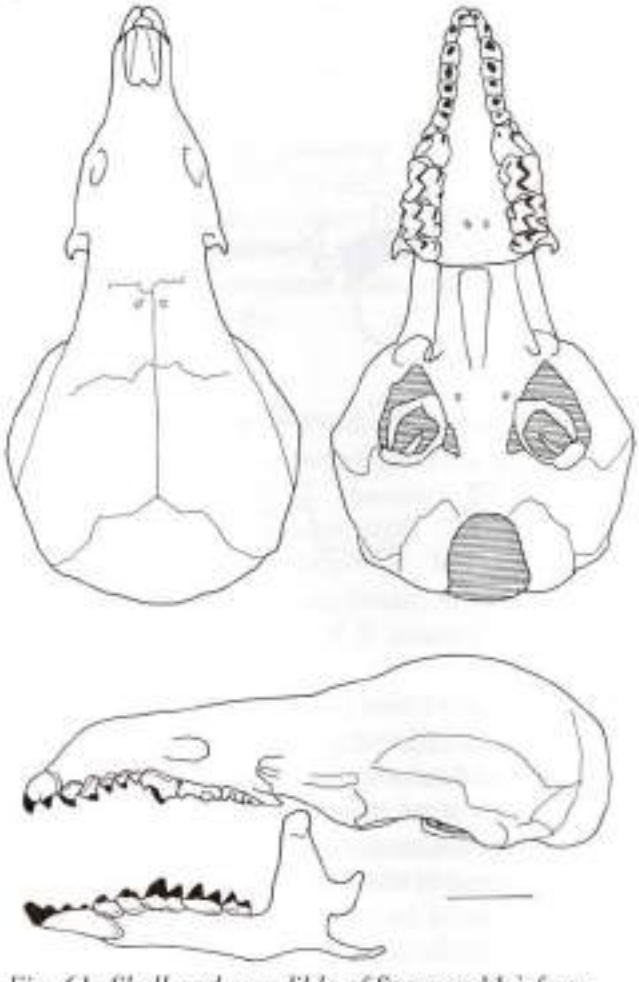

Fig. 61: Skull and mandible of Sorex raddei *from Çamlik above Rize, Turkey. Scale bar = 3 mm.*

Region	Altitude (m)	Condylobasal Length (mm)	Coronoid Height (mm)	Relative tail Length (%)
Artvin	1,300–2,200	(4) 18.73	(7) 4.76	(7) 60.53
Rest	450–800	(13) 19.14	(20) 4.88	(21) 68.11

Table 11: Differences in the average values of two morphometric characters and one ratio to demonstrate interpopulation differences between S. raddei *from the Artvin area and the rest of the species' Turkish range. Sample size is in parentheses. Based on data in Spitzenberger (1968).*

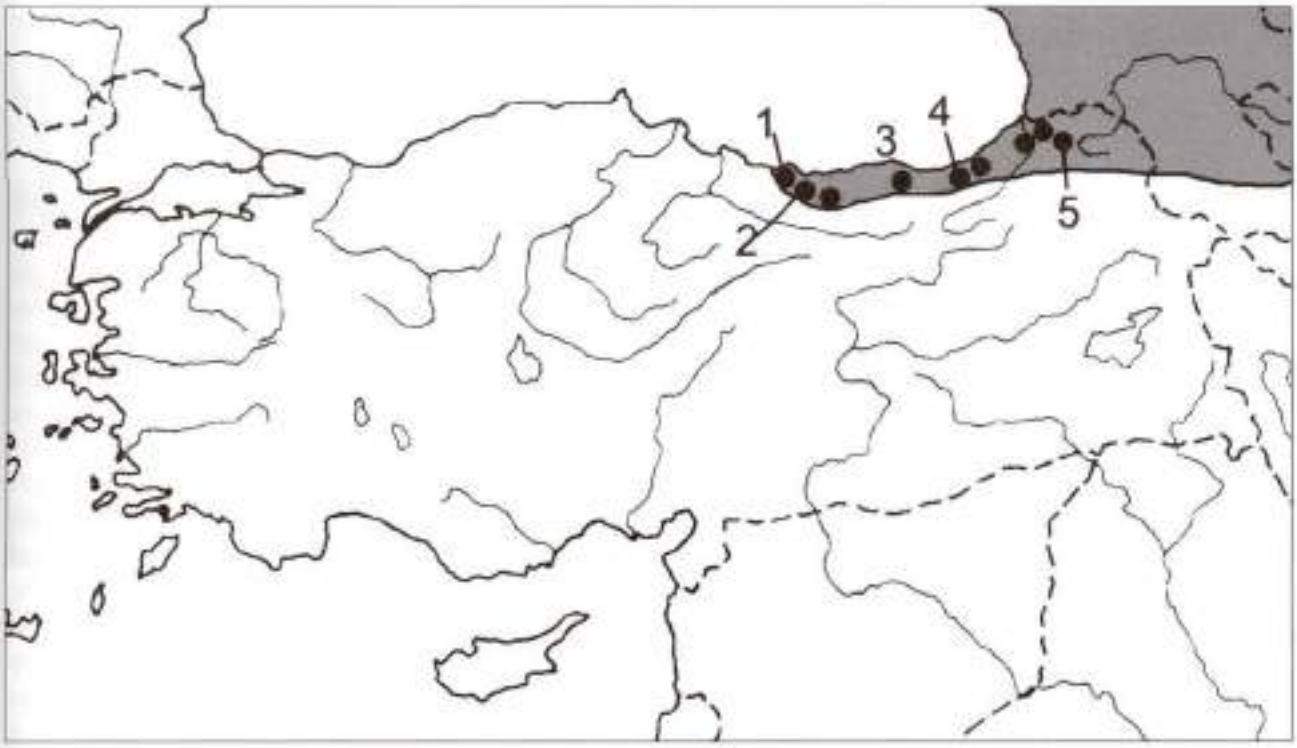

Fig. 62: Distribution of Sorex raddei *in Turkey. Marginal records: 1 = Ordu, Ulubey; 2 = Tamdere, Şehitler Geçidi; 3 = Meryemana; 4 = Rize, Çamlik; 5 = Artvin, Kutul. Corresponding references: Spitzenberger (1968): 1, 3, 5. Own data: 2, 4.*

colour (which is particularly evident on the belly).

The skull is as in *S. satunini*, but larger (Fig. 61). Pigmentation of the 1st upper incisor is intense; medial tines are missing and the pointed tips of the incisors are strongly divergent (Fig. 50). The 5th upper unicuspid is medium to large, and the lower canine is unicuspid or indistinctly bicuspid (Fig. 48); the M1 hypocone is pigmented (Fig. 49).

The diploid chromosome number is 2N = 36 and the fundamental number of the autosomal arms is NFa = 66; both heterosomes are acrocentric (Zima & Král, 1984, Sokolov & Tembotov, 1989).

Variation

Spitzenberger (1968) demonstrates that shrews from the Artvin area, living at higher altitudes, are smaller and have shorter tails than those living at lower altitudes from the remainder of the species' Turkish range (Table 11).

Distribution

Endemic to the Caucasus, from which its range extends to north-eastern Turkey, and possibly also occurs in Iran. The species' northern border coincides approximately with the rivers Terek and Kuban (Sokolov & Tembotov, 1989). Ten localities are known from Turkey, all from the eastern Black Sea Mts (Fig.

Fig. 63: Coniferous forest near Çamlik, northern slopes of Dilek Dağı, eastern Black Sea Mts (altitude 1,380 m asl). Habitat of Sorex raddei *and* S. volnuchini *in addition to* Neomys teres, Microtus majori, Chionomys roberti, Apodemus uralensis, *and* Dryomys nitedula. *Photo: B. Kryštufek.*

62). Santel & Koenigswald (1998) also (tentatively) ascribe Middle Pleistocene material from Yarimburgaz Cave (Thrace) to *S. raddei*.

Habitat

Records are from between 450–2,200 m asl (Spitzenberger, 1968), but it goes from sea level to 2,400 m in the Caucasus (Sokolov & Tembotov, 1989). Preferred habitats are moist areas with rocky outcrops in beech and fir forests, frequently along streams and rivers (Plate VI.1; Fig. 63). The same habitat is populated by *S. volnuchini* and *Chionomys roberti*. Spitzenberger (1968) also collected specimens in the Alpine belt, which corresponds to the situation known in the Caucasus.

Spitzenberger & Steiner (1962) report three pregnant females in June, carrying 3, 5 and 5 embryos. Reproduction in the Caucasus takes place until September, with the number of embryos varying between 2–8 (Sokolov & Tembotov, 1989).

Genus: *Neomys* Kaup, 1829

Genus *Neomys* contains semi-aquatic shrews (Fig. 64) with red tips to the tooth crowns. They are also the largest shrews in Turkey. The tail is with a keel of stiff hair along its ventral side and the hind feet are long, with fringes of stiff hair along the sides of the toes and the lateral edges (all add propellant power during swimming). The back is invariably black and the belly is white (and sharply demarcated from the back), silvery grey to pale cream; hair bases are mainly slate-grey and darkened. Occasionally there are dark medial spots and stripes present on the underparts (Fig.

Fig. 64: Water shrew Neomys *sp. Drawing: S. Polak.*

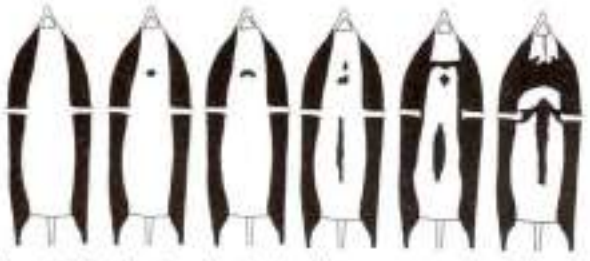

Fig. 65: Variation in the belly pattern coloration of water shrews from Turkey. The 2nd and the 3rd specimens from the right are Neomys anomalus *from Eber Gölü and the vicinity of Zonguldak, respectively; the remainder are* N. teres *from Tamdere, Sehitlor Geçidi. Not to scale.*

65) and, more rarely, the entire belly is dark. We saw no melanistic specimens from Turkey. The ears and eyes are small. Females have five inguinal nipples. The braincase is enlarged, so the skull profile is not as straight as in *Sorex*. The 1st upper incisor is noticeably hooked, and there are only four unicuspids in the upper jaw (Fig. 66). Dental formula: 3/1, 1/1, 2/1, 3/3 = 30. Genus is confined to the Palaearctic region and, of the three species, two occur in Turkey.

Key to species:

1 Size small: hind foot 18.3 mm or less, condylobasal length not more than 21.8 mm; glans penis short (up to 8 mm) with a blunt apex (Fig. 67) *N. anomalus*

1* Size larger: hind foot length at least 18.2 mm, condylobasal length at least 21.6 mm; glans penis long (more than 10 mm) with a pointed apex (Fig. 67) *N. teres*

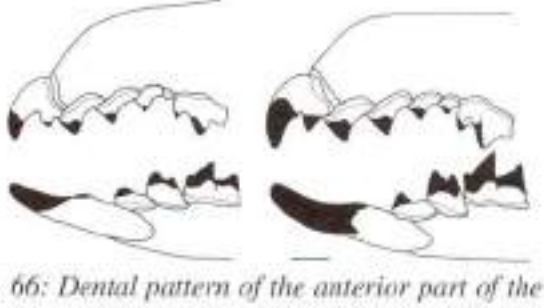

Fig. 66: Dental pattern of the anterior part of the rostrum and the anterior part of the mandible in Neomys anomalus *(left; vicinity of Zonguldak) and* N. teres *(right; Topçam). Scale bar = 1 mm.*

Miller's Water Shrew - *Neomys anomalus*

Neomys anomalus Cabrera, 1907. Type loc.: San Martin de la Vega, Madrid, Spain.

Description

Miller's water shrew is the most terrestrial *Neomys* species, so the ventral keel is not prominent or may be absent. *Neomys anomalus* is smaller than *N. teres* and has a relatively shorter tail (53–77% of head and body length) and a shorter hind foot. The belly is silvery whitish - occasionally with yellowish to brownish tinges. The ventrum is either plain or with a dark mid-ventral stripe and, more rarely, an additional transverse throat band is present (Fig. 65). The tail is indistinctly bi-coloured and the hind foot has a dark stripe above (Plate XII). The glans penis is short (7.0–8.0 mm) and simple, with a blunt apex (Fig. 67); the lateral flap is simple and surface horny spines are not dense.

For dentition and skull see Figs. 66 and 68, respectively.

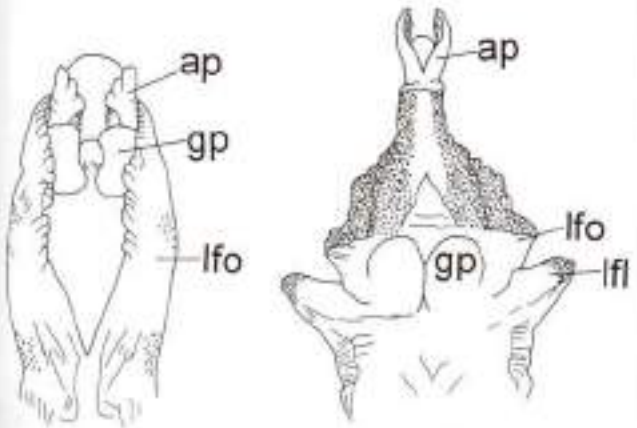

Fig. 67: Glans penis (ventral view) of Neomys anomalus *(left) and* N. teres *(right). ap = apical process, gp = globular processes, lfo = lateral fold, lfl = lateral flap. Not to scale.*

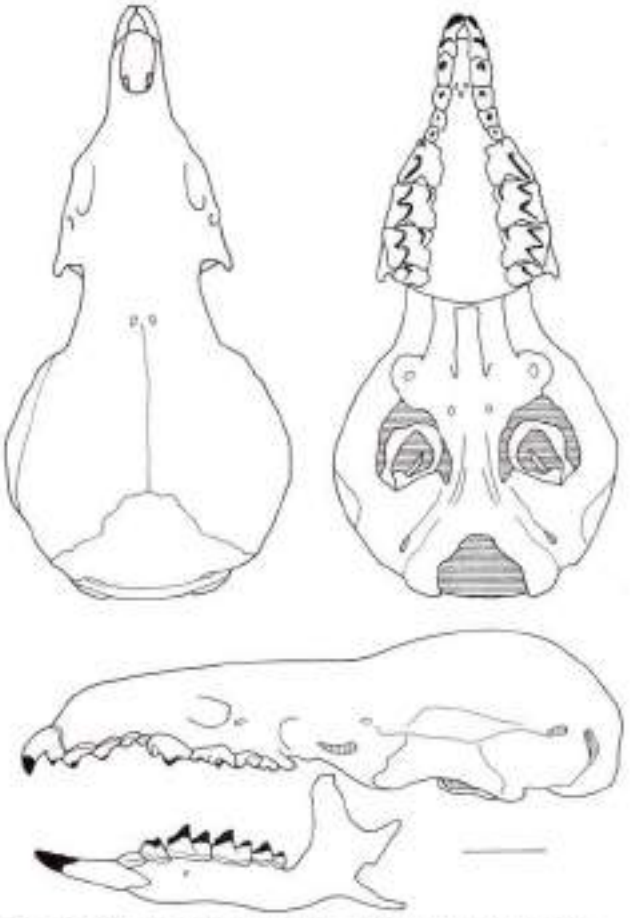

Fig. 68: Skull and mandible of Neomys anomalus *from Doğankōy (Eber Gölü) near Afyon, Central Anatolia, Turkey. Scale bar = 3 mm.*

	Thrace			*Anatolia*		
	N	*mean*	*min–max*	*N*	*mean*	*min–max*
Head and body	13	79.6	72–89	19	82.5	76–90
Tail	13	50.8	45–55	17	55.1	46–60
Hind foot	13	15.8	14.8–17.8	19	16.7	15.5–18.3
Weight	13	12.6	7–20	19	12.7	10–18
Condylobasal lenght	12	20.2	19.4–20.9	18	21.0	20.1–21.8
Braincase breadth	12	10.3	9.7–10.7	17	10.5	9.9–11.1
Coronoid height	13	4.60	4.35–4.80	20	4.75	4.4–5.0

Table 12: External and cranial dimensions of Neomys anomalus *from Turkey. Because of significant interpopulational differences, the European sample was treated separately from the Anatolian one. Based on Kryštufek* et al. *(1998) and NMW material.*

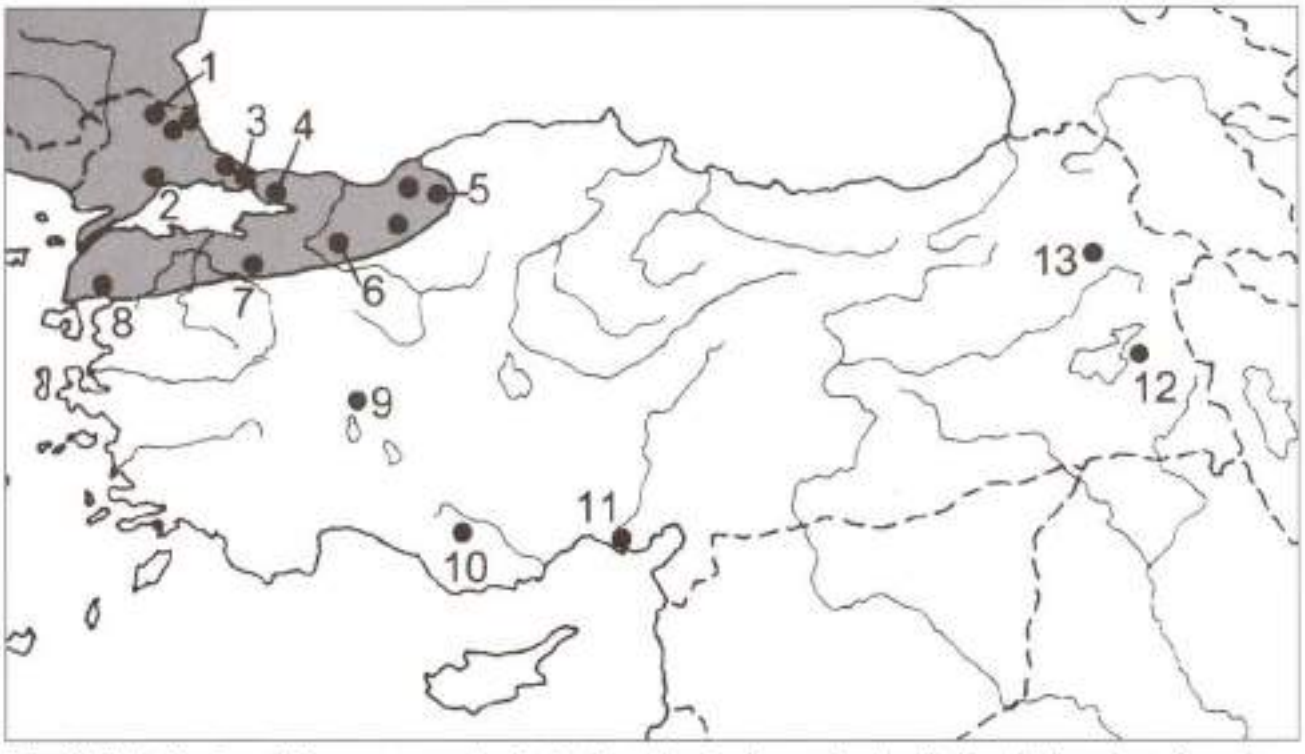

Fig. 69: Distribution of Neomys anomalus *in Turkey. Marginal records: 1 = Kırklareli, Sarpdere, Dupnisa Mağarası; 2 = Tekirdağ, Paşa Alandere estuary; 3 = İstanbul, Belgrad Orman; 4 = Mehmutşevketpaşa; 5 = 8 km north-west Yenice; 6 = Kapıorman Dağları, Hanyatak köyü; 7 = Bursa, Ulu Dağ; 8 = Kaz Geçidi, 10 km south-east Çırpılar; 9 = Eber Gölü, Doğanköy; 10 = Konya, Balkusan; 11 = Adana, Yeşilobu; 12 = Erçek Dağ; 13 = Sarikamiş. Corresponding reference: Kryštufek* et al. *(1998).*

Variation

Turkish *N. anomalus*, living in allopatry, are generally larger than their European counterparts (which are mainly sympatric with the water shrew *N. fodiens*). Anatolian specimens are larger than those from Thrace, whilst shrews from central Anatolia (Eber Gölü) are particularly big (Kryštufek *et al.*, 1998; Table 12). There seems to be no difference in ventral colour between populations from Europe and Anatolia.

A 335-base pair fragment of the mitochondrial *b* gene and a 375–378 base pair 12S rRNA sequence placed Anatolian *N. anomalus* close to a sample from Slovenia (Kryštufek *et al.*, 2000).

Distribution

Southern and central Europe, from the Iberian Peninsula to Crimea and the Dnepr River (Ukraine). Scattered isolates are also present in France, Denmark, Poland, Belarus and northern Iran. The species is absent from the Caucasus (Sokolov & Tembotov, 1989).

Miller's water shrew is common in northern Thrace (mainly along the Black Sea Coast). Its range is presumably contiguous in north-western Anatolia, but only scattered records are available from central, southern and eastern Anatolia (Fig. 69). Future research will show the extent to which these populations are actually isolated. There is a single case of sympatry of the two Turkish *Neomys* species: at Abant Gölü near Bolu (Kryštufek *et al.*, 1998; Fig. 70).

Habitat

As the most terrestrial *Neomys* species, it is also the least dependent on permanent water bodies (Kryštufek & Tvrtković, 1988). In Thrace, where it is the only water shrew present, *N. anomalus* inhabits the same habitats as *N. fodiens* in Europe, *i.e.* streams and small rivers in deciduous forests, from sea level up to 650 m (Kryštufek *et al.*, 1998; Fig. 52). A broad variety of habitats are occupied in Anatolia (Figs. 13, 70, Plate V.2), where the species is scarce. The species was found in dense vegetation or in marshes along streams, in both open places and in forests, in dense marshy

Fig. 70: Mountain river within a deciduous forest near Lake Abant, western Black Sea Mts (altitude ca. 1,200 m asl). Habitat of Neomys anomalus, *in addition to* Apodemus uralensis, Arvicola terrestris, and Clethrionomys glareolus. Neomys teres *was collected not far from this place. Photo: B. Kryštufek.*

vegetation surrounding lakes (central Anatolia), and even in an irrigated garden near Adana (Kryštufek *et al.*, 1998). The majority of eastern Anatolian records are from owl pellet samples, thus here the habitat is not well known. The species' vertical range in Anatolia is between 45–2,100 m asl.

Transcaucasian Water Shrew - Neomys teres

Neomys teres Miller, 1908. Type loc.: 25 miles north of Erzurum, Turkey.

Taxonomy

This species has been reported for Turkey under the names *N. fodiens* (Kumerloeve, 1975a; Spitzenberger, 1968; Corbet, 1978) or *N. fodiens teres* (Spitzenberger & Steiner, 1962) and in the Caucasus as *N. schelkovnikovi* (Sokolov & Tembotov, 1989; Hutterer, 1993; Wolsan & Hutterer, 1998). However, the morphology of glans penis provides strong evidence that large water shrews from northern Turkey and the Caucasus are conspecific - *i.e. N. schelkovnikovi* Satunin, 1913 (type locality Uškul village, Georgia), is a junior synonym of *N. teres* (Kryštufek *et al.*, 1998). Turkish *N. teres* are genetically distinct from the European *N. fodiens*. A 335-base pair fragment of the mitochondrial *b* gene and a 375–378 base pair 12S rRNA sequence place *N. teres* as a sister species of *N. anomalus* and not of *N. fodiens* (Kryštufek *et al.*, 2000).

Description

The largest *Neomys* shrew (Table 13), *N. teres* externally resembles *N. anomalus*, but the tail and hind feet are longer (relative length of tail is 64–85% of head and body length). The ventral keel of stiff hair is present in *ca.* 50% of specimens (it is common in *N. fodiens*), however, stiff hair along the lateral edge of the hind foot are common in *N. teres*, as is the case in *N. fodiens* (Kryštufek *et al.*, 2000). The back is almost black and the belly is silvery greyish (Plate XII). Yellow to brownish tinges are quite common, either restricted to the throat, to the inguinal region, or sometimes they are widespread all over the ventral side. Occasionally, specimens have a blackish throat spot and one specimen examined had a dark broad throat band and a mid-ventral stripe (Fig. 65). In general, dark bellied specimens seem rarer in *N. teres* than in Turkish *N. anomalus*. The hind foot has a dark stripe, as is also the case in the previous species. The glans penis (length 10.8–14.6 mm) is much prolonged distally (*i.e.* to the anterior of the lobular processes) resulting in a pointed apex. The fleshy lateral folds are more expanded, with extensive field of surface horny spines (Fig. 67; Kryštufek *et al.*, 2000). The skull is large, strongly built, and with pronounced lambda ridges (Fig. 71).

Variation

Several subspecies have been recognised from the Caucasus by Sokolov & Tembotov (1989): *N. t. schelkovnikovi* Satunin, 1913 (4th upper unicuspid small, occasionally partly hidden by the posterior cheek-tooth when observed from the lingual side), *N. t. balkaricus*

	N	*Mean*	*min–max*
Head and body	22	92.7	85–101
Tail	23	67.2	53–73
Hind foot	23	19.6	18.2–22.1
Weight	21	18.0	11–28
Condylobasal lenght	16	22.2	21.6–23.0
Braincase breadth	15	11.1	10.4–11.8
Coronoid height	22	4.87	4.7–5.1

Table 13: External and cranial dimensions of Neomys teres *from Turkey. Based on Kryštufek* et al. *(1998) and material in BMNH.*

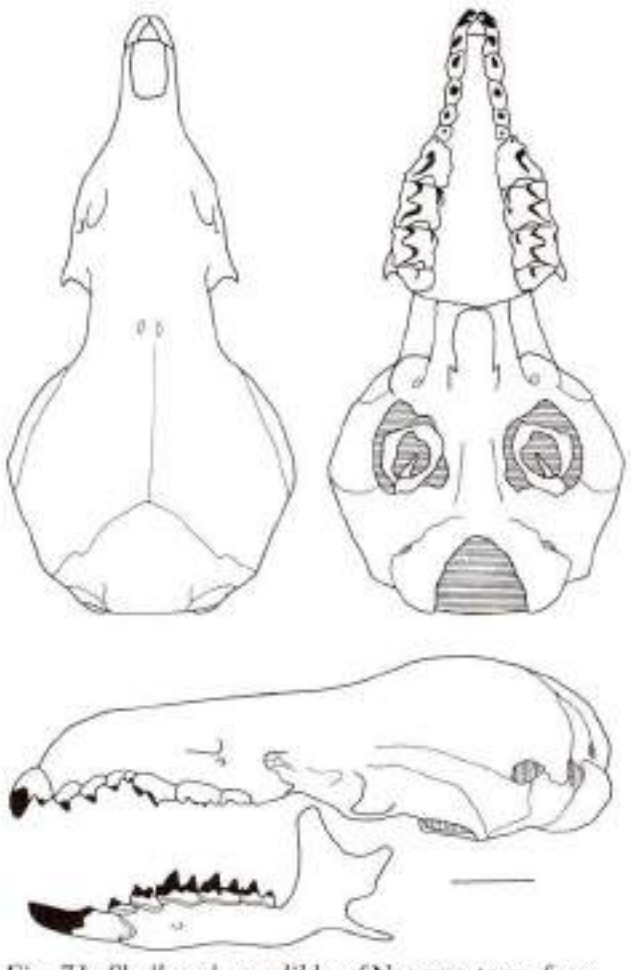

Fig. 71: Skull and mandible of Neomys teres *from Tandere near Giresun, Turkey. Scale bar = 3 mm.*

Ognev, 1926 (4th upper unicuspid large) and *N. t. leptodactylus* Satunin, 1914 (4th unicuspid small, but never hidden by the posterior cheek tooth). Colour differences are also considered to be important. The shrews we saw from Turkey are not readily ascribable to any of the above morphotypes, but this might be an artefact of small sample sizes. The size of the 4th unicuspid is certainly variable across small geographic distances in Turkey (Fig. 72) and, for the moment, we are inclined to believe that *N. teres* shows no significant interlocality morphological variation in Turkey.

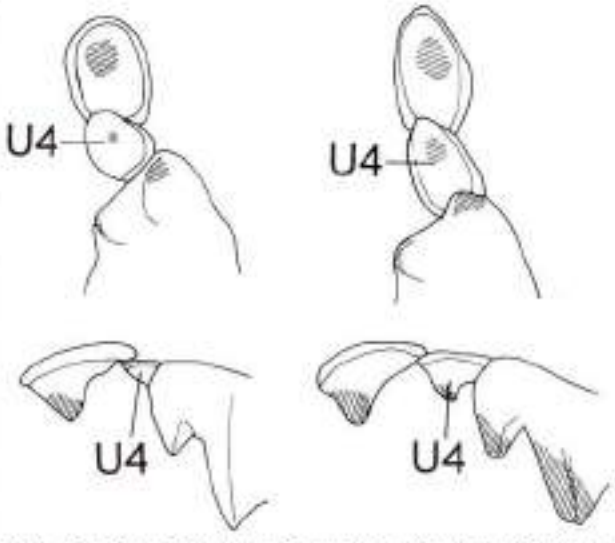

Fig. 72: Variability in size of the 4th unicuspid (U4) in two Transcaucasian water shrews from Tandere (left) and Topçam (right). Norma ventralis *is above, and* Norma lateralis *(buccal side) is below.*

Distribution

Endemic to the Caucasus and adjacent regions of Turkey, and possibly also in Iran (see Hutterer, 1993). The northernmost records are from Russia on the rivers Kuban and Terek, the southernmost is from Lenkoran', Azerbaijan (Sokolov & Tembotov, 1989). In Turkey the species inhabits the Black Sea Mts (as far to the west as Bolu) and the vicinity of Lake Van (Fig. 73).

Habitat

Closely associated with streams and small rivers. All Turkish records are from mixed or coniferous forests and alpine meadows between 500–2,450 m asl (Kryštufek *et al.*, 1998; Plate VI.2); banks densely overgrown with lush vegetation are preferred. In the Caucasus (vertical range from sea level to 2,500 m asl) habitat selection is apparently the same as in Turkey; in addition the species follows irrigation channels and ditches into fields and orchards (Bakhnikashvili & Kandaurov, 1998).

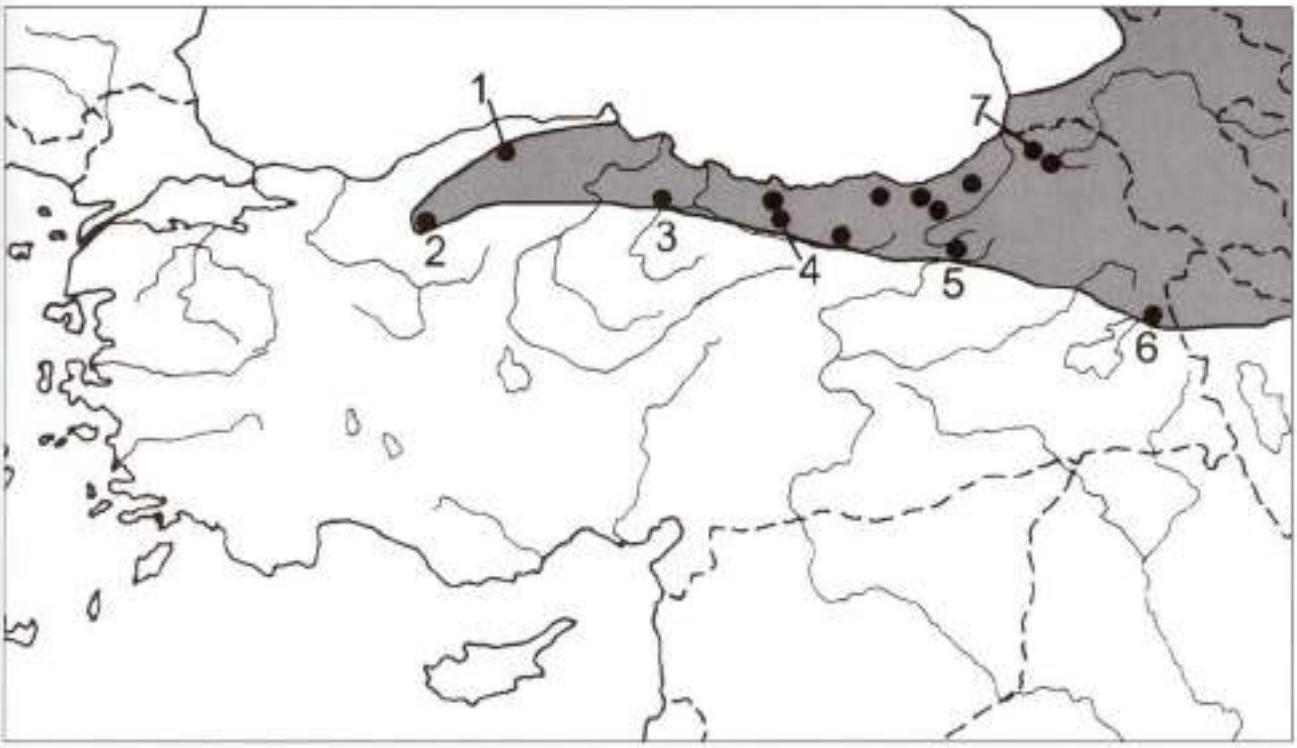

Fig. 73: Distribution of Neomys teres *in Turkey. Marginal records: 1 = 5 km north of Safranbolu; 2 = Bolu, Abant Gölü; 3 = Amasya, 2 km east of Seyfe; 4 = Topçam; 5 = 25 miles north of Erzurum; 6 = Bendimahi Canyon, 5 km north-east of Muradiye; 7 = Artvin, Kutul. Corresponding reference: Kryštufek* et al. *(1998).*

Genus: *Crocidura* Wagler, 1832

The most specious genus of shrews, characterised by fairly large ears and eyes, and by sparse long tactile hair on the tail (Fig. 74). There are three inguinal pairs of nipples. The skull is more robust than in *Sorex*, the rostrum is shorter and there are only three unicuspid teeth (Fig. 75, 76). The teeth have white tips, the upper incisor is hooked, and the cutting edge of the lower incisor is not cusped (Fig. 75). Dental formula: 3/1, 1/1, 1/1, 3/3 = 28. Colour is variable, but species from the western Palaearctic are mainly brown or grey with a paler to pure white belly. *Crocidura* is confined to the southern Palaearctic and Oriental regions and Africa; *ca.* 150 species are currently recognised, the majority of them from sub-Saharan Africa; three species occur in Turkey and Cyprus.

Among the Turkish species, *C. arispa* is the most distinct, although its actual position within the *pergrisea* species group is still far from clear. The remaining two species *(leucodon* and *suaveolens),* both highly variable in this region, have caused long-standing confusion. In general, *C. leucodon* is larger, however, geographic variability is likely to obscure size differences when distinct geographic samples are pooled (Table 14). Sympatric populations are successfully separated by the coronoid height alone, at least in Thrace, the Aegean region and along the Black Sea Coast. Little material is available from regions where *C. leucodon* becomes dwarfed, *i.e.* from eastern Anatolia and the western part of the Taurus Mts.

The tail is always relatively shorter in *C. leucodon*: its relative length (given as a percentage of the head and body length) is less than 60% (Spitzenberger, in Felten *et al.*, 1973) while it is greater than 55% in *C. suaveolens* (Figs. 77, 78). The actual overlap is likely to be less than this, as the results in Figs. 77 and 78 are biased by inconsistent measuring amongst different collectors. Other characters that allow the separation of the two shrews in Europe (Niethammer & Krapp, 1990) do not function in the Near and Middle East. *C. leucodon* is normally bi-coloured with a sharp demarcation between the white belly and the dark back, however, this difference is lost in the dark-bellied *C. leuc-*

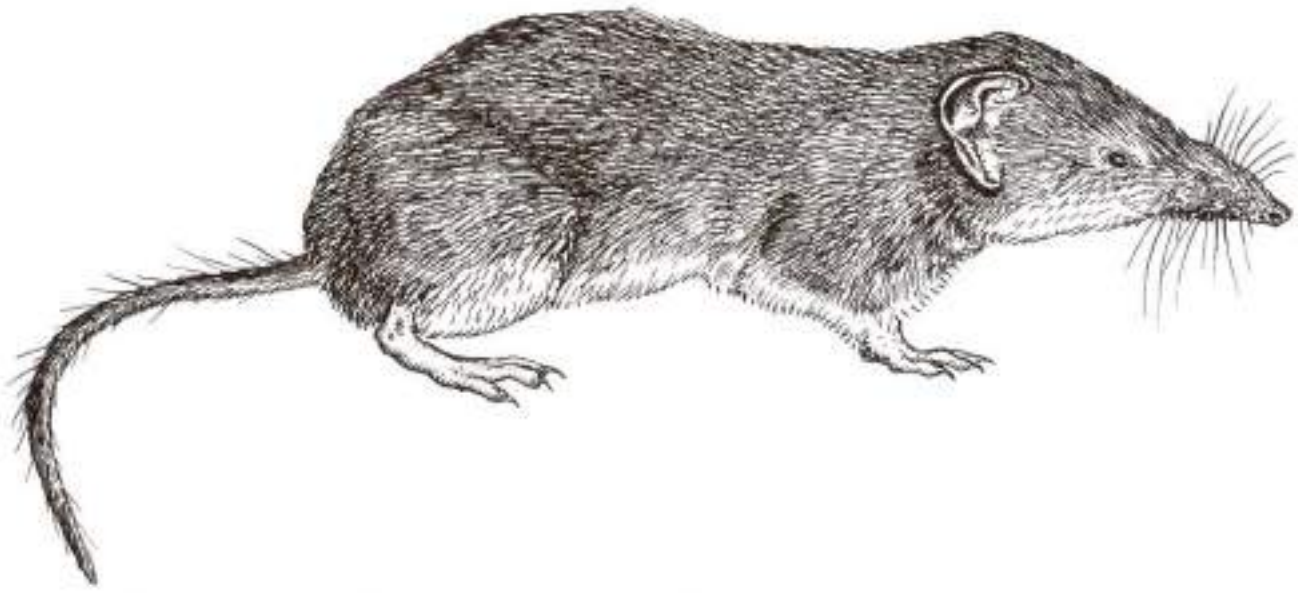

Fig. 74: White-toothed shrew Crocidura *sp. Drawing: S. Polak.*

odon lasia from the north-east Black Sea Coast.

Cranial characters are vague, and again those proposed for Europe *(e.g.* Niethammer & Krapp, 1990) do not hold in Turkey. The most stable seems to be the size and shape of the parastyle of the large upper premolar (P4), however, along the East Black Sea Coast, *C. leucodon lasia* does not differ from sympatric *C. suaveolens monacha*, and both have distinctly pointed parastyle (Fig. 79). However, even in cases such as these, when *C. leucodon* resembles *C. suaveolens* in coloration and in dental characters (as in the vicinity of Trabzon) the existence of two species can be demonstrated easily (Fig. 80). The shorter tailed *C. leuc-*

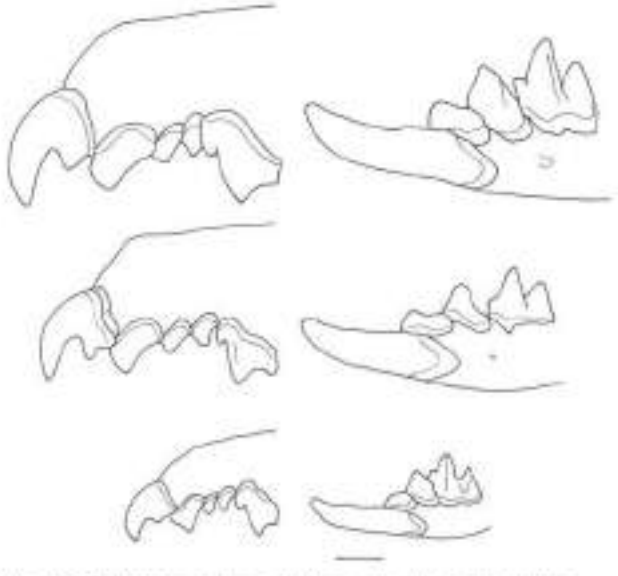

Fig. 75: Dental pattern of the anterior part of the rostrum (left column) and the anterior part of the mandible (right column) in three white-toothed shrews from Turkey. From top to bottom: Crocidura leucodon *(near Ayvacık),* C. suaveolens *(Bafra near Samsun) and* Suncus etruscus *(Adana). Scale bar = 1 mm.*

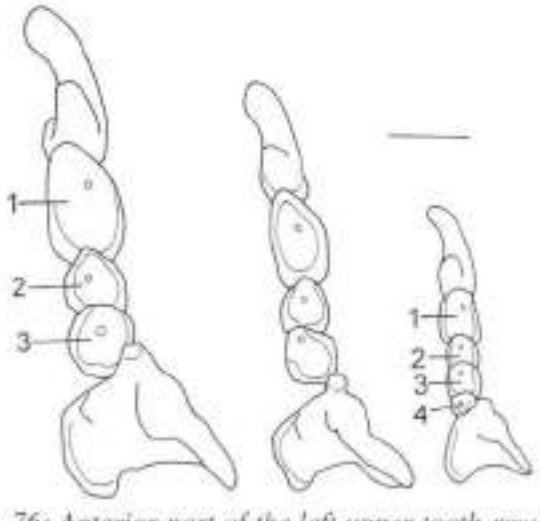

Fig. 76: Anterior part of the left upper tooth-row in three white-toothed shrews from Turkey (ventral view). From left to right: Crocidura leucodon *(near Ayvacık),* C. suaveolens *(Bafra near Samsun) and* Suncus etruscus *(Adana). Numbers indicate unicuspid teeth. Scale bar = 1 mm.*

	C. suaveolens	*C. leucodon*
Thrace	4.2–4.7	4.8–5.1
West Anatolia	4.2–4.7	4.8–5.5
Black Sea Coast	4.3–4.9	5.0–5.9
Turkey	4.0–5.0	4.3–5.9

Table 14: Ranges for the coronoid height (in mm) in C. suaveolens *and* C. leucodon *from Turkey by regions. Sympatric populations differ in size although their total ranges broadly overlap.*

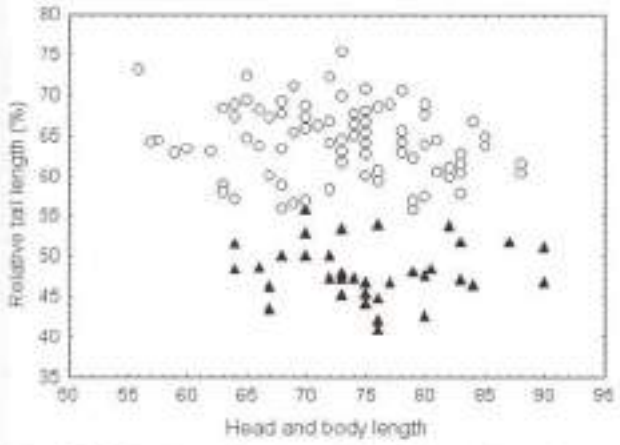

Fig. 77: Plot of a relative tail length (tail length with head and body as denominator multiplied by 100) against head and body length of a pooled sample of C. leucodon *(triangles) and* C. suaveolens *(circles) from Turkey.*

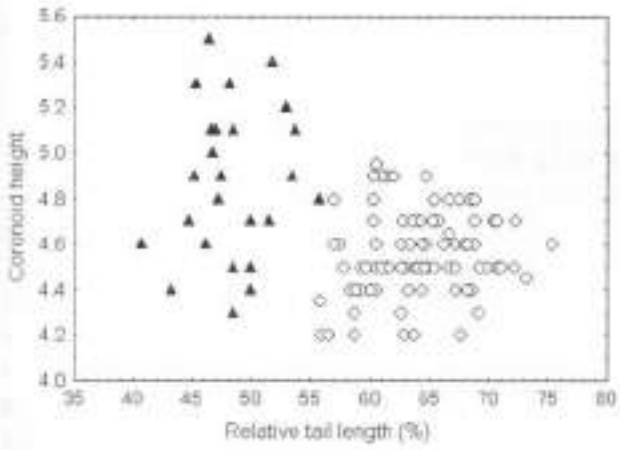

Fig. 78: Plot of coronoid height against relative tail length (tail length with head and body as denominator and multiplied by 100) of pooled samples of C. leucodon *(triangles) and* C. suaveolens *(circles) from Turkey.*

odon also differs from sympatric *C. suaveolens* by its larger size. There also seem to be ecological differences between the two. Amongst 31 white-toothed shrews, collected in winter 1905/06 by A. Robert at two localities near Trabzon (Altindere, altitude 700–1,000 m asl; Çosandere 1,000–1,200 m asl), *C. leucodon* was evenly distributed between the two sites (Altindere = 10 specimens; Çosandere = 8) but nearly all *C. suaveolens (i.e.* 12 of 13) were obtained in Çosandere.

KEY TO SPECIES:

1. Dorsal pelage silver grey; ears large (more than 9 mm); skull much flattened (braincase height less than 23% of condylobasal length); coronoid process as low as 4.1 mm *C. arispa*

1* Dorsal pelage brown; ears smaller (9 mm and less); skull not much flattened (braincase height at least 23% of condylobasal length); coronoid process 4.2 mm or more 2

2 Tail length less than 63% of head and body; belly white with a clear demarcation line along the flanks; P4 parastyle with a blunt apex or without it (Fig. 79)* *C. leucodon*

2* Tail length more than 55% of head and body; belly grey, no boundary line towards back; P4 parastyle with a pointed apex (Fig. 79)* *C. suaveolens*

* In the case of specimens from the eastern Black Sea region, for specific identification rely on coronoid height (Table 14) and on body proportions (Fig. 80).

Fig. 79: Variability in the parastyle of the 4th upper premolar in Crocidura suaveolens *and* C. leucodon. *From left to right:* C. suaveolens *(vicinity of Artvin),* C. suaveolens cypria *(vicinity of Larnaca, Cyprus),* C. leucodon *(vicinity of Manisa). pa = parastyle, mc = metacone, ms = metastyle.*

Bi-coloured White-toothed Shrew - *Crocidura leucodon*

Sorex leucodon Hermann, 1780. Type loc.: vicinity of Strasbourgh, Bas Rhine, eastern France.

Crocidura leucodon lasius Thomas, 1906. Type loc.: Scalita (= Altindere), near Trabzon, 700–1,000 m asl, Turkey.

Taxonomy

Large shrews of this group from the Black Sea Coast, western Anatolia, adjacent Aegean Islands and the Near East were usually treated as a separate species, named either *C. lasia* (Spitzenberger, 1970a; Felten *et al.*, 1973; Kumerloeve, 1975a; Atallah, 1977; Harrison & Bates, 1991; Hutterer & Harrison, 1988) or *C. lasiura* (Osborn, 1969b; Ondrias, 1969). Thomas (1906) described *lasia* as a subspecies of *C. leucodon*, but later raised it to species level (Thomas, 1907). On morphological grounds, Jenkins (1976) considers *lasia* to be a part of *C. leucodon*, and this is further supported by karyological data (Catzeflis *et al.*, 1985). This view, accepted by Gureev (1979), Hutterer (1993) and Quimsiyeh (1996) is followed also here.

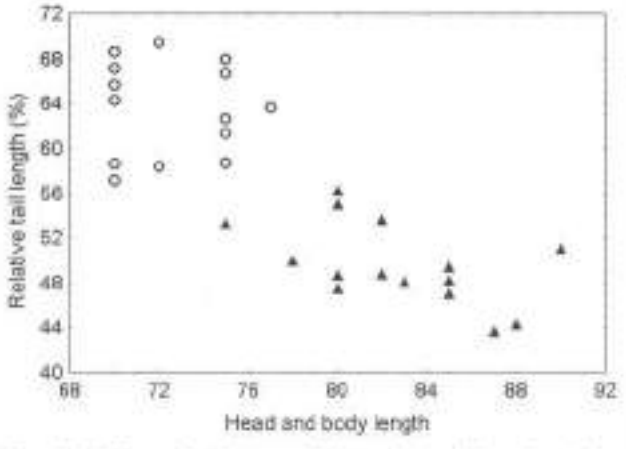

Fig. 80: Plot of relative tail length (tail length with head and body as denominator and multiplied by 100) against head and body length of sympatric C. leucodon *(triangles) and* C. suaveolens *(circles) from the vicinity of Trabzon, eastern Black Sea Coast. To avoid measuring errors, all measurements are from a single collector (i.e. A. Robert, BMNH).*

It should be underlined however, that the *C. leucodon* group in the Near and Middle East is in need of thorough revision. In our opinion, which is based on the examination of the corresponding type specimens in the BMNH, the following names are most likely junior synonyms of *C. leucodon*:

- *Crocidura leucodon persica* Thomas, 1907 (type loc.: Elbruz Mts near Demavend, Iran): a small (condylobasal length of the type is 18.7 mm, coronoid height 4.9 mm), short-tailed (tail = 48.6% of head and body length) and distinctly bi-coloured shrew with a blunt P4 paracone. It is evidently restricted to high altitudes (the type comes from *ca.* 2,150 m asl).
- *Crocidura russula caspica* Thomas, 1907 (type loc.: south-western coast of the Caspian Sea, Iran) is a large (condylobasal length of four BMNH topotype specimens, including the type, is between 19.7–20.6 mm, coronoid height 5.5–5.6 mm), short-tailed (tail is from 49.4–57.8% of head and body length) and, due to its dark belly, nearly uniformly blackish-brown shrew. The P4 paracone is either blunt (the type) or distinct and hooked, as in *C. suaveolens*. This is a lowland form, restricted to the south coast of the Caspian Sea.
- *Crocidura russula judaica* Thomas, 1919 (type loc.: near Jerusalem, Israel) is bi-coloured, short tailed shrew (the type has not been measured) with a blunt P4 paracone. The coronoid height of the type is 5.2 mm; the skull is badly damaged.

Considering interlocality differences in size, colour, and dental characters, variation in the bi-coloured white-toothed shrew exceeds that seen in any other shrew in the region.

Description

A fairly short tailed shrew; tail is usually between 41–55% of head and body. Upper parts are olive brown to mouse grey; belly is white (hair bases are grey) but darker in specimens around Trabzon. On the flanks, the delineation between the dark dorsal and pale ventral colour is usually sharp; this line, however, is obscured when the belly is dark. The tail is usually indistinctly bi-coloured in white bellied specimens, but monochrome dark in darker bellied ones (Plate XIII).

The skull is not easily distinguished from that of *C. suaveolens*, however, in sympatry the latter is smaller (Fig. 81). This pattern is again obscured in eastern Anatolia, where the two are of approximately the same size. Although data are scarce they suggest that dif-

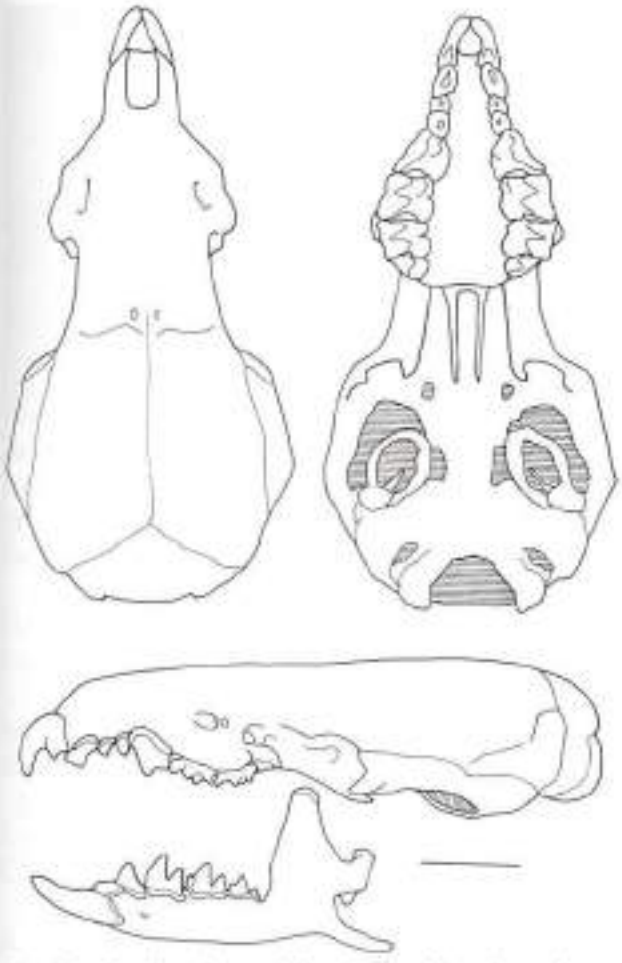

Fig. 81: Skull and mandible of Crocidura leucodon *from Harput near Elazığ, Turkey. Scale bar = 3 mm.*

ferences in the coronoid height might remain stable; *e.g.* in three white-toothed shrews collected near Elazıg, the coronoid heights are 4.7 and 4.7 mm in two *C. leucodon*, respectively, and 4.4 mm in a single *C. suaveolens*.

Turkish bi-coloured white-toothed shrews share the same karyotype (2N = 28, NF = 56) as their European counterparts (Tez, 2000), however, Catzeflis *et al.* (1985) report two distinct fundamental numbers, NF = 54 and NF = 56. The karyotype of *C. leucodon* from the Island of Lesbos matches the condition seen in Europe, *i.e.* 2N = 28, NF = 56 (Vogel & Sofianidou, 1996). *C. lasiura* has 2N = 40 (Maddalena & Ruedi, 1994).

Variation

Spitzenberger (in Felten *et al.*, 1973) documents enormous variation in size, colour and the relative tail length (see also Table 15). The population from Cığlikara is particularly small, and specimens from Thrace (ascribed by Spitzenberger (in Felten *et al.*, 1973) to ssp. *narentae*) are next to this in size. The largest animals are from the eastern Black Sea coast *(lasia)* and the Aegean region of western Anatolia. Pooling of large shrews from these widely separated regions of Anatolia as ssp. *lasia* is not consistent with the pattern of colour and dental variation. Namely, dark bellied shrews were found only around Trabzon, and are thus more restricted in distribution than the large morphotype. Gureev (1979) diagnosed ssp. *lasia* by its large size, and distinguished it from the nominate subspecies by the condylobasal length of skull: at least 21.0 mm in ssp. *lasia* and 20 mm or less in ssp. *leucodon*. This character does not hold in Turkey.

	min–max	*1* *N=11*	*2* *N=8*	*3* *N=10*	*4* *N=26*	*5* N=8
Head and body	62–69	75.4	77.8	68.9	82.0	69.3
Tail	29–46	34.8	40.1	33.7	40.9	34.2
Hind foot	11–15.0	13.4	12.8	12.4	13.7	11.9
Weight	5–14	9.4	10.2	–	12.8	6.5
Condylobasal lenght	16.7–22.4	19.5	19.9	17.7	20.4	18.0
Braincase breadth	7.8–10.4	9.3	9.1	8.5	9.6	8.8
Coronoid height	4.3–5.9	4.95	5.14	4.52	5.35	4.65

Table 15: External and cranial dimensions of Crocidura leucodon *from Turkey. Mean values are given for individual geographic samples to demonstrate interpopulation variability. The first column gives the range of a pooled Turkish sample. Sample identities: 1 = Thrace, 2 = Aegean region, 3 = Taurus Mts (Cığlikara), 4 = eastern Black Sea Mts, 5 = eastern Anatolia. Based on Osborn (1965b), Spitzenberger (in Felten* et al.*, 1973), Vogel & Sofianidou (1996), specimens in NMW, BMNH and SMF and own data.*

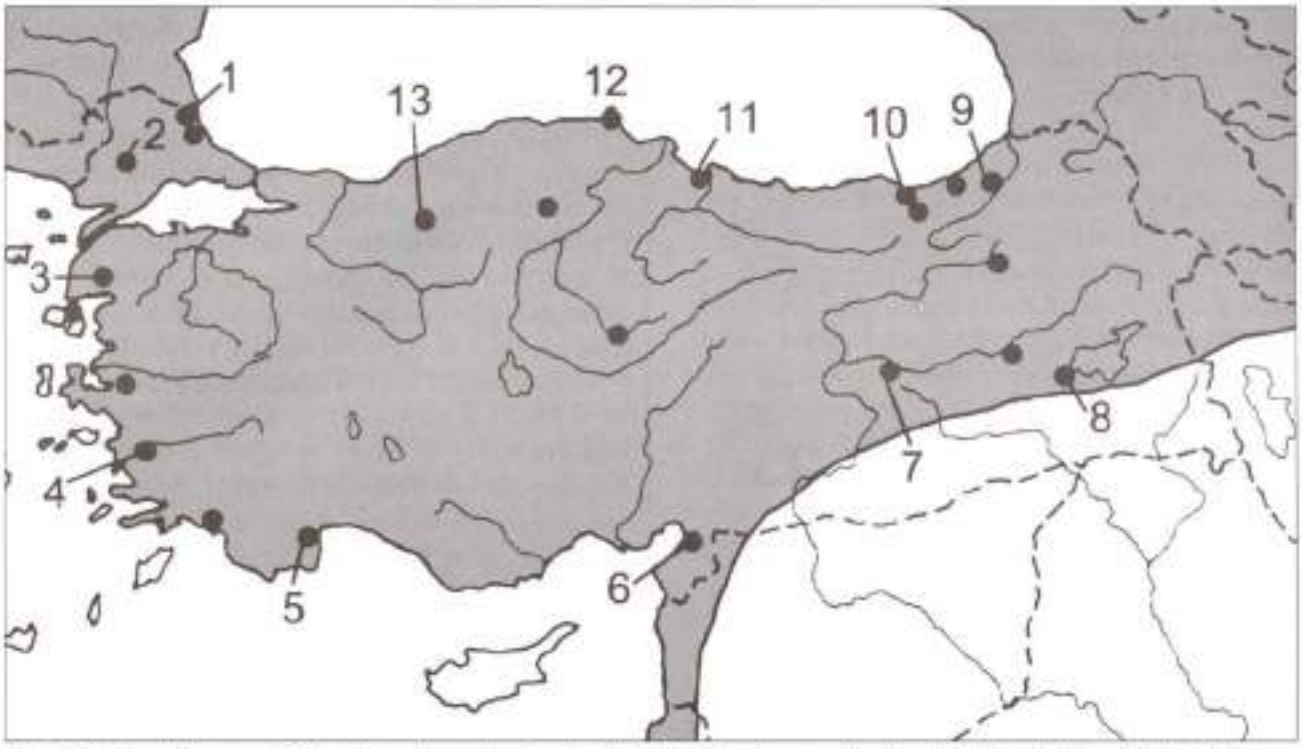

Fig. 82: Distribution of Crocidura leucodon *in Turkey. Marginal records: 1 = Kırklareli, Demirköy, Mahya Dağı; 2 = Edirne, Karakasım; 3 = Ayvacık, Behram; 4 = Kemalpaşa; 5 = Ciğlikara; 6 = Belen; 7 = Elazığ, Harput, Buzluk Mağarası; 8 = Tatvan; 9 = Ülkü; 10 = Trabzon; 11 = Samsun, 12 = Bektaşağa; 13 = Bolu, Seben Dağ. Corresponding references: Felten* et al. *(1973): 4, 5, 8, 9, 11, 13. Obuch (1994): 6. Vogel & Sofianidou (1996): 10. Osborn (1965b): 12. Own data: 1, 2, 3, 7.*

Distribution

Western Palaearctic, from northern France across central, southern and eastern Europe to the Volga, Caucasus, northern Iran and Palestine.

Turkish records are quite scarce, but are widely scattered in all regions (Fig. 82) so the species is presumably widespread except in south-eastern Anatolia. The majority of localities come from the coast; very few are from central Anatolia, but their number increases in eastern Anatolia. This shrew is absent from Cyprus, and from the majority of the Mediterranean Islands (the Aegean Island of Lesbos and the Adriatic Island of Cres are the only exceptions).

Habitat

Various habitats are populated and the species was found from close to sea level (Thrace, coast of the Aegean region) up to 1,700 m (Cığlikara) and 1,950 m asl. (Erzurum). In Georgia the species' vertical range is between sea level and 2,100 m (Bukhnikashvili & Kandaurov, 1998); Lay (1967) reports it at Khorassan, Iran, from *ca.* 2,150 m asl and Atallah (1977) from 2,000 m asl in Lebanon. The majority of Turkish specimens are from hedges, rock walls, dense tall grass and rocky habitats (Plates I,1 and II,2). In central Anatolia and at Cığlikara, it lives in hardwood forests (Osborn, 1965b; Felten *et al.*, 1973); similar habitats are also inhabited in Khorassan. Some specimens were collected at rodent burrow entrances: *Microtus (Terricola)* sp. in Cığlikara (Spitzenberger, in Felten *et al.*, 1973) and *M. guentheri* in eastern Turkey (Elazığ; Fig. 83) and Lebanon (Atallah, 1977). *C. leucodon* is frequently syntopic with *C. suaveolens*, however, the latter strongly dominates throughout Turkey. Of the 188 *Crocidura* shrews we collected in Turkey between 1993–1995, 180 were *C. suaveolens* and only 8 *(i.e.* 4.4%) were *C. leucodon*. *C. suaveolens* was the only member of the genus at 32 localities, and was syntopic with *C. leucodon* in a further four places; *C. leucodon* was the only white-toothed shrew on one single site. It is notable that Spitzenberger (in Felten *et al.*, 1973) found *C. leucodon* to be relatively abundant in

Fig. 83: Dry grassy slope near Elazig, East Anatolia. Habitat of Crocidura leucodon *and* C. suaveolens, *in addition to* Cricetulus migratorius *and* Microtus guentheri. *Photo: B. Kryštufek.*

karstic habitats at Cığlıkara, where it was free from competition with *C. suaveolens*. Tez (2000) states that it is more abundant in Thrace than in Anatolia. In Altindere near Trabzon, *C. leucodon* was collected with *Sorex raddei* (Catzeflis *et al.*, 1985).

Lesser White-toothed Shrew - *Crocidura suaveolens*

Sorex suaveolens Pallas, 1811. Type loc.: Khersones, near Sevastopol, Crimea, Russia.

Sorex gueldenstaedtii Pallas, 1811. Type loc.: near Dusheti, Georgia, Transcaucasia.

Crocidura russula cypria Bate, 1904. Type loc.: Cyprus.

Crocidura russula monacha Thomas, 1906. Type loc.: Scalita (= Altindere), Trabzon, 700–1,000 m asl, Turkey.

Crocidura russula aralychensis Satunin, 1914. Type loc.: marshy shores of the River Karasu, near Aralık, Turkey.

Crocidura suaveolens praecypria Reumer & Oberli, 1988. Type loc.: Kouklia, Cyprus. Stratum typicum: Holocene (Bronze Age), 13th–12th century BC.

Taxonomy

The high variability within eastern Mediterranean populations of *C. suaveolens* has, in the past, resulted in the recognition of two artificial, size-based species. In Turkey, the smaller species was uniformly called *C. suaveolens*, but several names were used for the bigger morphotype: *C. russula* (Osborn, 1965b), *C. gueldenstaedti* (von Lehmann, 1966; Zaitsev, 1991; Wolsan & Hutterer, 1998), *C. russula gueldenstaedti* (Spitzenberger, 1970a; Felten *et al.*, 1973; Corbet, 1978), and *C. russula monacha* (Jenkins, 1976). *C. russula monacha* of Thomas (1906) was frequently also synonymised with *C. guledenstaedti* (Anděra, 1972; Corbet, 1978; Gureev, 1979). Similarly, the island form from Cyprus was considered either as a species on its own *C. cypria* (Spitzenberger, 1978a; Catzeflis, 1983; Reumer & Oberli, 1988; Nadachowski *et al.*, 1990) or as a subspecies: *C. russula cypria* (Ellerman & Morrison-Scott, 1966; Corbet, 1978). An extreme opinion is that of Zaitsev (1991) who only lists *C. gueldenstaedti* for Turkey; however, distinctive characters that he provides on the upper unicuspids and the large upper premolar did not separate our Turkish material from European *C. suaveolens*.

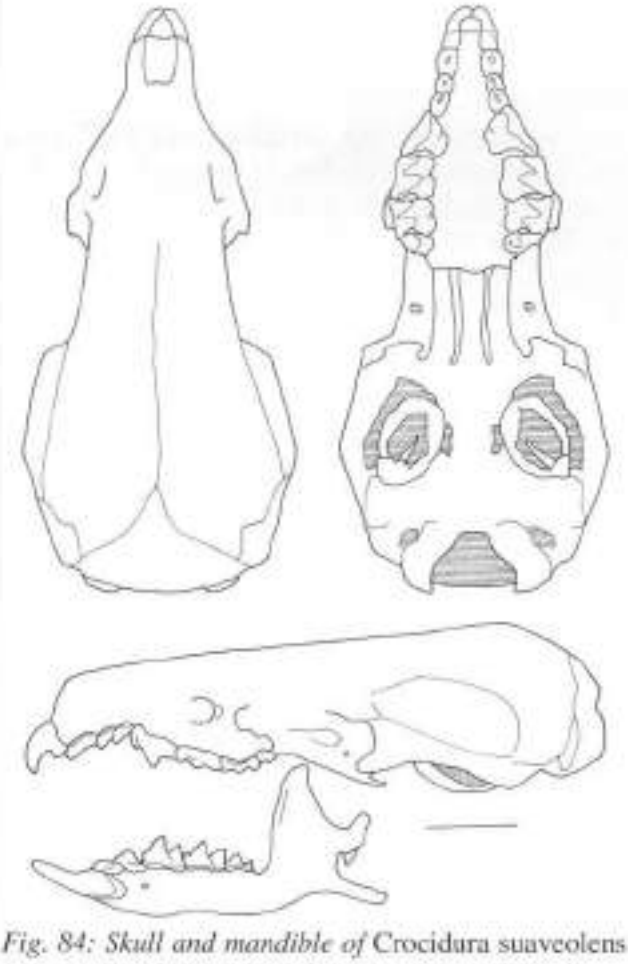

Fig. 84: Skull and mandible of Crocidura suaveolens *from Doğanköy (Eber Gölü) near Afyon, Central Anatolia, Turkey. Scale bar = 3 mm.*

Karyological and electrophoretic evidence acquired in the 1980s show that both *C. cypria* and *C. russula monacha* are indistinguishable from European *C. suaveolens* (Catzeflis, 1983; Catzeflis *et al.*, 1985; Vogel *et al.*, 1986). Catzeflis (1983) left open the subspecific position of *cypria*. Electrophoretic evidence suggests it to be older than *C. suaveolens canea* from Crete (1,500 BC), which is presumably of Asian origin (Vogel *et al.*, 1986). Reumer & Oberli (1988) see a direct ancestor for *cypria* in *C. suaveolens praecypria* from Bronze Age strata in Cyprus. The presumed ancestor was smaller than recent *cypria*; in addition the talonid of the 3rd lower molar is said to be more complex, having also a rudimentary entoconid. Specimens of both the recent *cypria* and *suaveolens* from Turkey that we examined, possessed an inconspicuous entoconid on m3. In size, *cypria* is closer to small *C. suaveolens* from Turkish Thrace, rather than to its large counterparts from the southern coasts of Asia Minor. However, it is generally darker and with relatively longer tail.

Description

A small shrew with the tail longer than half of the body length (usually 55–75% of head and body). The upper parts are brown to dark brown, the belly is grey, and the line of demarcation is obscured. The tail is usually monochrome dark, with a short terminal pencil (Plate XIV). For skull see Fig. 84. For comparison with *C. leucodon* see the latter. For size variation see Table 16.

Karyotypic data was reported for specimens from various localities in Turkey, including the topotypes of *monacha* and *aralycensis* (Catzeflis *et al.*, 1975; Kefelioğlu & Tez, 1999), and from Cyprus (Catzeflies, 1983). This is identical with the chromosome set of European *C. suaveolens*: 2N = 40, NF = 50.

Variation

Lesser white-toothed shrews are mainly large in Turkey (average condylobasal length over 18 mm), with smaller shrews (average condylobasal length less than

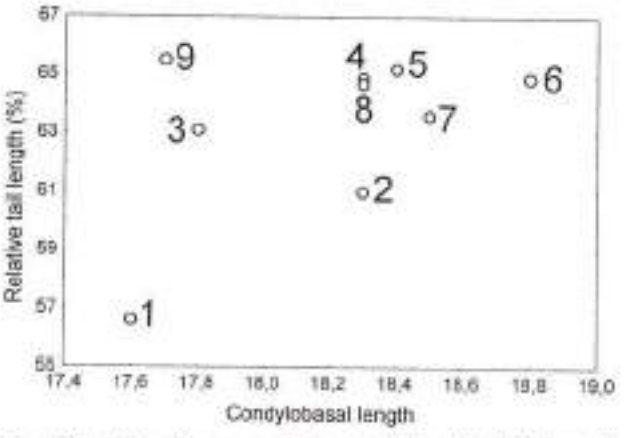

Fig. 85: Plot of mean relative tail length (tail length with head and body as denominator multiplied by 100) against mean condylobasal length in nine geographic samples of Crocidura suaveolens *from Turkey and Cyprus. See Table 16 for sample identities.*

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
	min–max	*N=16*	*N=16*	*N=17*	*N=32*	*N=52*	*N=46*	*N=15*	*N=13*	*N=23*
Head and body	56–88	66.0	72.8	66.9	72.0	73.0	78.4	72.6	75.5	69.5
Tail	35–56	37.0	44.1	42.1	45.5	47.6	50.7	46.1	48.3	43.3
Hind foot	10.8–14.3	12.1	12.8	12.5	12.9	12.7	13.9	13.3	12.9	12.1
Weight	4.5–15	8.4	9.4	6.7	8.7	8.8	9.3	–	8.2	7.7
Condylobasal lenght	16.6–20.1	17.6	18.3	17.8	18.3	18.4	18.8	18.5	18.3	17.7
Braincase breadth	8.1–9.4	8.5	8.7	8.4	8.6	8.6	8.9	8.9	8.6	8.5
Coronoid height	4.0–5.0	4.41	4.60	4.40	4.53	4.51	4.62	4.61	4.53	4.48

Table 16: External and cranial dimensions of Crocidura suaveolens *from Turkey and Cyprus. Mean values are given for individual geographic samples to demonstrate interpopulation variability. The first column gives the range of a pooled sample from Turkey and Cyprus. Sample identities: 1 = Thrace, 2 = western Black Sea Mts (Zonguldak region), 3 = Aegean region, 4 = central Anatolia (Konya Basin), 5 = eastern Taurus (vicinities of Ermenek, Adana and Kahraman Maraş; Hatay), 6 = central Black Sea Coast (Samsun region), 7 = eastern Black Sea Mts (Trabzon region), 8 = eastern Anatolia (Van, Erzurum, Doğubayazit), 9 = Cyprus. Based on Osborn (1965b), Spitzenberger (1978a, in Felten* et al., *1973), specimens in NMW and BMNH and own data.*

18 mm) coming from Thrace, the Aegean region and, surprisingly, Cyprus (Table 16). In the opinion of Reumer & Oberli (1988) size (as perceived through the coronoid height) did increase from the subfossil *praecypria* (average coronoid height 4.32, n = 9) to the recent *cypria* (average height 4.55, n = 55) which was ascribed to a general trend towards size increases seen in island populations of small mammals. When *cypria* is compared with large *suaveolens* from Anatolia, it can hardly be cited to support the island phenomenon of increased size.

Large shrews also tend to be darker and with a relatively longer tail. Anyhow, there is no linear relationship between these two variables; particularly exceptional are shrews from Cyprus, which are unusually long-tailed for their size (Fig. 85).

Distribution

Southern Palaearctics from northern Spain to Korea. Many Mediterranean islands, as well as several Channel and Pacific islands. It is the most widespread and most common shrew in Turkey and in Cyprus. Turkish records are widely scattered across the country, with the highest density of records along the Black Sea Coast and in the Aegean region. On the other hand, localities are scarcer in central, eastern, and particularly, south-east Anatolia. *C. suaveolens* is common on the Aegean islands off the western Turkish coast (Fig. 86).

Cyprus seems to be widely populated by this shrew, since the species has been found from the lowlands to the central mountains (Mt Troodos; Catzeflis *et al.*, 1985). Spitzenberger (1978a) collected it at ten localities out of 25 surveyed. Again, the majority of records are from the coastal regions of the island.

Habitat

Most common in dense, mainly thorny bushes (*Rubus*

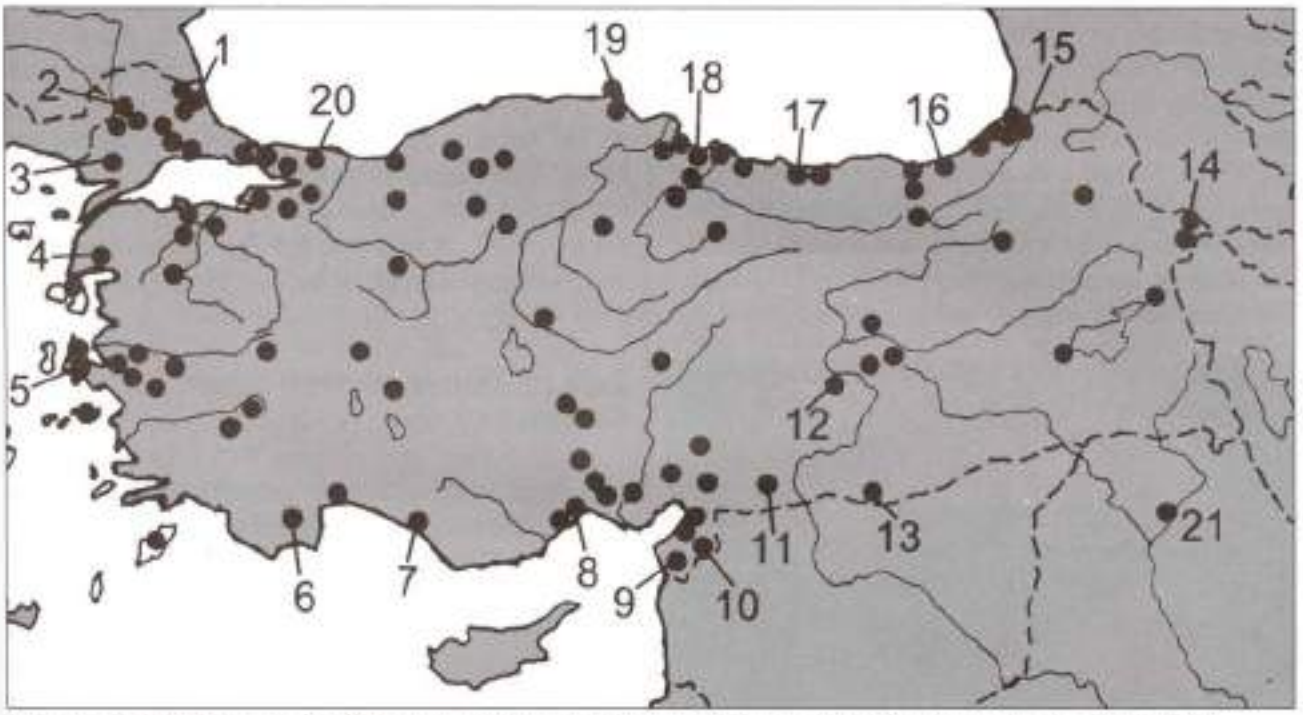

Fig. 86: Distribution of Crocidura suaveolens *in Turkey and Cyprus. Marginal records: 1 = Demirköy, İğneada; 2 = Edirne, Karakasım; 3 = Keşan; 4 = Ayvacık, Behram; 5 = 1 km north of Bornova; 6 = Antalya, Elmalı; 7 = İncekum; 8 = Mersin, Limonlu; 9 = Antakya; 10 = 5 km west Reyhanlı; 11 = Gaziantep, Oğuzeli; 12 = Malatya, Akçadağ; 13 = Harran; 14 = Doğubayazit; 15 = 4 km east of Artvin; 16 = Ülkü, Kaza Camlihesin; 17 = Ordu, Eski cezaevi Yanı; 18 = Samsun; 19 = Bektaşağa; 20 = Şile. Iraq: 21 = Al Mawsil. Localities on Cyprus are so numerous that they are not mapped (see details in Spitzenberger, 1978). Corresponding references: Kefelioğlu & Tez (1999): 1, 3, 6, 10, 11, 12, 15, 17. Felten* et al. *(1973): 5, 7. Spitzenberger (1970a): 9, 16, 18, 19, 20. Obuch (1994): 15. Andēra (1972): 21. Own data: 2, 4, 8, 13, 14.*

Fig. 87: Coastal dunes near Samsun, western Black Sea Mts (close to sea level). High density habitat of Crocidura suaveolens. *Collected on the same spot were also* Talpa levantis, Microtus rossiaemeridionalis, Mus macedonicus, Apodemus flavicollis, *and* A. iconicus. *Photo: B. Kryštufek.*

sp., *Crataegus* sp.) and in reeds (*Phragmites* sp.) around ditches and water holes, in hedgerows, along stone walls (where it seeks shelter below rocky blocks), under piles of trash from gardens, fields, in tall grass, poplar stands etc (Plates I.1, II.2, V.2, and VIII.2; Figs. 83, 87, 88). It was collected more rarely in hardwood forest (along the Black Sea Coast) or pine forest (Mediterranean coast). In arid central and eastern Anatolia, this shrew is mainly associated with humid conditions along streams, in swamps and around water holes or lakes. However, at Elazıg, we collected one specimen in a dry, rocky habitat populated by *Microtus guentheri*, *Cricetulus migratorius* and *C. leucodon* (Fig. 83). Osborn (1965b) reports two specimens collected from a house in Ankara. Similarly, Lay (1967) found this shrew in buildings on Mt. Elbruz at 2,742 m asl. Turkish records are mainly from low altitudes, the lowest ones literally only few meters from the seashore (Fig. 87). In central Anatolia we collected *C. suaveolens* as high up as 1,450 m (near Niğde). The highest records are seemingly from eastern Anatolia where Obuch (1994) found specimens in owl pellets at 1,800 and 1,900 m asl, respectively. Atallah (1977) also reports the species at altitudes of up to 1,700–2,000 m asl in Lebanon.

Fig. 88: Mountain brook near Niğde, central Anatolia (altitude 1,450 m asl). Slopes are eroded while the fertile soil in the valley is cultivated. Habitat of Crocidura suaveolens *in addition to* Mus musculus, Apodemus iconicus, *and* A. mystacinus. *Photo: B. Kryštufek.*

Spitzenberger (1978a) reports *C. suaveolens* from various habitats in Cyprus: small marshes with dense grass cover, tall grass, bushes and *Arundo donax* around ditches, along a mountain stream, and under rocky boulders. Optimal habitats were belts of *Arundo donax* amongst individual plantations. The altitude of the highest records is not given, but the highest peak of Mt Troodos is 1,957 m asl.

Twenty nine females from Turkey contained between 2 and 7 embryos (average = 4.7). Litter size seems to be slightly smaller on Cyprus, where Spitzenberger (1978) reports four females as having 2, 3, 3, and 5 embryos, respectively. This shrew is polyphasic in its activity.

Jackass White-toothed Shrew - *Crocidura arispa*

Crocidura pergrisea arispa Spitzenberger, 1971. Type loc.: 20 km E.S.E. of Ulukişla, Niğde, Turkey.

Taxonomy

This highly interesting shrew is known on the basis of only two specimens, both collected in southern Turkey. *C. arispa* was originally considered to be a part of *C. pergrisea* Miller, 1913 (Spitzenberger 1971), described from Baltistan, Kashmir. The *pergrisea* group contains many named forms, although Zaitsev (1991) states that it is represented in museums by barely more than twenty voucher specimens. These shrews, which are scattered across the mountainous regions of the western Palaearctic (*i.e.* the Taurus Mts, the Caucasus, Baluchistan, Hindu Kush, Pamir, and Tien Shan;

Zaitsev, 1991; Hutterer, 1993) are characterised by grey upper parts, a long tail, a long hind foot relative to the head and body, and an elongated skull (Gureev, 1979). At least seven names have been proposed so far, reduced by Hutterer (1993) to four species: *armenica*, *zarudnyi*, *pergrisea*, and *serezkiensis*. To this number one might add *Crocidura ramona* which was recently described from Makhtesh Ramon, Negev, Israel, but not compared with any of the above taxa (Ivanitskaya *et al.*, 1996); however, the skull is not flattened in *ramona* (Hutterer, *in litt.*). There is strong disagreement amongst different authorities with regard to the taxonomic arrangement of the group. Gureev (1979) considers *pamirensis* and possibly *dinniki* to be valid species, both of which are treated as junior synonyms of *C. suaveolens* by Hutterer (1993). Also considered a junior synonym of *C. suaveolens* is *C. portali* Thomas, 1920 (type locality: Ramleh, south-east of Jaffa, Israel), which is clearly distinct. *C. portali* is characterised by a pale greyish back and almost purely white belly, white feet, a pale tail, large ears, and a short, blunt P4 parastyle. It is possible that *portali* is the senior synonym of *ramona*; their type localities are only 150 km apart.

Jenkins (1976) restricted the name *pergrisea* to the largest named forms, which induced Hutterer (1993) to ascribe *arispa* to *C. serezkyensis*. However, *arispa* clearly differs from the remaining species of the *pergrisea* group, which makes elevation to species level meaningful. Differences are as follows:

- *C. pergrisea* Miller, 1913 (type loc.: Skoro Loomba, Baltistan, Kashmir) is larger (condylobasal length at least 19.0 mm).
- *C. serezkiensis* Laptev, 1929 (type loc.: Lake Sarezkoye, Pamir Mts, Tadžikistan) is characterised by a grooved posterior margin on the 3rd unicuspid (Zaitsev, 1991) which is round in the type of *arispa* (Fig. 89).
- *C. zarudnyi* Ognev, 1928 (type loc.: Baluchistan, Iran) has a shorter rostrum, heavier mandible (coronoid height at least 4.4 mm) and possibly also a slightly shorter ears (8–10.5 mm; Hassinger, 1970; Spitzenberger, 1971, specimens in BMNH and own data from Iranian Baluchistan).
- *C. armenica* Gureev, 1963 (type loc.: 14 km downriver from Garni, Armenia) is of smaller size (mean condylobasal length = 16.7 mm; Zaitsev, 1991) and has a more elongate braincase (*cf.* Gureev, 1979).

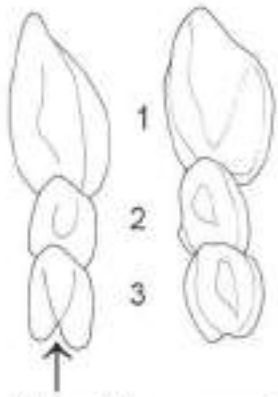

Fig. 89: Ventral view of the upper unicuspids (1 to 3) in Crocidura serezkyensis (left) and C. arispa. *Lingual side is to the left.* C. serezkyensis *is from Zaitsev (1991). The arrow indicates the posterior notch in* C. serezkyensis. *Not to scale.*

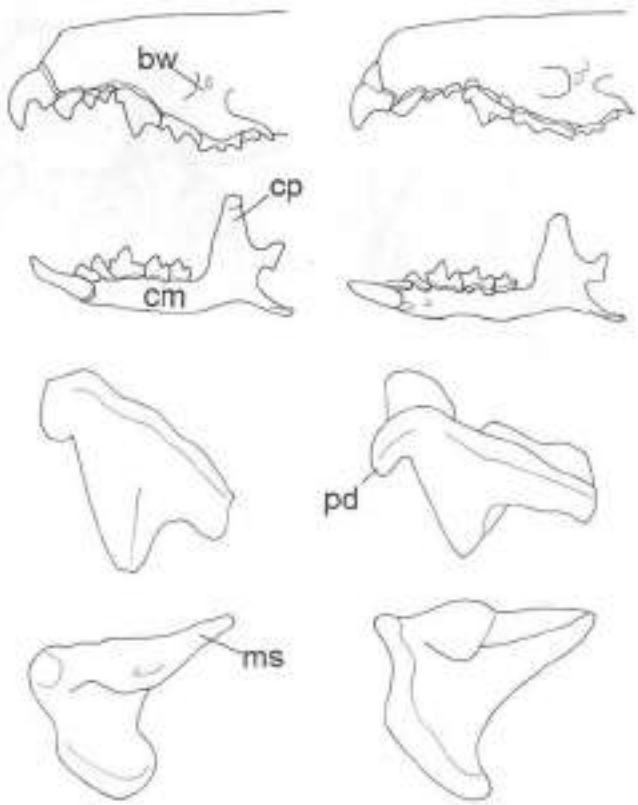

Fig. 90: Comparison between Crocidura portali *(left) and* C. arispa *(right). Both specimens are types. From top to bottom: rostrum, mandible, 4th upper premolar (labial side), 4th upper premolar (ventral side). Left structures are shown. bw = outer bony wall of the infraorbital channel, cm =* corpus mandibulae, *cp = coronoid process, ms = metastyle, pa = parastyle. Not to scale.*

- *C. portali* Thomas, 1920 has shorter ears (9 mm), a blunt P4 parastyle, a deeper skull, a slender P4 metastyle, a broad outer bony wall to the infraorbital channel, a higher coronoid process (4.7 mm) and more robust corpus mandibulae (characters of *portali* are based on the type specimen; Fig. 90).

Description

Size and tail length are as in *C. suaveolens* (Table 17). Ears are unusually large (10.1 and 9.5 mm in the type and the paratype, respectively) which, at glance, separates *C. arispa* from both *C. suaveolens* and *C. leucodon*. The tail is 64 and 69% of head and body length in the only two available specimens, *i.e.* within the range of *C. suaveolens*, but evidently longer than in *C. leucodon*. The back is smoke grey with brown shades, the belly pale smoke grey; there is no clear demarcation line. Hair are bi-coloured with slate grey bases. The tail is pale, indistinctly bi-coloured and with white terminal pencil; feet and ears are also pale (Plate XV.1).

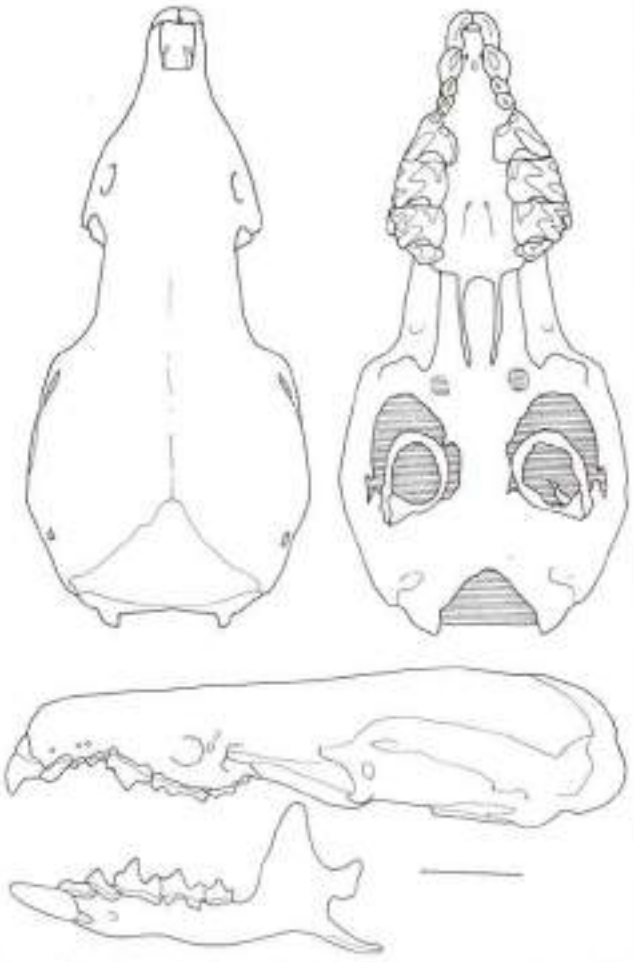

Fig. 91: Skull and mandible of the type specimen of Crocidura arispa. *Scale bar = 3 mm.*

The skull is clearly flattened (Fig. 91) with the height of the braincase being 22.8 and 22.9% of the condylobasal length, respectively, in the two specimens (*vs* 25.0–28.3 in *C. suaveolens* and 23.6–25.6% in *C. leucodon*). The pterygoid processes is bent inwards posteriorly (straight in the remaining two species). The first unicuspid is as long as the remaining two unicuspids together (in the remaining two *Crocidura* it is usually shorter than the combined length of the 2nd and 3rd unicuspids). The parastyle of 4th premolar is hooked, as in *C. suaveolens* (compare Fig. 79). The mandible is delicate and low; coronoid height is thus lower than in the other two *Crocidura* shrews of the same size.

The karyotype of this elusive shrew is unknown, however, shrews of the *pergrisea* group from the vicinity of Džufla (Azerbaijan) (which were interpreted by Hutterer (1993) as *C. serezkiensis*) show the lowest diploid number among shrews: 2N = 22, NF = 34 (Grafodatsky *et al.*, 1998). In *C. ramona*, the karyotype is 2N = 28 and NFa = 42 (Ivanitskaya *et al.*, 1996).

Variation

The species is known from only two specimens; we saw only the type.

Distribution

As understood here, *C. arispa* is endemic to the Taurus Mts of southern Turkey. It is known from only two localities (Spitzenberger, 1971), which are *ca.* 400 km apart (Fig. 92).

	Cığlıkara	*Madenköy*
Head and body	75	70
Tail	48	48
Hind foot	12.6	12.5
Weight	–	9
Condylobasal lenght	18.4	17.9
Braincase breadth	8.5	8.3
Coronoid height	4.1	4.1

Table 17: External and skull measurements of the two existing specimens of Crocidura arispa. *Based on Spitzenberger (1971).*

Habitat

C. arispa is a specialised rock dweller, adapted to arid climates (Spitzenberger, 1971). In Cığlıkara it was collected in a karstic 'doline' on the timber line (1,750 m asl), together with rock dwelling rodents: *Chionomys nivalis*, *Dryomys laniger* and *Apodemus mystacinus*. *C. leucodon* also occurred in the same place. In the region of Niğde, *C. arispa* was also found amongst boulders at 2,000 m asl, and shared the habitat with *Chionomys nivalis* (Spitzenberger, 1971).

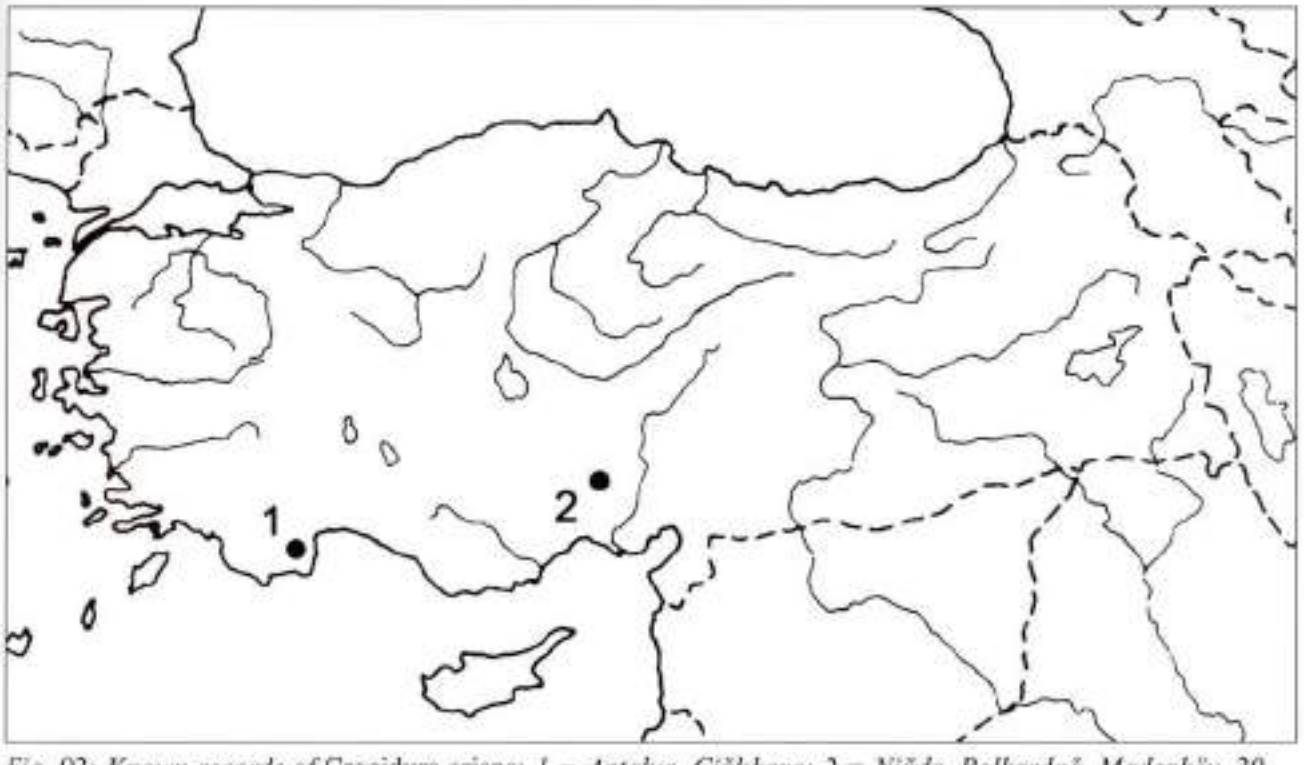

Fig. 92: Known records of Crocidura arispa: *1 = Antalya, Cığlıkara; 2 = Niğde, Bolkardağ, Madenköy, 20 km east-south-east Ulukişla (Spitzenberger, 1971).*

Genus: *Suncus* Ehrenberg, 1832

Suncus (Fig. 93) is closely related to *Crocidura*, but differs in having four upper unicuspids instead of three (Fig. 76). Sixteen species are found in the Oriental and Ethiopian region. *S. etruscus* is widely distributed in the southern Palaearctic realm.

Fig. 93: Pygmy white-toothed shrew Suncus etruscus. *Drawing: S. Polak.*

Pygmy White-toothed Shrew - *Suncus etruscus*

Sorex etruscus Savi, 1822. Type loc.: Pisa, Italy.

Description

The smallest shrew in the area and also one of the smallest mammals in the world. Externally resembles *C. suaveolens*, however, the difference in size is so evident that it is impossible to confuse the two (Table 18). The tail is longer than half the head and body length (57.5–65%) and covered with scattered longer hair (Fig. 93). The pelage is short, grey-brown on the back, grey below; the demarcation line is obscured. The tail is indistinctly bi-coloured (Plate XV.2).

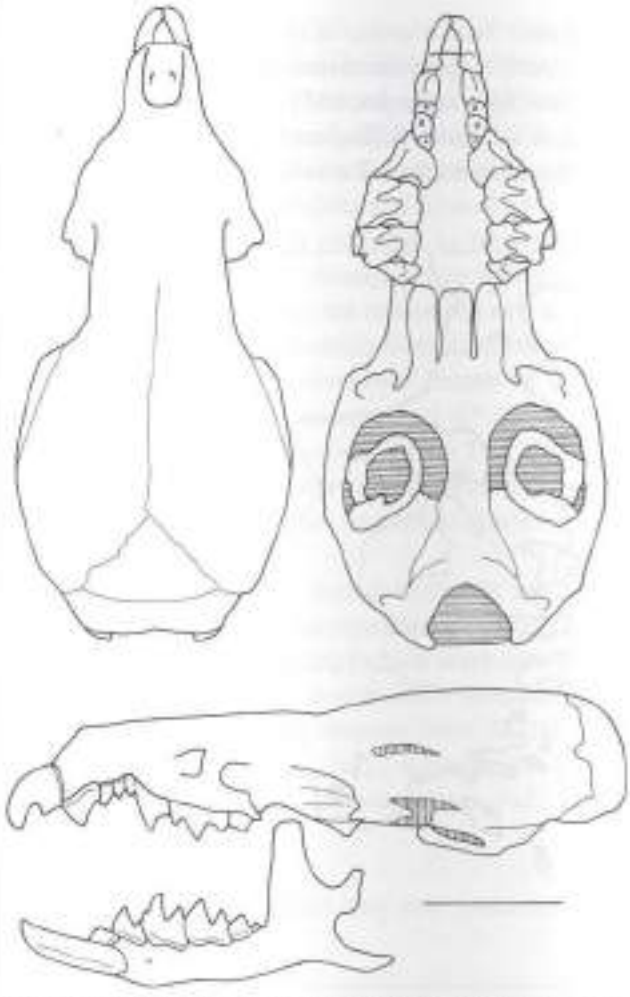

Fig. 94: Skull and mandible of Suncus etruscus *from Bulgarian Black Sea Coast. Scale bar = 3 mm.*

	N	*Mean*	*min–max*
Head and body	9	49.0	42–54
Tail	10	26.1	24–31
Hind foot	10	7.9	7.2–8.3
Weight	7	1.9	1.5–2.5
Condylobasal lenght	3	12.6	12.4–12.7
Braincase breadth	2	–	5.7/6.0
Coronoid height	43	3.06	2.8–3.3

Table 18: External and cranial measurement of Suncus etruscus *from Turkey, Cyprus, the Aegean island of Samos and the Black Sea coast of Bulgaria. Based on Spitzenberger (1970b, 1978a), Laar & Daan (1967), Vohralík (1985), Niethammer (1989), Popov & Nijagolov (1991) and own material.*

The skull and dentition resemble the condition in *C. suaveolens* (Fig. 94), however, there are four unicuspids. Dental formula: 3/1, 1/1, 2/1, 3/3 = 30.

Variation

According to Kock & Nader (1983) there is no indication of size variation in the Near East. On the other hand, Harrison & Bates (1991) report a good deal of individual variation in specimens from Arabia. Reumer & Oberli (1988) found no morphological difference between recent Cypriot shrews and a sample from the Late Bronze Age (13th–12th century BC).

Distribution

Southern Palaearctic and Indomalayan regions; possibly also in sub-Saharan Africa (Hutterer, 1993). In the western Palaearctic region it is restricted to the Mediterranean coasts of Europe, Asia and Africa. Also found in the Caucasus, Turkmenistan, Uzbekistan, Iran, Syria, Iraq, Arabia, and on many Mediterranean islands.

Turkish records are scarce (Fig. 95). The sampling of small mammals by snap trapping (the most common approach practised so far in Turkey) is ineffective in recording such a small shrew. For this reason, *S. etruscus* is usually perceived as being a rare species - for example it has not been recorded in neighbouring Georgia for the last 40 years (Bukhnikashvili & Kandaurov, 1998). Not surprisingly, Turkish records mainly derive from either owl pellets (Niethammer, 1989; Obuch, 1994) or pitfall trapping (Spitzenberger, 1970a; Felten *et al.*, 1973). The majority of finds are from the coast of western Anatolia. The species also occurs on three Aegean islands off the coast of Turkey which, biogeographically, are part of Turkey (see also van Laar & Daan, 1967): Samos, Rhodes and Kos. On the other hand, *S. etruscus* has not been found on Chios and Lesbos (Niethammer, 1989). Kock *et al.* (1972) provide evidence of the occurrence of *S. etrus-*

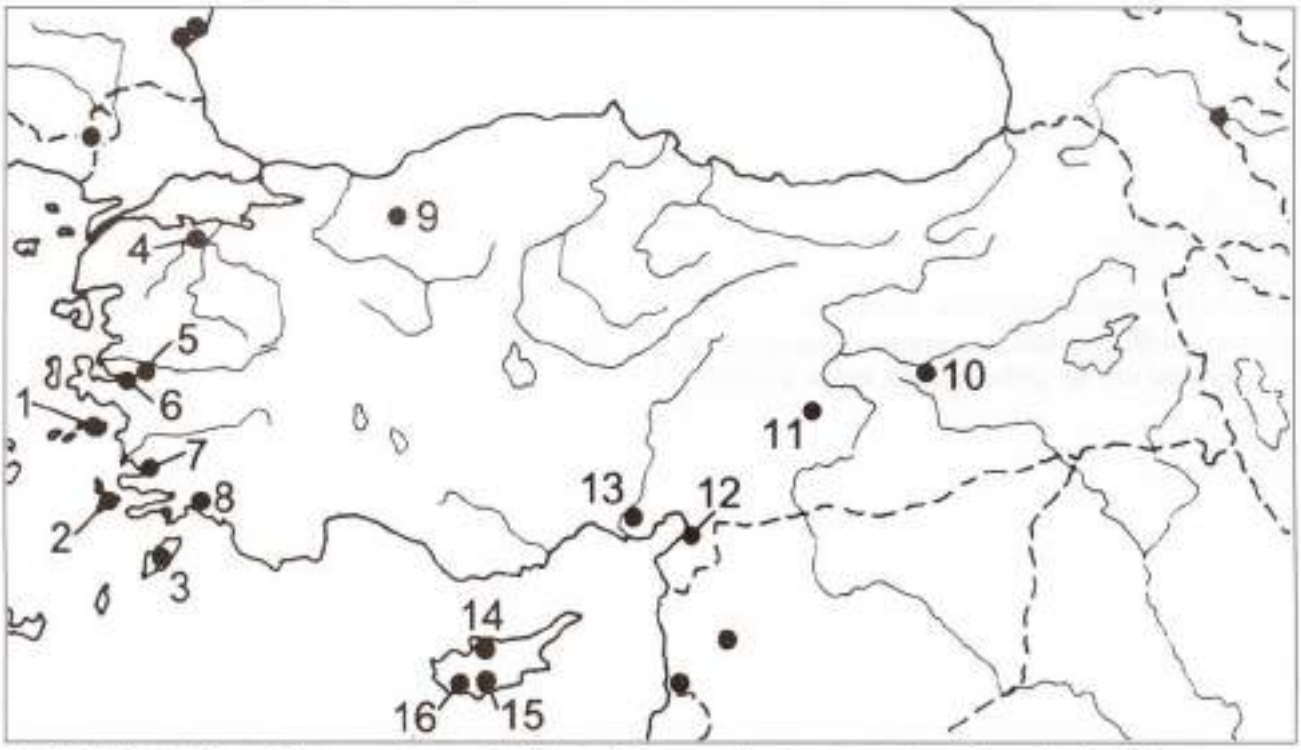

Fig. 95: Distribution of Suncus etruscus *in Turkey, Cyprus and adjacent regions. Records: 1 = Samos; 2 = Kos; 3 = Rhodes; 4 = Kuş Gölü; 5 = İzmir, Kemalpaşa; 6 = İzmir, 3 km south of Kuşadası; 7 = Milet; 8 = Köyçiz; 9 = Bolu district (uncertain); 10 = Norşun Tepe near Alişam; 11 = Karadut; 12 = Belem; 13 = Adana; 14 = Kyreania, 7 km east of Orga; 15 = Limassol, Yarmasoyia; 2 km south-east of Apsiou; 16 = Paphos. Corresponding references: Laar & Daan (1967): 1, 3. Niethammer (1989): 2. Felten* et al. *(1973): 5, 9. Spitzenberger (1970b): 6. Niethammer (1989): 7. Baran* et al. *(1994): 8. Kock* et al. *(1972): 10. Obuch (1994): 11, 12. Spitzenberger (1978b): 14, 15, 16. MAK: 4. Own data: 13.*

cus in eastern Anatolia (Norşun Tepe) in the period 3,500–300 BC, and its continuous presence in this region was confirmed by Obuch (1994).

The presence of *S. etruscus* is also beyond doubt in Thrace, as the species has been confirmed for two localities on the Bulgarian Black Sea Coast, not far from the Turkish border (Vohralík, 1985; Popov & Nijagolov, 1991) and from Didymoticho (Greece), only four kilometres from the Turkish border (Vohralík & Sofianidou, 2000).

Four recent records are available from the island of Cyprus (Spitzenberger, 1978a; Nadachowski *et al.*, 1990) - all from coastal regions. The presence of *S. etruscus* on the island is noted from the Late Bronze Age (Reumer & Oberli, 1988).

Habitat

Disturbed habitats, from the sea level up to 1,200 m on the west coast (Niethammer, 1989) and to 1,300 m in eastern Anatolia (Obuch, 1994). Niethammer (1989) demonstrates that *S. etruscus* is more abundant, relative to *C. suaveolens*, in arable land than in Mediterranean brush, and that its share decreases with increasing altitude. *S. etruscus* is also more abundant on the coast than on the offshore Island of Samos. Moreover, *S. etruscus* was approximately 4.5 times less common than *C. suaveolens* in owl pellets collected around Milet (Niethammer, 1989). Spitzenberger (1970b, 1978a) mainly collected it in olive plantations, and Baran *et al.* (1994) obtained one specimen during daytime under a stone in a rocky habitat. On the Black Sea Coast, a specimen was obtained from dense vegetation on a lake shore, close to the water's edge (Vohralík, 1985).

Family: Talpidae Fischer von Waldheim, 1817

The majority of species in this family *(ca.* two thirds) are fossorial with stout bodies, minute eyes and short appendages, particularly the front ones. The remaining species are terrestrial or semi-aquatic. The family's distributional range covers the Holarctic and marginally enters the Oriental region. So far, 42 species in 17 genera are known, but only one genus occurs in Turkey.

Genus: *Talpa* Linnaeus, 1758

All the species in this genus are very similar to one another, a result of marked adaptation to fossorial life. They are consequently easily recognisable from the other small mammals of Turkey, both externally and cranially, but are very similar to each other. The body is cylindrical with a pointed snout, the fore limbs are broad, flat and turned backwards, and their area is enlarged by an extra radial sesamoidal bone. In contrast, the hind limbs are relatively weak (Fig. 96). There are five fingers, and the claws of the front feet are particularly robust. The tail is short and sparsely covered with long bristle-like hair. The blackish fur is short, soft and dense. External pinnae are missing and the eyes are much reduced and covered in the majority of species by skin *(i.e.* the eyelids are grown together). There are four pairs of nipples (1 pectoral, 2 abdominal, 1 inguinal).

The skull is long and narrow with slender zygomatic arches and flattened bullae. The small, almost rudimentary premolars are sometimes missing from either the upper or the lower jaw. The incisors are small and simple, and the upper canine is large, whilst the lower one is small and incisiform (as a consequence, the first lower premolar is caniniform). Moles retain the complete dental set of the primitive recent eutherians (dental formula: 3/3, 1/1, 4/4, 3/3 = 44) but up to six individual teeth can be lost in *Talpa* (see under *T. davidiana).* In taphonomically altered material, moles can also be recognised by their highly characteristic humerus (Fig. 97) and pelvis. Two basic pelvis types can be recognised (Grulich, 1971). In the europaeoidal type the 4th *foramen sacrale* is closed posteriorly by the bone bridge connecting the sacrum and ischium, however, there is no such anastomosis in the caecoidal type, in which the 4th foramen sacrale is open posteriorly (Fig. 98). Within such a morphologically uniform species group as the Western Palaearctic moles, the pelvis is a useful auxiliary identification character, even though it shows marked interindividual variability.

The genus contains nine species, all restricted to the Western Palaearctic. Until recently, morphological uniformity caused taxonomic problems, not only in Turkey, but also throughout the Palaearctic. Kumerloeve (1975a) still reports only a single mole species for Turkey *(i.e. T. caeca),* although Osborn (1964) had already listed *T. europaea* as well. Significant progress towards a better understanding of the taxonomy of

Fig. 96: Mole Talpa *sp. Drawing: S. Polak.*

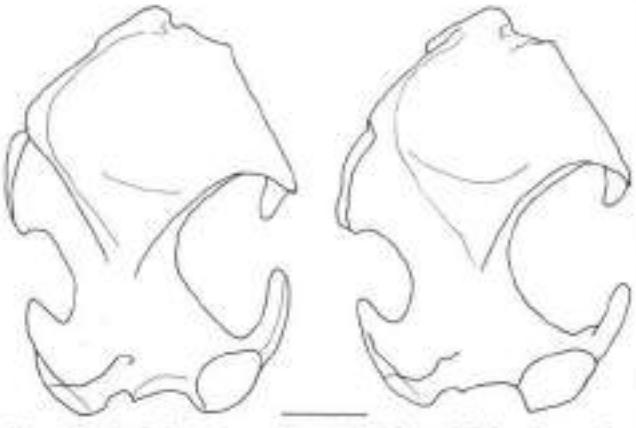

Fig. 97: Left humerus (lateral side) of Talpa levantis *(Bafra near Samsun) and* T. caucasica *(Talysh Mts., Iran). Proximal side is up. Scale bar = 3 mm.*

Turkish moles was made by Doğramaçı (1989c,d) whose review is followed here. Doğramaçı also provides evidence for the existence of two further species in Turkey: *T. caucasica* and *T. streeti*. In the 1960s and 1970s *T. caeca* was still a collection of small-sized, blind western Palaearctic moles. Further evidence, supported by karyotypes and allozymic data clearly demonstrates that *T. caeca s.l.* includes several distinct species; *T. levantis* from Asia Minor and the Caucasus is just one amongst them. Vohralík (1991) reports that small blind moles from Turkish Thrace and adjacent parts of Bulgaria are conspecific with *T. levantis*, which was further supported by skull morphology. However, several samples from north-western Anatolia are cranially indistinguishable from the Balkan *T. caeca*. These moles were subsequently removed from *T. levantis* and are tentatively reported here as *T.* cfr. *caeca*, which might be an additional species in the Turkish fauna (Kryštufek, 2001). Moles are absent from Cyprus.

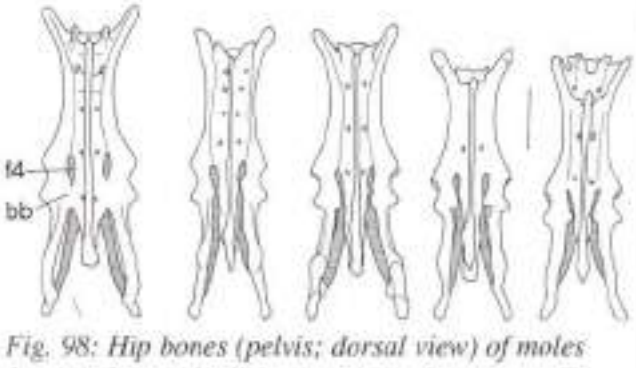

Fig. 98: Hip bones (pelvis; dorsal view) of moles from Turkey and adjacent regions. Anterior to the top. From left to right: Talpa europaea *(Turkish Thrace),* T. caucasica *(Talysh Mts., Iran),* T. levantis *(Tatvan),* T. *cfr.* caeca *(Ulu Dağ),* T. davidiana *(Tatvan). The first hip bone is of the europaeoidal morphotype and all the remainder are of the caecoidal morhotype, f4 = 4th sacral foramen, bb = bony bridge. Scale bar = 5 mm.*

KEY TO SPECIES:

1 Rostrum very broad (Fig. 99), particularly anteriorly; tail markedly short
T. davidiana

1* Rostrum not much broader; tail not markedly short
2

2 Eyelids not grown together *(i.e.* eyes not covered by skin); pelvis always of europaeoidal morhotype (Fig. 99)
T. europaea

2* Eyelids closed together *(i.e.* eyes covered by skin), pelvis mainly caecoidal but rarely of europaeoidal morphotype (Fig. 98)
3

3 Condylobasal length over 33 mm
T. caucasica

3* Condylobasal length less than 33 mm
T. levantis

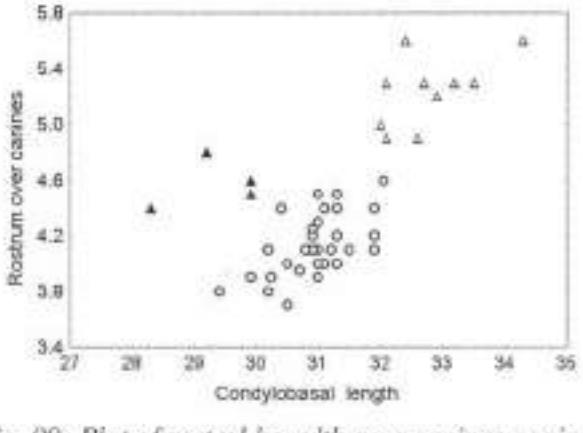

Fig. 99: Plot of rostral breadth over canines against condylobasal length in Talpa levantis *from Turkey and Iran (circles) and* T. davidiana *(triangles). Closed triangles indicate specimens from Tatvan and Akbes and open triangles are moles from Hakkari and Iranian Kurdistan.*

Common Mole - *Talpa europaea*

Talpa europaea Linnaeus, 1758. Type loc.: Engelholm, Kristianstad, southern Sweden.

Description

The common mole is a typical representative of its genus and also one of the largest Turkish moles (Table 19; Plate XVI). In Thrace it is readily distinguished from the smaller *T. levantis* by size alone (condylobasal length of skull not exceeding 32 mm in Thracian *T. levantis* but >33 mm in *T. europaea*). Males are larger than females. The eyes are not covered by skin, consequently they can be seen if the eyelids are pulled apart.

The skull is long and narrow (Fig. 100), and the rostral breadth (across molars) amounts to less than 28% of the condylobasal length. The pelvis is of the europeaoidal morphotype; its greatest length in males is 28.3–30.1 mm (29.5 mm on average) and in females 25.5–26.8 mm (average of 26.2 mm; Doğramacı, 1989c).

Of the upper incisors, the first one (I1) is not much enlarged and I2 and I3 are sub-equal (Fig. 101). The molars are relatively small (smaller on average than in the remaining species) and the largest diameter of M2 is *ca.* 1.80–1.90 mm.

The diploid number of chromosomes is 2N = 34; fundamental number of chromosomal arms is NF = 68. The species has clearly not been karyotyped from Turkey, but data are available from neighbouring parts of the Balkan Peninsula (Todorović *et al.*, 1972).

	Males (N=16)	*Females (N=13)*	*min–max*
Head and body	146.0	136.0	120–150
Tail	34.0	33.0	30–39
Hind foot	24.0	22.0	20–25
Weight	95.0	75.0	60–105
Condylobasal lenght	35.7	32.8	32.4–37.0
Rostral breadth (molars)	9.8	9.0	8.9–10.1
Maxillary tooth-row	–	–	13.0–13.6

Table 19: External and skull dimensions of Talpa europaea *from Turkish Thrace. Variation ranges for the sexes are pooled. Maxillary tooth-row length range is based on five specimens of both sexes (OMU). Based on Osborn (1964a), Doğramacı (1989b), and material in OMU.*

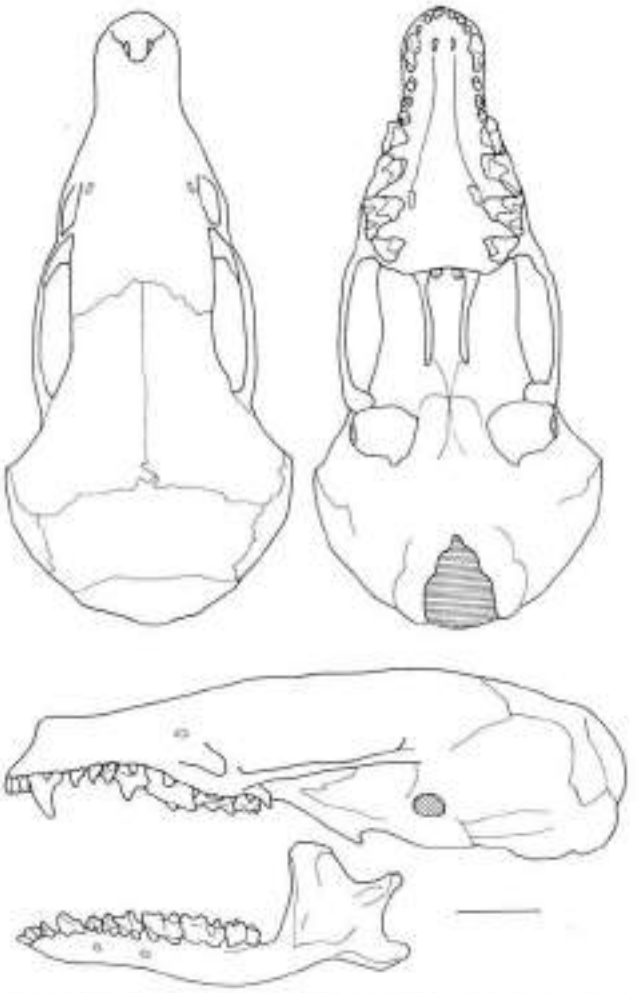

Fig. 100: Skull and mandible of Talpa europaea *from Turkish Thrace, Turkey. Scale bar = 5 mm.*

Variation

Geographic variation relates mainly to size and the relative breadth of skull across rostrum, however, the

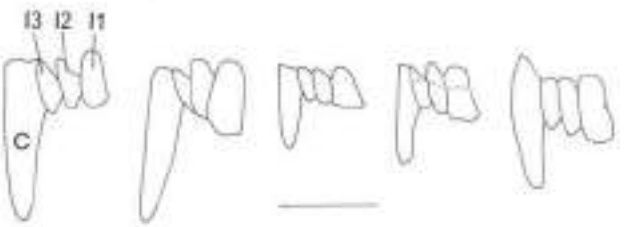

Fig. 101: Right upper incisors (I1 – I3) and canine (C) in moles from Turkey and adjacent regions. From left to right: Talpa europaea *(Turkish Thrace),* T. caucasica *(Talysh Mts, Iran),* T. levantis *(Tamdere),* T. *cfr.* caeca *(Ulu Dağ),* T. davidiana *(Taivan). Scale bar = 2 mm.*

number of subspecies recognised differs among authorities. Doğramacı (1989b) ascribed Turkish population to *T. e. velessiensis* Petrov, 1941 (type locality is Krivolok near Veles, Macedonia), but there is no agreement over whether this subspecies is valid (see Petrov (1971) for a discussion and measurements of the topotypes).

Distribution

Widespread in Europe, but absent from the majority of the Iberian and the Balkan peninsulas, Italy, Scandinavia, Ireland and the Mediterranean islands. In west Asia the species goes as far east as *ca.* 70 °E. In Turkey it is restricted to the European part of the country (Fig. 102), where it is common and widespread in the lowlands, but absent from the Istranca Mts.

Habitat

As a fossorial insectivore, the common mole strongly depends on deep, wet soils. In dry Turkish Thrace, it is therefore mainly tied to the proximity of rivers in the lowlands and is absent from dry slopes. The best habitats are moist deciduous forests (including poplar stands) in river valleys. In Europe, the common mole is mainly allopatric with its smaller counterpart *T. caeca*. Doğramacı (1989d) reports a single Thracian locality (Pınarhisar) where *T. europaea* was sympatric with the smaller *T. levantis*.

Caucasian Mole - *Talpa caucasica*

Talpa caeca caucasica Satunin, 1908. Type loc.: Stavropol, Russia.

Taxonomy

This mole was first reported for Turkey by Doğramacı (1988) as the subspecies *T. caeca orientalis* Ognev, 1926.

Description

Very similar to *T. europaea* in size and shape (Table 20), but the eyes are covered by skin. The pelage is blackish grey or black (Plate XVI). Males are larger than females: average head and body length in males is 128 mm (in females 124 mm), average body mass in males 68 g *v.* 58 g in females (Stroganov, 1948).

The skull is long and narrow (Fig. 103) with an average rostral breadth across molars of *ca.* 27.7% that

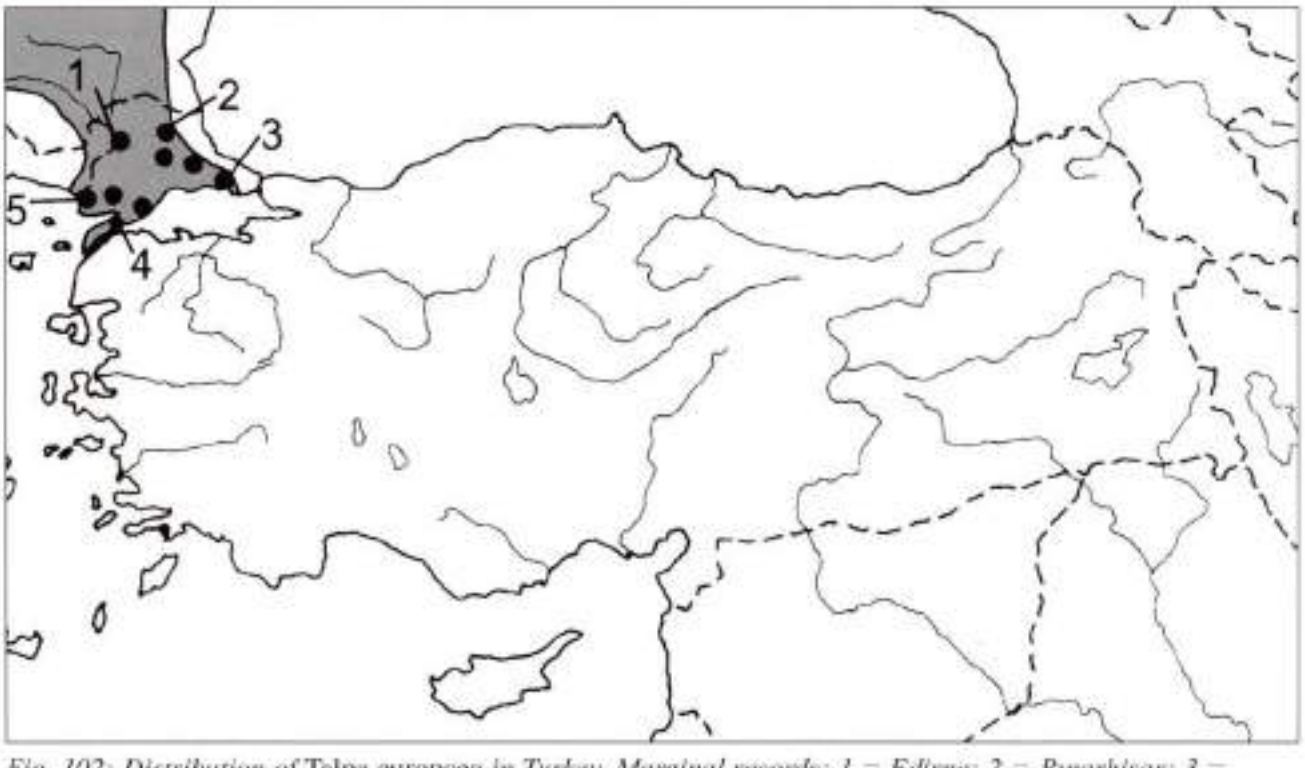

Fig. 102: Distribution of Talpa europaea *in Turkey. Marginal records: 1 = Edirne; 2 = Pınarhisar; 3 = Silivri; 4 = Gelibolu; 5 = Enes. Corresponding reference: Doğramacı (1989b).*

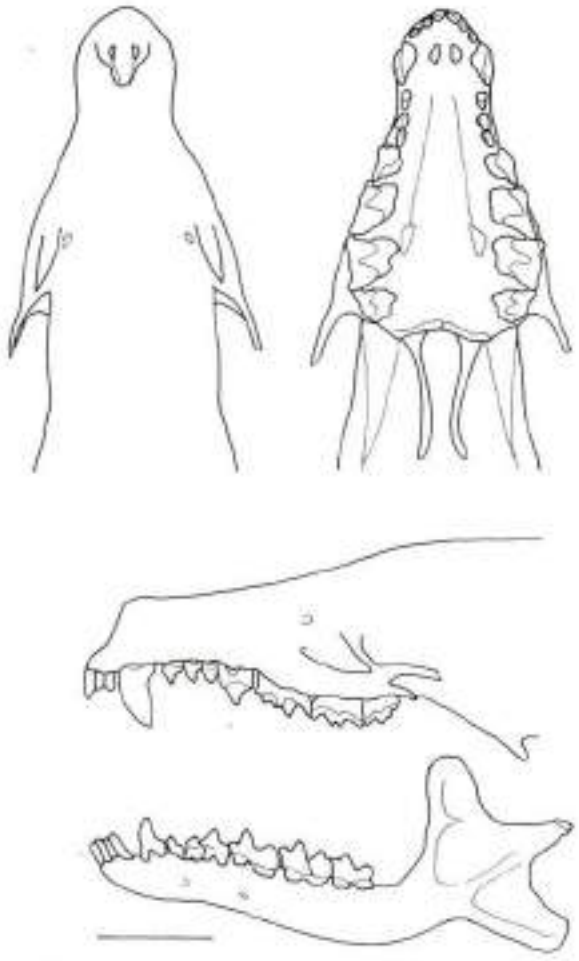

Fig. 103: Anterior skull and mandible of Talpa caucasica *from Psebaĭ in the north-western Caucasus, Russia. Scale bar = 5 mm.*

of the condylobasal length. The molars are relatively robust (largest M2 diameter is up to 2.5 mm) and, of the upper incisors, I1 is considerably larger than I2 and I3 which are of decreasing size (Fig. 101). The mesostyle of the upper molars is more pronouncedly bicuspid than is in sympatric *T. levantis* (Zaitsev, 1999). The pelvis is of the caecoidal morphotype (Fig. 98); its greatest length is 26.6–28.8 mm (27.5 mm on average; Doğramacı, 1989c).

The diploid number of chromosomes from Artvin district is 2N = 38, fundamental number of autosomal arms is NFa = 62 (Kefelioğlu & Gençoğlu, 1996). Similar values are reported from the Caucasus (Sokolov & Tembotov, 1989), where the largest chromosome is acrocentric (bi-armed in Turkey).

	N	*Mean*	*min–max*
Head and body	12	138.0	134–142
Tail	12	24.0	20–26
Hind foot	12	20.0	17–23
Weight	12	75.0	62–91
Condylobasal lenght	12	34.2	33.6–35.0
Rostral breadth (molars)	12	9.5	9.0–10.1
Maxillary tooth-row	12	15.2	14.7–15.8

Table 20: External and cranial measurements of Talpa caucasica *from Turkey. Sexes are pooled. Based on Kefelioğlu & Gençoğlu (1996).*

Variation

Three subspecies are recognised by Sokolov & Tembotov (1989) on the basis of size differences. The biggest moles from western Transcaucasia (average condylobasal length in males 34.5, in females 34.0 mm) were classified as *T. c. ognevi* Stroganov, 1948 (type locality is Bakurniani, Georgia). This name is possibly also applicable to Turkish populations. Kefelioğlu (pers. comm.) found yellowish spots on the snout and on the chests and throat of Turkish specimens (Plate XVI).

Distribution

Occurs in the western Caucasus in Russia, Georgia and, very marginally, in Turkey. Also known in the lowlands to the south-east of the Sea of Azov. Turkish records are all from the district of Hopa (Fig. 104).

Habitat

This mole depends on a humid substrate abundant of invertebrates, especially earthworms (Gureev, 1979). It is common everywhere in the dense broad-leaved forest zone, although also appears in humid meadows and swampy places. It is absent from shallow, skeletal soils and from steep canyons (Sokolov & Tembotov, 1989). In Georgia the species' vertical range is from sea level to 2,500 (and exceptionally 2,800 m) (Bukhnikashvili & Kandaurov, 1998).

In Turkey, *T. caucasica* lives in proximity to water and in wet soils in gardens and fields. In such habitats Doğramacı (1989d) found the same localities also to be populated by *T. levantis* (Kemalpaşa, Cumhuriyet mahallesi). The larger *T. caucasica*, however, is mainly restricted to the coastal regions of Turkey, whilst the smaller *T. levantis* also inhabits mountains further inland (Kefelioğlu & Gençoğlu, 1996)

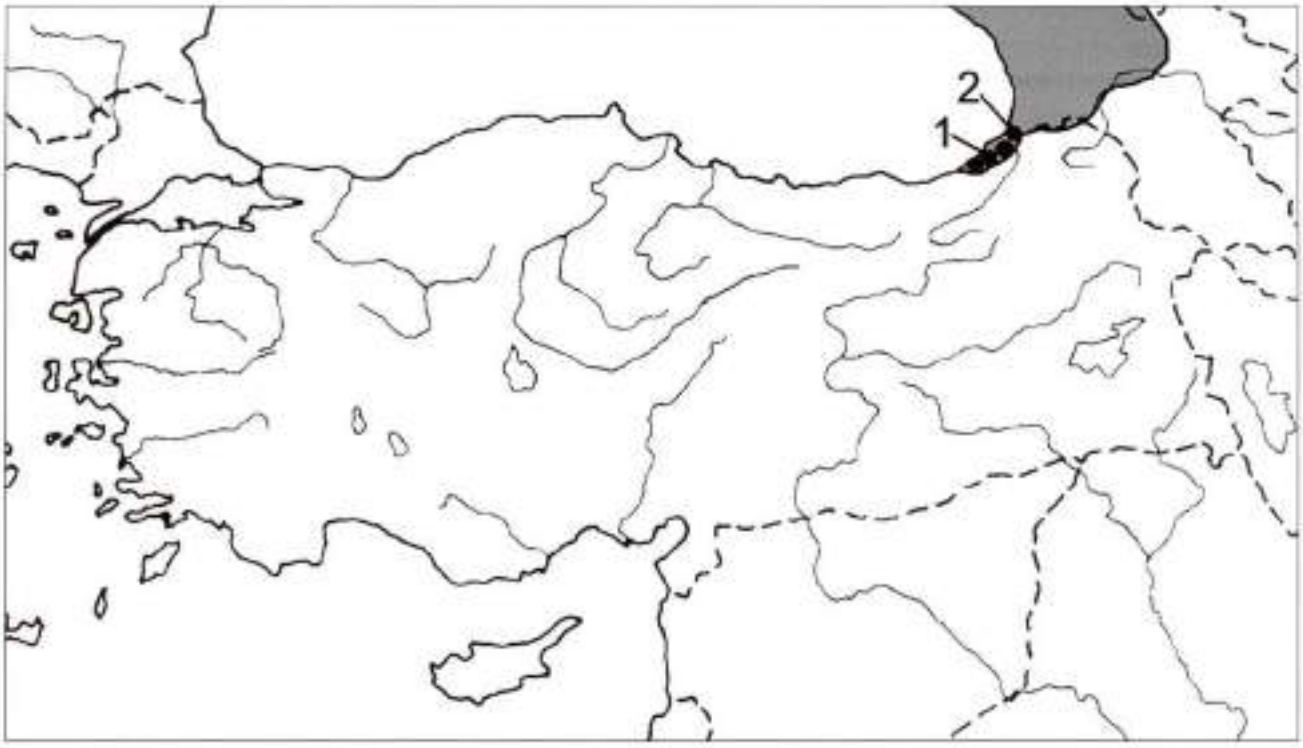

Fig. 104: Distribution of Talpa caucasica *in Turkey. Marginal records: 1 = Arhavi, Konaklı köyü; 2 = Kemalpaşa. Corresponding references: Kefelioğlu & Gencoğlu (1996): 1. Doğramacı (1989d): 2.*

Levant Mole - *Talpa levantis*

Talpa caeca levantis Thomas, 1906. Type loc.: Scalita (= Altindere), south of Trabzon, Turkey.

Taxonomy

This mole was first described as a subspecies of *T. caeca*. It was then long considered as such (Spitzenberger & Steiner, 1962; Osborn, 1964; Grulich, 1972), but it was suggested as a species on its own right by Spitzenberger (in Felten *et al.*, 1973) and by Kumerloeve (1975). Kryštufek (1994) showed that *T. levantis* differs from *T. caeca* in its skull morphology, whilst Kefelioğlu & Gençoğlu (1996) demonstrate that the two have different karyotypes (see also comments under *T. cfr. caeca.)*

Description

A small mole (Table 21) with the eyes overgrown with skin. The pelage is blackish grey or black, and does not differ from the other Turkish species. The front and back feet are pale and the front claws are white. The tip of snout is also pale, but the rhinarium is black (Plate XVI).

The skull is delicate with a slender, pointed rostrum (Fig. 105); rostral breadth across molars averages up to *ca.* 27.0% of the condylobasal length. The molars are relatively broad with the largest M2 diameter between 1.54–1.90 mm, and the 1st upper incisor (I1) is clearly larger than the subsequent I2 and I3 (Fig. 101). The pelvis is of the caecoidal morphotype (Fig. 98) and its greatest length is 22.3–26.1 mm (24.3 mm on average) (the sexes are of similar size).

The diploid number of chromosomes from the Black Sea Mts is 2N = 34, fundamental number of

	N	*Mean*	*min–max*
Head and body	34	123.0	105–134
Tail	34	26.4	18–39
Hind foot	34	18.2	14.5–20.0
Weight	15	47.1	36–53
Condylobasal lenght	35	30.9	29.2–32.5
Rostral breadth (molars)	37	8.4	7.5–9.1
Maxillary tooth-row	37	11.6	11.0–12.2

Table 21: External and cranial measurements of Talpa levantis *from Turkey and Iran. Sexes are pooled. Based on specimens in NMW, NMNH, FMNH and own material.*

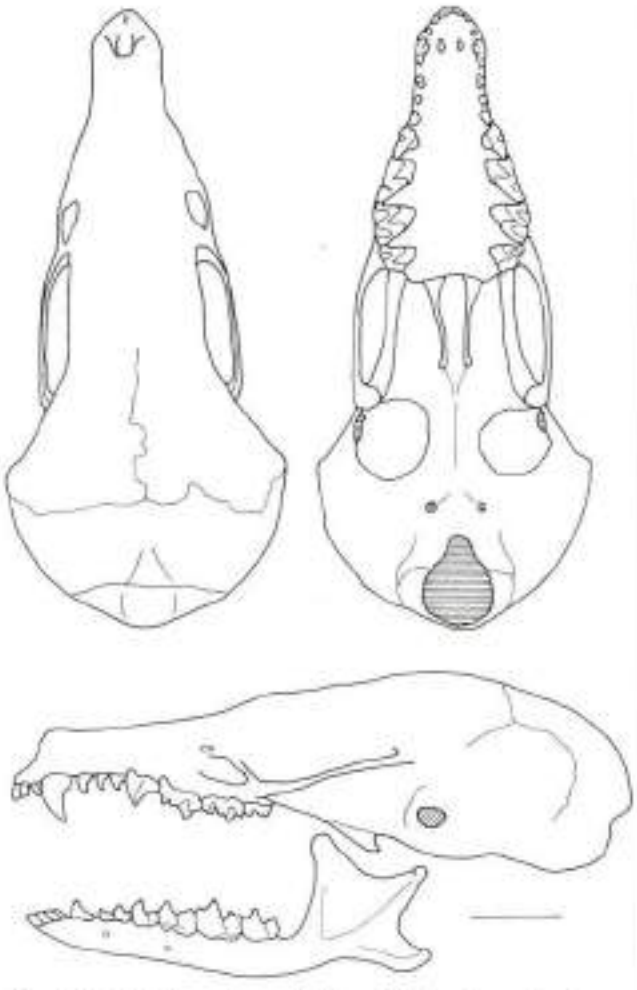

Fig. 105: Skull and mandible of Talpa levantis *from Bicik near Giresun, Turkey. Scale bar = 5 mm.*

autosomal arms is NFa = 64 (Kefelioğlu & Gençoğlu, 1996). The same values are reported from the Caucasus (Sokolov & Tembotov, 1989) however, the fundamental number is not given.

Variation

Sokolov & Tembotov (1989) recognise three subspecies from the Caucasus, not including the nominate race: the differences are size based. We did not find any clear differences amongst samples from Turkey and Iran (Kryštufek, 2001) so no subspecific division is adopted here.

Distribution

The species' range stretches along the shores of the Black Sea Coast, starting from south-eastern Bulgaria (Vohralík, 1991) across the Black Sea Mts into the Caucasus, and then to the south-west coast of the Caspian Sea in Azerbaijan and adjacent parts of Iran. The majority of the range is in the Greater Caucasus, within the borders of Russia, Georgia, Azerbaijan and Armenia.

The species' Turkish range is in several fragments. The only European isolate is in the Istranca Mts, and the range is presumably not continuous in northern Turkey, with a gap in Paphlagonia *(i.e.* between Zonguldak and Sinop). However, it is premature to conclude whether this gap is genuine or simply reflects collecting bias. The species' range in the Black Sea Mts to the east of Sinop is contiguous with that in Caucasia. There is also a small isolate at Tatvan (Fig. 106; Kryštufek, in press).

The presence of *T. levantis* in Marmara and Thrace is beyond doubt, however, Marmara seems also to be populated with *T.* cfr. *caeca*. We identified specimens from Rumeli Hisar, Kagithane Dere, Mehmutşevkepaş and Karadere as *T. levantis* (Kryštufek, 2001). Despite this, the majority of localities from north-western Turkey are from Doğramacı (1989d) and we saw none of the material. It is thus possible that some records from the Marmara region actually refer to *T. cfr. caeca*. Santel & Koenigswald (1998) report this mole from the Middle Pleistocene of Yarımburgaz Cave in Turkish Thrace.

Habitat

This is the most widespread mole in Turkey; of 187 Turkish moles examined, 130 were *T. levantis* (Doğramacı, 1989a). Suitable habitats are on deep and moist soils. The species occurs from the sparse meadows on the sandy beaches along the Black Sea littoral (Fig. 87), to the broad-leaved and conifer forests, forest clearings and meadows of the coastal mountains. Proximity to water is essential; thus *T. levantis* is most common along streams or around lakes (European records are also from broad-leaved forests along streams). Vertical range is from sea level (Turkey) up to 2,400 m asl (the Caucasus).

In Turkey, *T. levantis* is of very marginal co-occurrence with two larger moles: *T. europaea* and *T. caucasica* (see comments for these species). It is sympatric with *T. davidiana* at Tatvan.

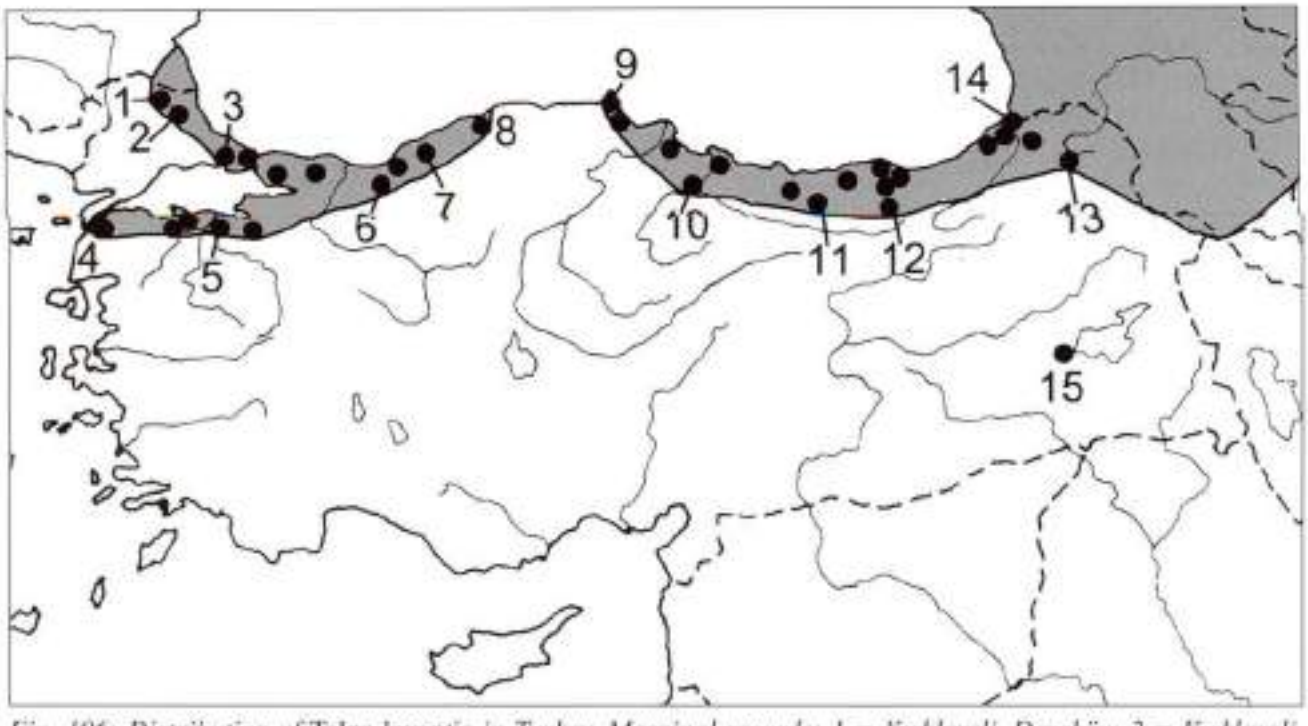

Fig. 106: Distribution of Talpa levantis *in Turkey. Marginal records: 1 = Kırklareli, Dereköy; 2 = Kırklareli, Pınarhisar; 3 = Bahçeköy; 4 = Çanakkale; 5 = Karacabey; 6 = Bolu, Karadere; 7 = Zonguldak; 8 = Bartın, Ziraat Findanlığı; 9 = Sinop, Gerze; 10 = Borabay Gölü, Taşova; 11 = Tamdere, Giresun; 12 = Gümüşhane, Torul; 13 = Kars, Yalnızçam Geçidi; 14 = Kemalpaşa; 15 = Bitlis, Tatvan. Corresponding references: Doğramacı (1989d): 1, 2, 3, 4, 5, 7, 9, 12, 14. Spitzenberger (in Felten* et al., *1973): 6, 13. Kefelioğlu & Gençoğlu (1996): 8. Osborn (1964a): 10. FMNH: 15. Own data: 11.*

Père David's Mole - *Talpa davidiana*

Scaptochirus davidianus Milne-Edwards, 1884. Type loc.: Meydanekbez (= Akbes), south-west of Gaziantep, Turkey.

Talpa streeti Lay, 1965. Type loc.: Hezar Darreh, Kurdistan Prov., Iran.

Taxonomy

The enigmatic mole *Scaptochirus davidianus*, described by Milne-Edwards (1884) from the "vicinity of Akbes on the border between Syria and Asia Minor" is evidently conspecific with the more recently named *T. streeti* from Iranian Kurdistan; the later name is thus a junior synonym. Furthermore, although this species possesses the most unique skull shape within genus *Talpa* and shows a high incidence of oligodonties, its pelvis clearly indicates that it is not closely related to China's *Scaptochirus moschatus* Milne-Edwards, 1867 as it was proposed by Grulich (1982) (see Kryštufek *et al.*, 2001).

Description

Recognisable by its shorter tail, Père David's mole externally resembles the other species of *Talpa*, but is slightly larger than *T. levantis*. The pelage is black and the rhinarium is pale (Plate XVI).

The skull is very robust with a broad, heavy rostrum (Figs. 99, 107; Table 22): rostral breadth across molars makes 28.6–33.2% of the condylobasal length (30.5% on average). The rostrum tapers more gradual-

	N	*Mean*	*min–max*
Head and body	7	128.3	120–134
Tail	7	24.1	18–30
Hind foot	7	19.0	17.8–21.0
Weight	5	74.3	61–80
Condylobasal lenght	9	31.2	28.3–33.5
Rostral breadth (molars)	9	9.5	8.1–10.7
Maxillary tooth-row	9	11.9	10.6–13.2

Table 22: External and cranial measurements of Talpa davidiana *from Turkey. Based on Kryštufek* et al. *(2001).*

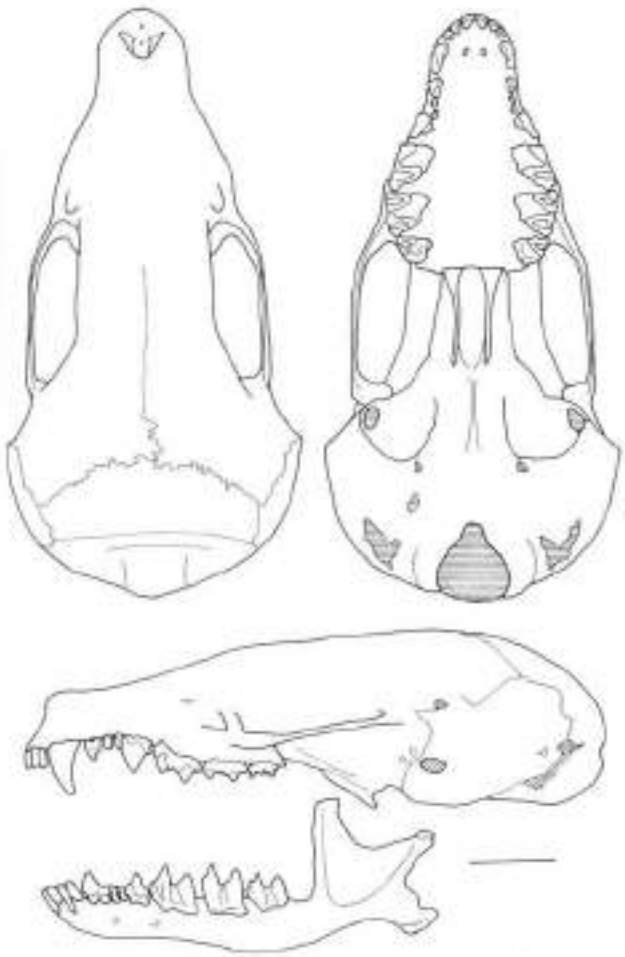

Fig. 107: Skull and mandible of Talpa davidiana *from Mergama Zona in the Cilo-Sat-Mts., Hakkari, Turkey. Scale bar = 5 mm.*

ly toward the anterior than in other moles, so it remains disproportionately broad also across the canines. The rostral breadth across the canines makes up 14.9–17.3% of the condylobasal length (as opposed to 12.1–14.5% in *T. levantis*). The molars are robust and the largest M2 diameter usually exceeds 2.0 mm. The 1st upper incisor is clearly larger than the second and the third ones (Fig. 101), whilst the lower incisors are crowded, occasionally resulting in the reduction of i3 (Fig. 108). Also prone to reduction are the peg-like premolars p2, p3, P2, and P3. The pelvis is of the caecoidal morphotype (Fig. 98), measuring 23.5–25.5 mm in length (Doğramacı 1989c). The karyotype is not known.

Variation

T. davidiana is larger in Iran (condylobasal length between 32.0–34.3 mm) whilst the type of *Scaptochirus*

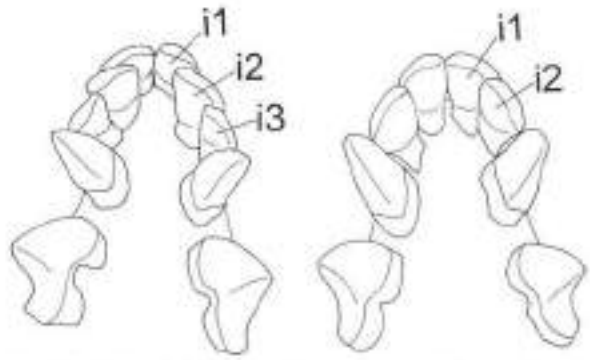

Fig. 108: Variability in the number of lower incisors (i1 - i3) in Talpa davidiana. *Left - complete set with crowded incisors (Hakkari); right - only two incisors on each side (Tatvan). Not to scale.*

Fig. 109: Habitat of Talpa davidiana: *alpine pastures on the Cilo-Sat Mts, Hakkari, East Turkey (altitude 2,400 m asl). Photo: E. Weiss; from Spitzenberger (1976).*

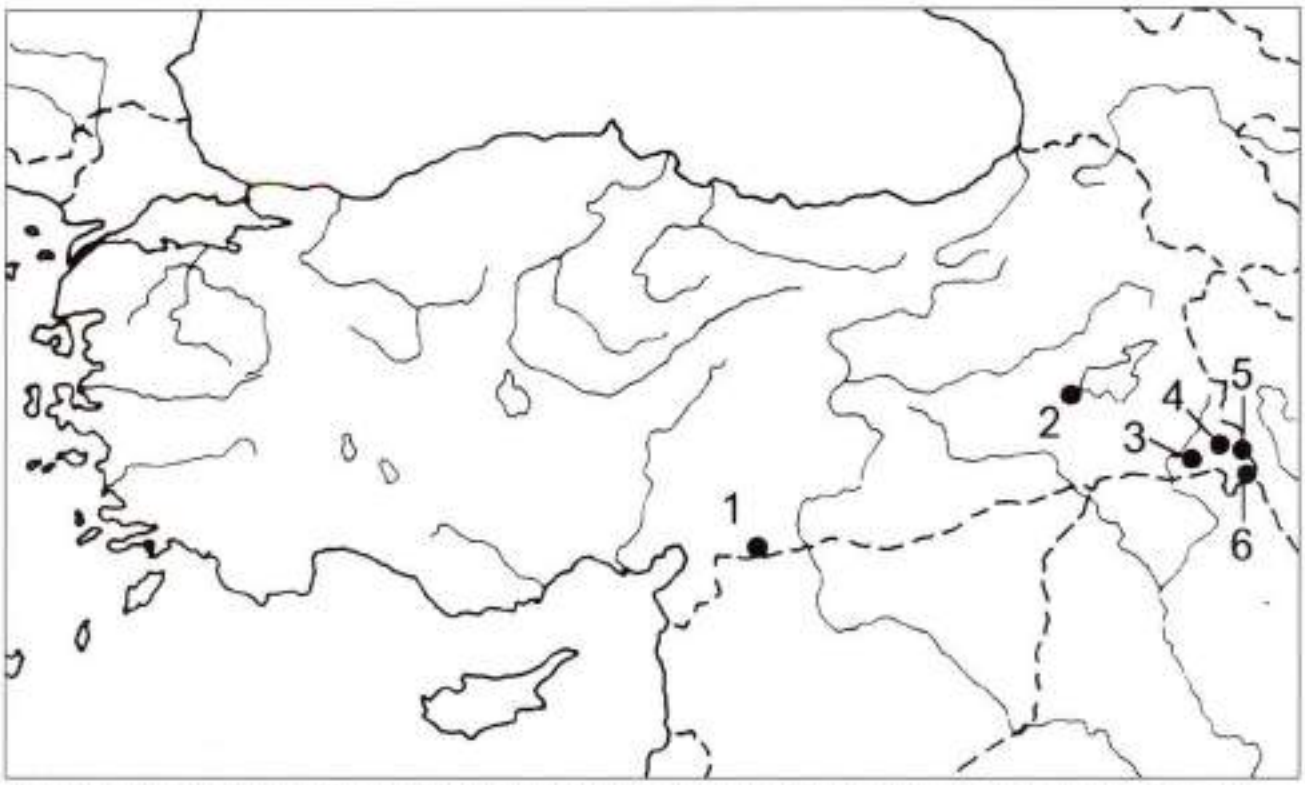

Fig. 110: Distribution of Talpa davidiana *in Turkey. Records: 1 = Meydanekbes (= Akbes); 2 = Tatvan; 3 = Hakkari, Mezralar; Megabuti yaylası; 4 = Cilo-Sat Mts, Mergan Zoma; 5 = Hakkari, Otluca köyü; 6 = Yüksekova. Corresponding reference: Kryštufek* et al. *(2001).*

davidianus from Meydanekbes is particularly small (condylobasal length 28.2 mm). Moles from Iran and Hakkari retain the complete dental set of 44 teeth; this number is reduced to 38 in moles from Tatvan (dental formula: 3/2, 1/1, 3/3, 3/3; Fig. 108). A similar set was found in the type of *S. davidianus*, but i2 was missing on the right side. Material of Père David's mole is scarce, so it is impossible to speculate on geographic trends.

Distribution

Known from the southern margin of the Anatolian - Iranian high plateau (Fig. 110). Only two localities are available from Iran, both near Divandarreh, Kurdistan. The majority of records come from the Hakkari region, but there are two more isolates near Van and at Meydanekbes; the latter is particularly far from the bulk of the species' known range.

Habitat

Specimens were apparently always collected at high altitudes (above 1,000 m, but mainly around 2,000 m asl), but very few data are available. This mole inhabits mountain meadows and pastures (Fig. 109), and also occurs in gardens (two specimens from Tatvan were collected from burrows in a hayfield). Meydanekbes seems anomalous from the point of view of both, altitude and habitat (see further discussion in Kryštufek *et al.*, 2001). The only place where *T. davidiana* co-occurs with another mole *(T. levantis)* is Tatvan.

Possible addition: Blind Mole - *Talpa caeca*

Talpa caeca Savi, 1822. Type loc.: near Pisa, Italy.

Taxonomy

After *T. caeca* had been split into several independent species, *T. levantis* was listed for Turkey instead of *T. caeca*. Our reason for re-considering *T. caeca* as a possible inhabitant of Anatolia is based on morphological grounds. Namely, although *T. caeca* from the Balkan Peninsula and *T. levantis* from Anatolia can be separated with relative ease, some moles from the Marmara region appear to be indistinguishable from *T. caeca*. Simple bivariate plots (Fig. 111) are also supported by a multivariate statistical analysis (Kryštufek, 2001). We are well aware that the morphological evidence alone might be misleading, however, since these animals are worthy of further research, they are treated here in this way instead being hidden within *T. levantis*.

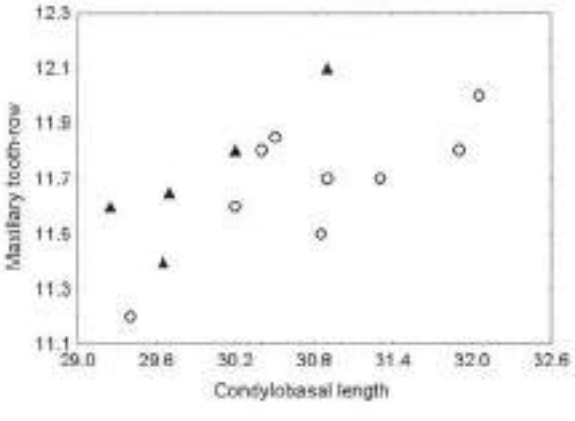

Fig. 111: Plot of maxillary tooth-row length against condylobasal length in Talpa levantis *from western Anatolia (circles) and* T. *cfr.* caeca *from Turkey (triangles).*

Description

Very similar to *T. levantis* in all aspects of morphology discussed so far (Table 23), but the maxillary tooth-row is relatively longer (Fig. 111). The animals' size is small, the eyes are covered with skin, and the pelvis is of the caecoidal morphotype (its length in a single female from Ulu Dağ is 22.3 mm). The 1st upper incisor is larger than the remaining two (Fig. 101). The skull

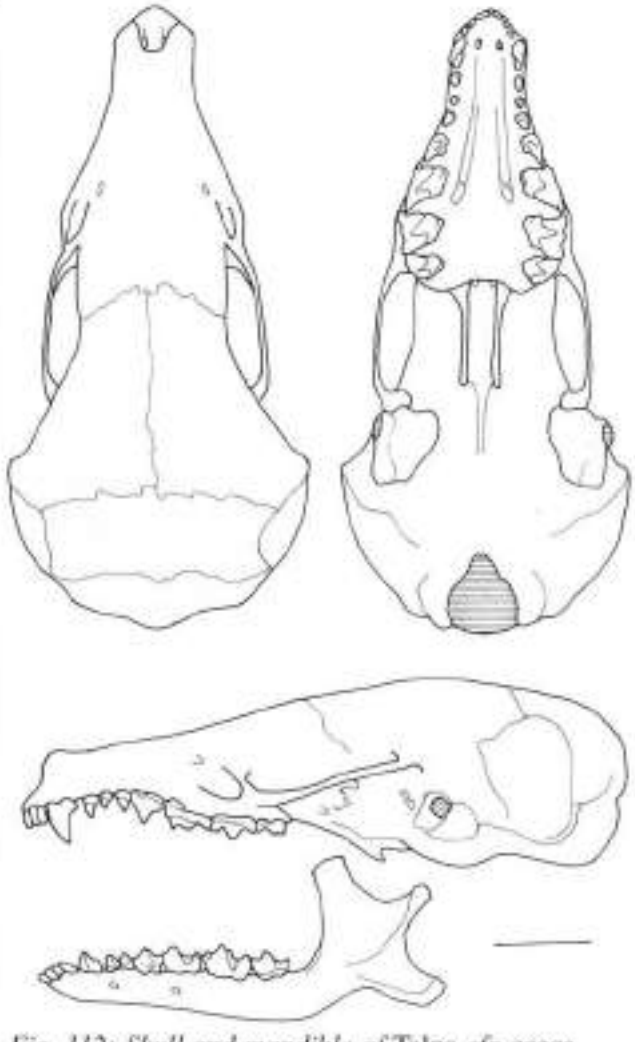

Fig. 112: Skull and mandible of Talpa *cfr.* caeca *from Ulu Dağ, Turkey. Scale bar = 5 mm.*

is slender (Fig. 112) and the average rostral breadth across molars is 27.5% of the condylobasal length.

The diploid number of chromosomes of *T. caeca*

	N	*Mean*	*min–max*
Head and body	4	110.5	103–118
Tail	4	29.0	28–30
Hind foot	4	16.3	15–18
Weight	3	47.3	40–55
Condylobasal lenght	5	30.0	29.6–30.9
Rostral breadth (molars)	5	8.2	7.8–8.9
Maxillary tooth-row	5	11.7	11.4–12.1

Table 23: External and cranial measurements in Talpa *cfr.* caeca *from the Marmara region of Turkey. Sexes are pooled. Based on specimens in NMW, NMNH, and own material.*

from the Balkans is 2N = 36 and the fundamental number of chromosomal arms is NF = 68 (Todorović *et al.*, 1972). Western Anatolian moles, ascribed here to *T.* cfr. *caeca*, have not been karyotyped.

Variation

Two subspecies are recognised in the Balkans (Kryštufek, 1994). The moles from Turkey are cranially closer to *T. c. steini* Grulich, 1971 (type locality is Mt. Lovćen in Montenegro, Federal Republic of Yugoslavia).

Distribution

The species' range is small and fragmented into three in southern Europe: the western Alps, the Apennines, and the western Balkans south of the Neretva River. So far, moles from three localities in north-western Anatolia were found to fit the cranial morphology of *T. caeca* (Fig. 113).

Habitat

From sea level to 1,800 m asl. On Mt. Ulu Dağ we collected this mole along a brook in a coniferous forest, whilst Osborn (1964a) reports it as a common inhabitant of "alpine meadows, as well as in beech and fir forest". It seems that habitat selection does not differ from that reported for *T. levantis*. It is noteworthy that thus far the two moles have not been collected from the same locality, however, collections are too small for any firm conclusions to be reached.

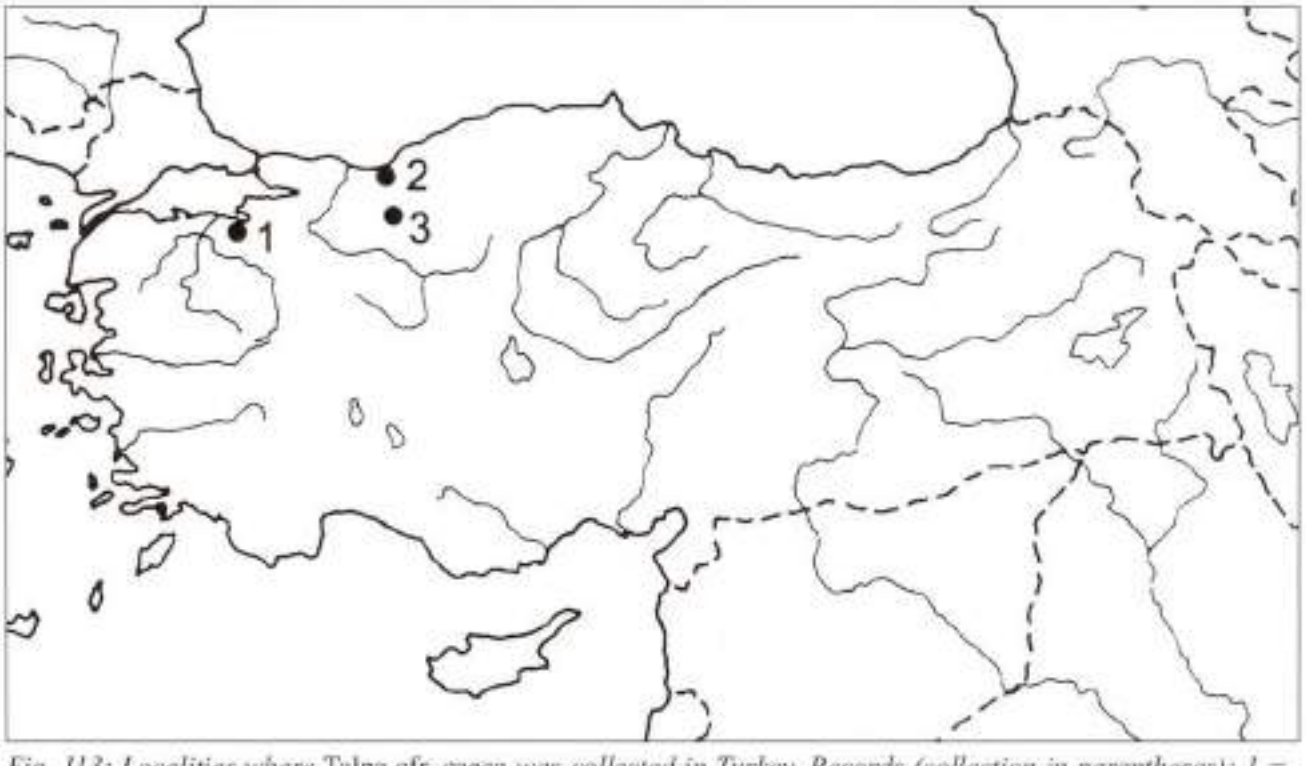

Fig. 113: Localities where Talpa cfr. caeca *was collected in Turkey. Records (collection in parentheses): 1 = Ulu Dağ (NMNH); 2 = between Akçakoca and Alaplı (NMNH); 3 = Bolu, Semen Dağ (NMW).*

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Sesalci Turčije in Cipra
Uvod, seznam vrst, žužkojedi

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POVZETEK

Turčija (površina 779.452 km^2) in Ciper (9.251 km^2) oklepata severozahodni del mediteranskega bazena. Tako imata obe območji, ki sta geografsko zelo raznoliki, poudarjen sredozemski značaj. Za obrobje Turčije (približno 30% površine) in celoten Ciper je značilno sredozemsko podnebje, medtem ko je Anatolska planota pod vplivom celinskega podnebja. Območje je gorato in kar 85% turškega ozemlja leži višje kot 450 m nad morjem, mediana nadmorska višina pa znaša 1.128 m. Malo Azijo oklepata dve vzporedni gorski verigi (Pontsko gorovje na severu in Taurus na jugu), ki se vzhodno od Evfrata skleneta v gorato vzhodno Anatolijo. Med gorstvi leži osrednja Anatolska planota, ki predstavlja srce Turčije.

Prvi podatki o sesalcih današnjega turškega ozemlja segajo v 11. stoletje (Usáma ibn Munkiz), začetki sodobnih favnističnih raziskav pa so iz 30-ih let 19. stoletja. V 19. stoletju sta bili najpomembnejši dve terenski odpravi C. G. Danforda, na začetku 20. stoletja pa zbirki A. C. Bailwarda in R. B. Woosmana iz vzhodne Anatolije ter A. Robertsa iz okolice Trabzona. V prvi polovici 20. stoletja so posebej pomembne raziskave G. Neuhäuser. V prvih desetletjih po l. 1941 so k poznavanju sesalcev Turčije največ prispevali raziskovalci iz Nemčije (H. Kumerloeve, G. Storch, D. Kock, H. Felten), Avstrije (F. Spitzenberger, H. M. Steiner), Belgije (X. Missone) in ZDA (J. D. Osborn). V tem času postajajo pogostejše objave turških zoologov (B. Mursaloğlu, M. Çağlar, S. Doğramacı, E. Kıvanç, C. Kurtonur), ki v 90-ih letih, skupaj z mlajšimi sodelavci prevzamejo vodilno vlogo pri raziskavah teriofavne nacionalnega ozemlja. Raziskave recentnih sesalcev so se na Cipru začele razmeroma pozno (druga polovica 19. stoletja) in so v glavnem ostale skromne. Izjema so temeljite raziskave F. Spitzenberger v 70-ih letih.

Kljub nekaterim novejšim kompilacijam (Doğramacı, 1989; Demirsoy, 1996), je temeljno delo za sesalce Turčije še vedno Kumerloeve (1975a). Podobno delo za sesalce Cipra je objavila F. Spitzenberger (1978a, 1979). Revizija je pokazala, da je v 20. stoletju živelo na proučevanem območju 142 vrst sesalcev (brez kitov Cetacea), od katerih je ena morska (*Monachus monachus*), preostale pa kopenske. Eno vrsto je v tem obdobju človek že iztrebil (tiger *Panthera tigris*), najmanj dve pa je namenoma naselil (*Oryctolagus cuniculus, Myocastor coypus*). Glodalci so z vrstami daleč najbogatejši red (43% vrst), sledijo pa jim netopirji (24%), zveri (13,5%) in žužkojedi (12%). Ciprska favna je izrazito otoška z močno prevlado netopirjev, ki predstavljajo kar 54% vseh vrst; vseh sesalcev je na otoku 26. Z izjemo endemične bodičaste miši *Acomys nesiotes*, najdemo vse ciprske sesalce tudi v Turčiji. Od 141 sesalcev jih živi v evropski Turčiji najmanj 67, v Mali Aziji pa 132 (= 93,6%). Številne vrste segajo v Turčijo iz enega od štirih glavnih biogeografskih centrov, zato je njihovo pojavljanje v Turčiji zelo obrobno. Iz evropskega (in deloma azijskega) prostora so to *Sorex araneus, S. minutus, Talpa europaea, Sciurus vulgaris, Spermophilus citellus, Apodemus agrarius, Nannospalax leucodon* in *Mustela putorius*. Preostala biogeografska središča so še kavkaško (*Talpa caucasica, Prometheomys schaposchnikovi, Microtus daghestanicus, Sicista caucasica*), iransko (*Ellobius lutescens, Meriones persicus, M. vinogradovi, M. meridianus, Allactaga elater*) in arabsko (*Taphozous nudiventris, Rousettus aegyptiacus, Otonycteris hemprichi, Gazella spp., Mesocricetus auratus, Tatera indica, Meriones lybicus, M. crassus, Gerbillus dasyurus, Allactaga euphratica, Eliomys melanurus*). Pet vrst je endemičnih za Anatolijo (*Crocidura arispa, Microtus dogramaci, M. anatolicus, Acomys cilicicus, Dryomys laniger*), areali nadaljnih šestih vrst pa so pretežno znotraj meja Turčije (*Talpa davidiana, Spermophilus xanthoprymnus, Mesocricetus brandti, Nannospalax ehrenbergi, Myomimus roachi, Allactaga williamsi*). Za obstoj sedmih vrst, ki jih za Turčijo navaja literatura, ni dokazov o njihovi prisotnosti na tem območju (*Procavia capensis, Cuon alpinus, Mustela erminea, Felis ornata, Lynx pardinus, Nesokia indica, Eliomys quercinus*).

Sedemnajst vrst na Cipru in v Turčiji živečih žužkojedov sva podrobneje obdelala. Za vsako vrsto podajava veljavno znanstveno ime s sinonimiko, komentar k taksonomskemu položaju, opis (zunanja morfologija, lobanja, zobovje, kariotip), geografsko variabilnost, razširjenost, ter način življenja

(predvsem izbiro habitata). Opis dopolnjuje fotografija muzejskega primerka ter risba lobanje, podatke o razširjenosti pa točkovna arealna karta. Podan je tudi določevalni ključ, vsak rod pa je predstavljen z risbo značilnega predstavnika.

Beloprsi jež *Erinaceus concolor* Martin, 1838, je v Turčiji splošno razširjen (z izjemo puščavskih območij ob meji s Sirijo), na Cipru pa ne živi. Geografska variabilnost je izražena v velikosti in obarvanosti, novejša taksonomska revizija pa kaže na možen obstoj treh podvrst.

Dolgouhi jež *Hemiechinus auritus* (Gmelin, 1770) je pogost na Cipru (do nadmorske višine 900 m), kamor ga je očitno zanesel človek, v Turčiji pa se pojavlja samo na obrobju v okolici Aralika (vzhodna Anatolija) in ob meji s Sirijo. Otoška podvrsta *H. a. dorotheae* Spitzenberger, 1978 je večja od celinske *H. a. calligoni* (Satunin, 1901).

Mala rovka *Sorex minutus* Linnaeus, 1766, je znana samo s pogorja Istranca v evropski Turčiji, kjer živi v vlažnih bukovih gozdovih z bogato podrastjo grmičastega sleča na nadmorski višini 800 metrov.

Kavkaška mala rovka *Sorex volnuchini* Ognev, 1921 je morfološko zelo podobna mali rovki. Razlike obstajajo na kariološkem in molekularno-biološkem nivoju. Vrsta je endemična za Kavkaz in pontsko gorovje vse do kraja Bolu na zahodu. Živi v vlažnih gozdovih na nadmorski višini med 400 in 2.400 m. Le izjemoma smo jo našli simpatrično s kavkaško gozdno rovko.

Gozdna rovka *Sorex araneus* Linnaeus, 1758, je znana samo s pogorja Istranca v evropski Turčiji, kjer živi simpatrično z malo rovko. Za populacijo z Istrance je značilen specifičen kromosomski komplet (2N = 26).

Kavkaška gozdna rovka *Sorex satunini* Ognev, 1921, je endemit Kavkaza in gorskih območij v severni Anatoliji (do Ulu Dağa na zahodu). Morfološko je zelo podobna gozdni rovki, vendar je nekoliko svetlejša, še posebej na trebuhu, in ima dvobarven rep. Zanesljiva determinacija je mogoča na osnovi kromosomskega kompleta in mobilnosti izoencimov v električnem polju. Kjer je kavkaška gozdna rovka simpatrična z raddejevo rovko, se izogiblje gozdovom in živi na alpinskih travnikih.

Raddejeva rovka *Sorex raddei* Satunin, 1895, je endemit Kavkaza in vzhodnih pontskih gora v Turčiji. To vrsto so dolgo časa obravnavali skupaj z gozdno rovko, čeprav obstajajo jasne morfološke razlike (obarvanost, podrobnosti v zobovju). Raddejeva rovka živi na vlažnih mestih z večjimi skalami v gozdovih; zlasti pogosta je ob vodnih tokovih.

Močvirska rovka *Neomys anomalus* Cabrera, 1907, je znana tako iz Trakije, kot iz Male Azije. Areal v osrednji in vzhodni Anatoliji ter v pogorju Taurus je razmerom slabo znan. Vrsta je povsod vezana na bližino vode.

Kavkaška vodna roka *Neomys teres* Miller, 1908 je bila vse do nedavna znana pod imenom *N. schelkovnikovi* Satunin, 1913. Je endemična za Kavkaz in pontsko gorovje v Turčiji (do Boluja na zahodu in Vana na jugu). Zelo je podobna močvirski rovki, se pa razlikuje po obliki penisa in v zaporedju baznih parov mitohondrijskega *b* gena in dela 12S ribosomske RNK. Vrsti rodu *Neomys* sta v Anatoliji pretežno alopatrični in samo ob jezeru Abant smo ju našli blizu skupaj. Kavkaška vodna rovka živi ob gorskih potokih in rečicah, med 500 in 2.450 m nadmorske višine.

Poljska rovka *Crocidura leucodon* (Hermann, 1780) je v Turčiji splošno razširjena od nivoja morske gladine do 1.950 m visoko, vendar je občutno redkejša od vrtne rovke. Za poljske rovke iz severovzhodne Turčije je značilen temen trebuh, ki je pri ostalih turških populacijah bel.

Vrtna rovka *Crocidura suaveolens* (Pallas, 1811) je v Turčiji in na Cipru najbolj razširjena in najpogostejša rovka. Obstaja znatna geografska variabilnost v barvi in velikosti; populacija s Cipra je dokaj majhna, vendar razmeroma dolgorepa. Vrtna rovka živi v odprtih habitatih, od morske obale do višine 1.900 m.

Oslovska rovka *Crocidura arispa* Spitzenberger, 1971, je endemit Anatolije. Znana je po vsega dveh primerkih, ujetih na dveh nahajališčih v pogorju Taurus. Vezana je na skalne bloke.

Etruščanska rovka *Suncus etruscus* (Savi, 1822) je v Turčiji in na Cipru najmanjši sesalec. Najdbe so redke, kar pa je v glavnem posledica metodologije pri terenskem zbiranju malih sesalcev.

Navadni krt *Talpa europaea* Linnaeus, 1758, živi samo v nižavju turške Trakije.

Kavkaški krt *Talpa caucasica* Satunin, 1908, je endemit Kavkaza, v Turčijo pa seže samo v okolici Hope.

Levantinski slepi krt *Talpa levantis* Thomas, 1906, naseljuje severno Anatolijo in gorovje Istranca v Trakiji; v okolici Vana živi izolirana populacija. To je najpogostejša vrsta krta v Turčiji. Primerki iz severozahodne Anatolije so v značilnostih lobanje bolj podobni evropskemu slepemu krtu *Talpa caeca* Savi, 1822, zato puščamo njihov taksonomski položaj odprt.

Davidov krt *Talpa davidiana* (Milne-Edwards, 1884) je bil vse do nedavna znan pod imenom *Talpa streeti* Lay, 1965. Najden je bil na vsega nekaj nahajališčih vzdolž južnega roba anatolsko-iranske visoke planote. Morfološko je najbolje opredeljena vrsta rodu *Talpa*.

Colour Plates

PLATE I/1

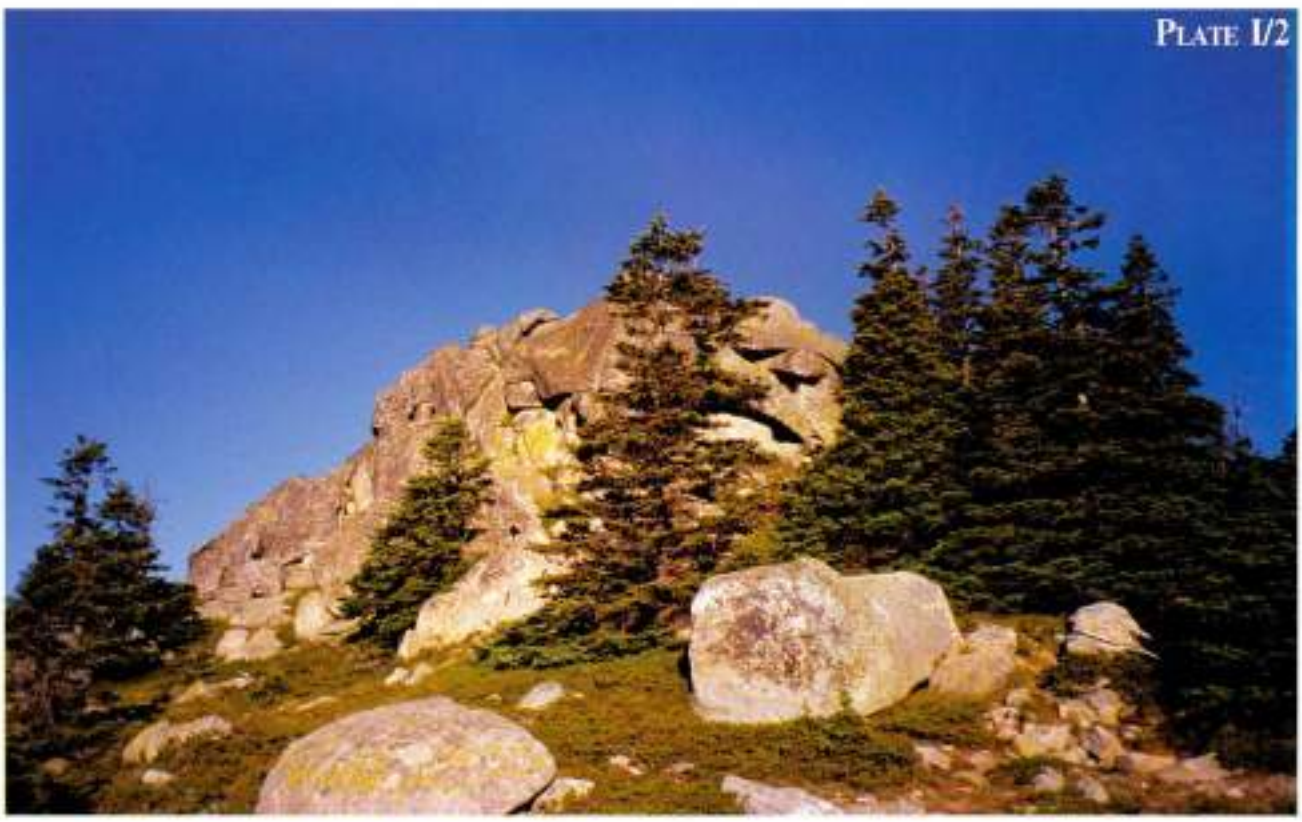


PLATE I/2

PLATE II/1

PLATE II/2

PLATE III/1

PLATE III/2

Plate IV/1

Plate IV/2

PLATE V/1

PLATE V/2

PLATE VI/1

PLATE VI/2

PLATE VII/1

PLATE VII/2

Plate VIII/1

Plate VIII/2

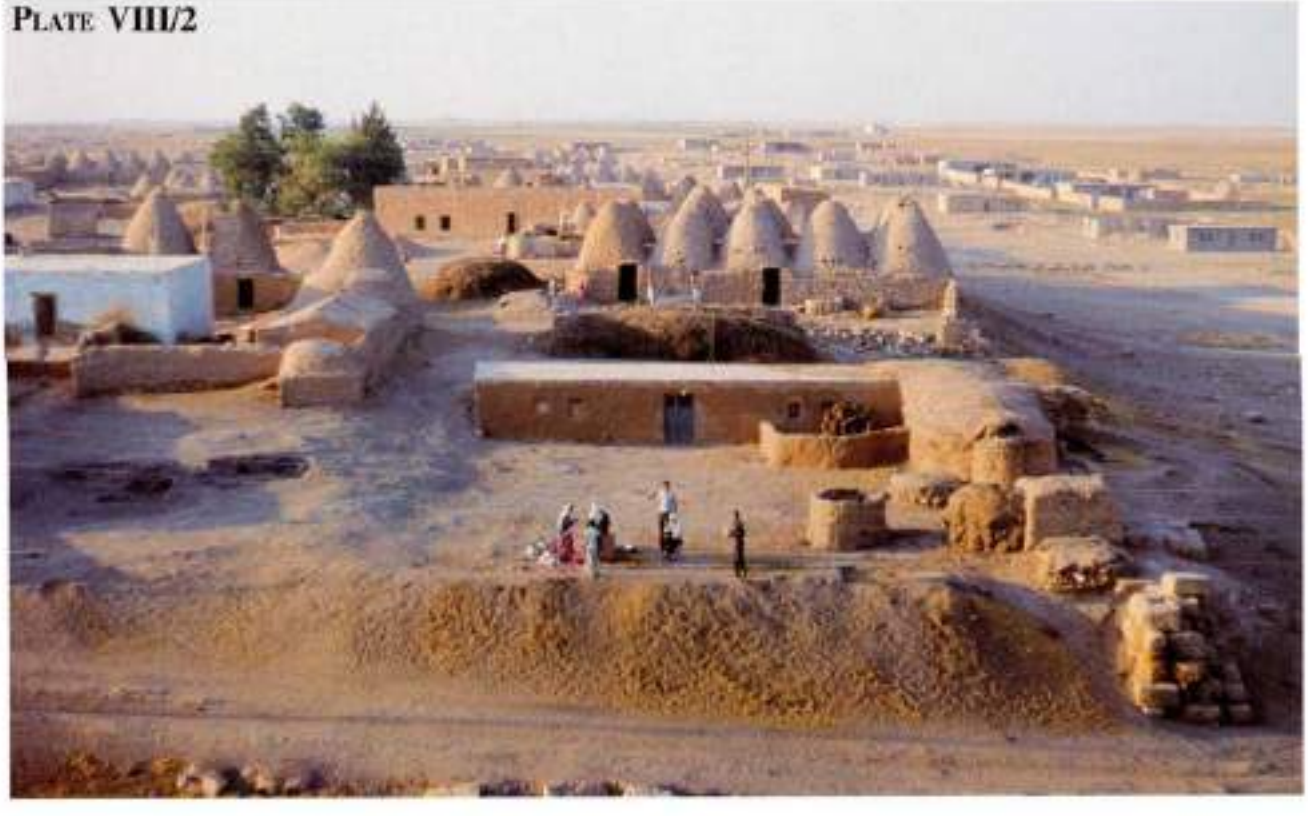


PLATE IX/1

PLATE IX/2

Plate X/1

Plate X/2

PLATE XI/1

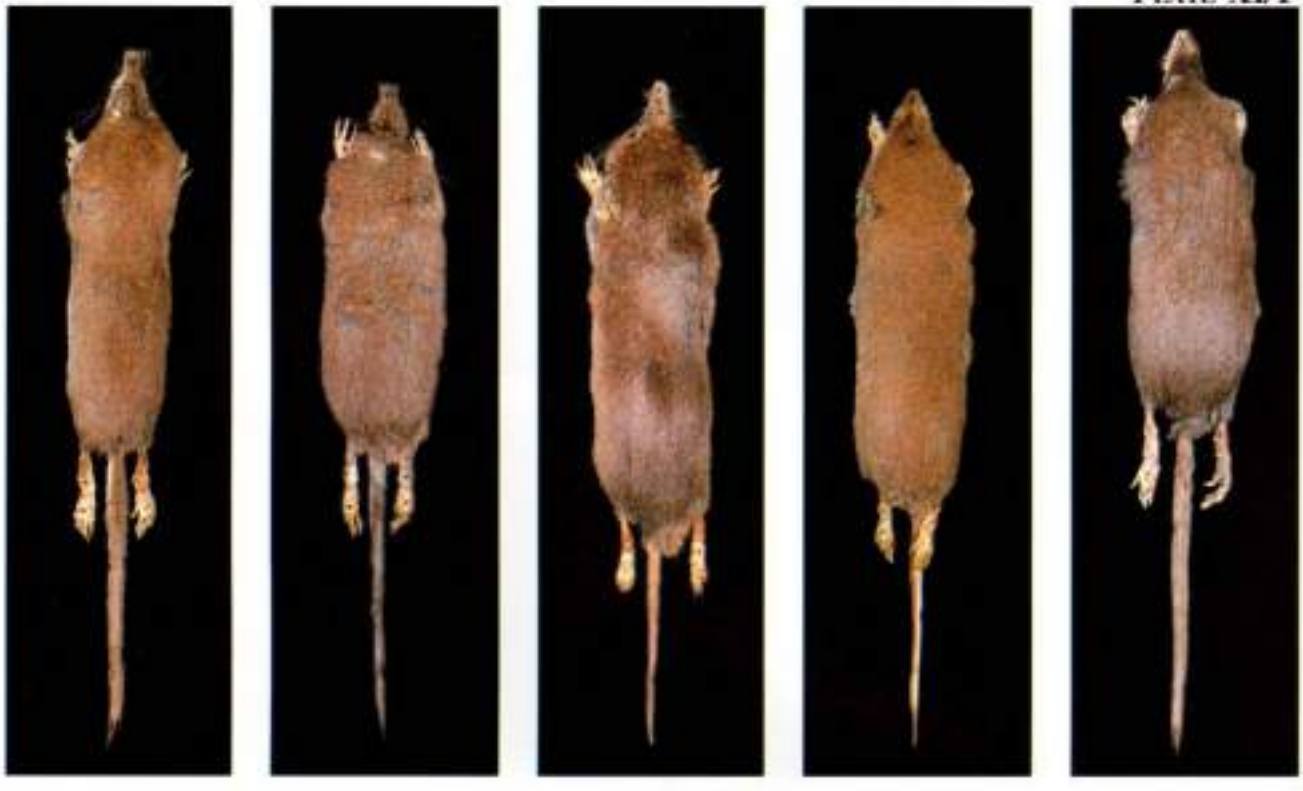


PLATE XI/2

PLATE XII/1

PLATE XII/2

PLATE XIII/1

PLATE XIII/2

Plate XIV/1

Plate XIV/2

PLATE XV/1

PLATE XV/2

Plate XVI/1

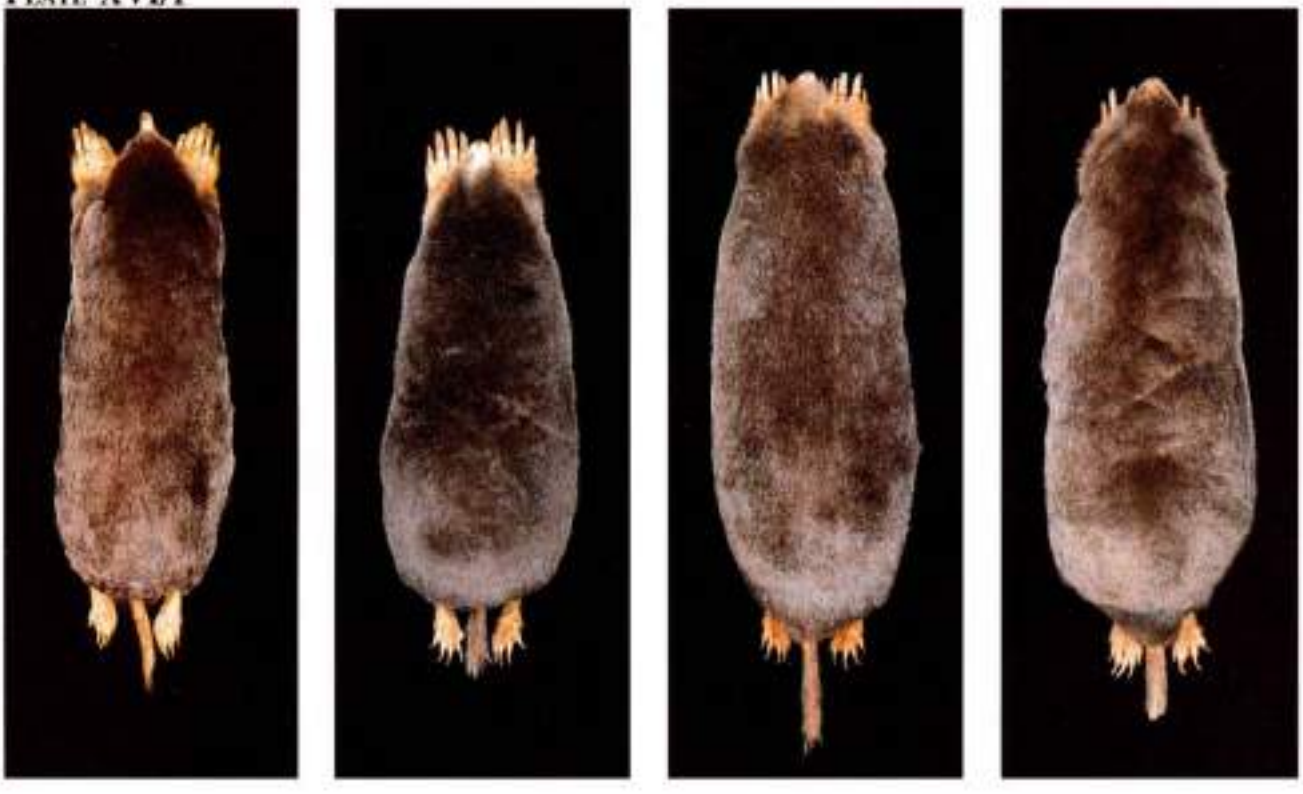


Plate XVI/2

Captions to Colour Plates

Plate I/1
Anthropogenic steppe in Turkish Thrace, interspersed with shrubs and trees. Karakasım, south of Edirne (altitude 40 m asl). Habitat of *Erinaceus concolor, Crocidura leucodon, C. suaveolens, Spermophilus citellus, Microtus rossiaemeridionalis, Mus macedonicus, Apodemus flavicollis, A. sylvaticus, Nannospalax leucodon, Myomimus roachi,* and *Dryomys nitedula*. Photo: B. Kryštufek.

Plate I/2
Pastures and rocky outcrops above the timberline on Mt. Ulu Dağ, Marmara *(ca.* 2,000 m asl). Habitat of *Microtus subterraneus, Chionomys nivalis,* and *Apodemus uralensis*. Photo: B. Kryštufek.

Plate II/1
Mixed forest (mainly maple, various oaks and pine) on the slopes of Kaz Dağları, Marmara. Habitat of *Apodemus iconicus* and *A. mystacinus*. Photo: B. Kryštufek.

Plate II/2
Degraded landscape with rocky habitats near Ayvacık, Aegean (close to the sea level). Habitat of *Crocidura leucodon, C. suaveolens, Mus macedonicus, Apodemus iconicus, A. flavicollis,* and *A. mystacinus*. Photo: B. Kryštufek.

Plate III/1
Citrus plantation in a fertile valley; eroded slopes are with sparse shrub vegetation. Vicinity of Aydın, Aegean (altitude *ca.* 200 m asl). Habitat of *Microtus guentheri, Cricetulus migratorius, Mus macedonicus, Apodemus flavicollis, A. iconicus,* and *A. mystacinus*. Photo: B. Kryštufek.

Plate III/2
Eroded slopes with pines and cedars near the village of Derekôy, Ak Dağları, central Taurus Mts (altitude *ca.* 1,600 m asl). Photo: D. Král.

Plate IV/1
Mediterranean vegetation around Içel, the eastern Taurus Mts (close to the sea level). Habitat of *Mus macedonicus, Apodemus mystacinus,* and *Acomys cilicicus*. Photo: B. Kryštufek.

Plate IV/2
Dry steppe between Niğde and Kayseri, central Anatolia (altitude 1,120 m asl). Habitat of *Spermophilus xanthoprymnus*. Photo: B. Kryštufek.

Plate V/1
Alpine pastures on Mt. Erciyes Dağı, central Anatolia (altitude 1,950 m asl). Habitat of *Mustela nivalis, Spermophilus xanthoprymnus, Chionomys nivalis, Apodemus iconicus,* and *A. mystacinus*. Photo: B. Kryštufek.

Plate V/2
Deciduous forest (plane-trees, oaks, beech) along the Yenice River, north-west of Karabük, western Black Sea Mts. Habitat of *Erinaceus concolor, Neomys anomalus, Crocidura suaveolens, Clethrionomys glareolus, Microtus subterraneus, Apodemus flavicollis, A. uralensis,* and *A. iconicus*. Photo: B. Kryštufek.

Plate VI/1
Mixed forest (alder, beech, spruce) along a mountain brook near Maçka, western Black Sea Mts (altitude *ca.* 1,000 m asl). Habitat of *Sorex volnuchini, S. raddei, Microtus majori, Chionomys roberti, Apodemus uralensis,* and *A. mystacinus*. Photo: B. Kryštufek.

Plate VI/2
Alpine meadow with rocks on the Ovitdağı mountain Pass, eastern Black Sea Mts (altitude 2,450 m asl). Habitat of *Sorex satunini, Neomys teres, Arvicola terrestris, Microtus majori,* and *Chionomys gud*. Photo: B. Kryštufek.

Plate VII/1
Dry pastures with trees and bushes along the stream near Sirbasan, district of Kars, East Anatolia (altitude *ca.* 2,200 m asl). Habitat of *Sorex satunini* (along the stream), *Microtus obscurus, M. daghestanicus, Cricetulus migratorius, Mesocricetus brandti,* and *Apodemus iconicus*. Photo: D. Frynta.

Plate VII/2
Rocky landscape above Elazıg, East Anatolia. Habitat of *Chionomys nivalis* and *Apodemus mystacinus*. Photo: B. Kryštufek.

Plate VIII/1
Dry rocky steppe at the foot of Mt. Ararat near Doğubayazit, East Anatolia (altitude 1,900 m asl). Habitat of *Cricetulus migratoris, Mesocricetus brandti,* and *Allactaga williamsi*. Photo: D. Král.

Plate VIII/2
Harran, district of Urfa, south-eastern Anatolia (altitude 350 m asl). Semidesert habitats around the village are populated with *Hemiechinus auritus, Crocidura suaveolens, Eliomys melanurus, Allactaga euphratica, Tatera indica* and various jirds *Meriones* spp. Photo: D. Frynta.

Plate IX/1
Mediterranean maquis on limestone at Episkopi (west of Limassol), Cyprus (close to the sea level). Habitat of *Mus* sp. Photo: A. Kryštufek.

Plate IX/2
Dry grassy slope with brushes on a mudstone bedrock north-east of Limassol. Habitat of *Mus sp., Rattus rattus,* and *Acomys nesiotes*. Photo: A. Kryštufek.

Plate X/1
Skin of *Erinaceus concolor* from Gökcimen, Konya district, central Anatolia in dorsal (left) and ventral view (right). Photo: C. Mlinar.

Plate X/2
Skin of *Hemiechinus auritus dorotheae* from the vicinity of Larnaca, Cyprus, in dorsal (left) and ventral view (right). Collection NMW 14,840. Photo: C. Mlinar.

Plate XI/1
Skins of *Sorex* shrews from Turkey in dorsal view. From left to right: *Sorex minutus* (Velika köy, Istranca Mts, Turkish Thrace; IZCU TU-32); *S. volnuchini* (Meryemana near Trabzon, eastern Black Sea Mts; IZCU TU-263); *S. araneus* (Velika köy, Istranca Mts, Turkish Thrace; IZCU TU-27); *S. satunini* (vicinity of

Bağdaşan, district of Kars, eastern Black Sea Mts; IZCU TU-689); *S. raddei* (Çankurtan Geçidi, district of Artvin, eastern Black Sea Mts; IZCU TU-246). Photo: C. Mlinar.

Plate XI/2
Skins of *Sorex* shrews from Turkey in ventral view. See caption to Plate XI/1 for the identity of specimens. Photo: C. Mlinar.

Plate XII/1
Skins of the two water shrews of Turkey in dorsal view: *Neomys anomalus* (above; from the Istranca Mts., Turkish Thrace: NMW 11,628) and *N. teres* (below; from Ulubey near Ordu, eastern Black Sea Mts; NMW 19,869). Photo: C. Mlinar.

Plate XII/2
Skins of the two water shrews of Turkey in ventral view. See caption to Plate XII/1 for the identity of specimens.
Photo: C. Mlinar.

Plate XIII/1
Skins of *Crocidura leucodon* from Turkey in dorsal view: white bellied specimen (above) from Cığlıkara near Antalia, the Taurus Mts (above; NMW 20,470), and *C. l. lasia* (below) from Rize, eastern Black Sea Mts (IZEA 1,349). Photo: C. Mlinar.

Plate XIII/2
Skins of *Crocidura leucodon* from Turkey in ventral view. See caption to Plate XIII/1 for the identity of specimens. Photo: C. Mlinar.

Plate XIV/1
Skins (in dorsal view) of *Crocidura suaveolens* (above) from the district of Artvin, eastern Black Sea Mts (NMW 18,575) and of *Crocidura suaveolens cypria* (below) from the vicinity of Nicosia, Cyprus (NMW 14,881). Photo: C. Mlinar.

Plate XIV/2
Skins (in ventral view) of *Crocidura suaveolens*. See caption to Plate XIV/1 for the identity of specimens. Photo: C. Mlinar.

Plate XV/1
Skin of the type specimen *Crocidura arispa* from Ulukisla, distict of Niğde, central Anatolia in dorsal (above) and ventral view (below). Collection NMW 13,284. Photo: C. Milnar.

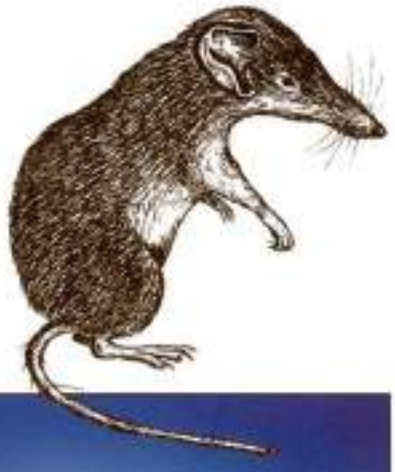
Plate XV/2
Skin of *Suncus etruscus* from Adana in dorsal (above) and ventral view (below). Collection IZCU TU-79. Photo: C. Mlinar.

Plate XVI/1
Skins of Turkish moles in dorsal view. From left to right: *Talpa europaea* (Gradsko, Republic of Macedonia); *T. caucasica* (Konaklı köyü near Arhavi, district of Artvin, eastern Black Sea Mts; OMU 574); *T. levantis* (Tatvan, Bitlis, eastern Anatolia; OMU 235); *T. davidiana* (Hakkari region, eastern Anatolia; OMU 231). Photo: C. Mlinar.

Plate XVI/2
Skins of Turkish moles in ventral view. See caption to Plate XVI/1 for the identity of specimens. Photo: C. Mlinar.

Dr. Boris Kryštufek je izredni profesor za zoologijo, vodja Inštituta za biodiverzitetne študije pri Znanstveno-raziskovalnem središču Republike Slovenije Koper in muzejski svetnik v Prirodoslovnem muzeju Slovenije. Zanimajo ga biologija, taksonomija in varstvo sesalcev ter biodiverzitetni vzorci. Sesalce je zbiral v palearktisu, orientalisu, nearktisu in etiopisu. Poleg prek sto znanstvenih objav je tudi avtor dveh knjig (Sesalci Slovenije, Osnove varstvene biologije) in sourednik nadaljnjih dveh (Atlas evropskih sesalcev, Ključ za določanje vretenčarjev Slovenije). Dr. Kryštufek je član petih specialističnih skupin (komisije za varstvo vrst pri Mednarodni zvezi za varstvo narave), več uredniških odborov, deluje pa tudi v nekaj nacionalnih komisijah za ohranjanje biodiverzitete in varstvo velikih zveri.

Dr. Vladimír Vohralík je višji predavatelj na Oddelku za zoologijo Karlove univerze v Pragi. Zanimajo ga biologija, taksonomija in zoogeografija malih terestričnih sesalcev. Je odbornik in knjižničar Češkega zoološkega društva. Dr. Vohralík je zbiral žužkojede in glodalce v raznih območjih osrednje Evrope, Balkana ter Bližnjega in Srednjega Vzhoda. Rezultate je objavil v prek tridesetih znanstvenih člankih. Poleg drugega je sourednik Atlasa evropskih sesalcev in Praških študij v mamologiji.



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