John, B., and Lewis, K. R. (1968): The Chromosome Complement. Protoplasmatologia. Handbuch der Protoplasmaforschung, Bd. VI, Springer-Verlag, Wien — New York.
Makino, S. (1943): Studies on the murine chromosomes. III. A comparative study of chromosomes in five species of *Rattus*. J. Fac. Sci. Hokkaido Imp. Univ. Ser. VI, Zool. **9**, 19—57.
Matthey, R. (1956): La formule chromosomique de quelques Murinae (Murida — Rodentia — Mammalia). Arch. Jul. Klaus-Stiftung **31**, 294—306.
— (1959): Les chromosomes des Mammifères euthériens Liste critique et essai sur l'évolution chromosomique. Arch. Jul. Klaus-Stiftung **33**, 253—297.
— (1964): La signification des mutations chromosomiques dans les processus de spéciation. Étude cytogénétique du sous-genre *Leggada* Gray (Mammalia-Muridae). Arch. Biol. **75**, 169—206.
— (1966): Le polymorphisme chromosomique des *Mus* africains du sous-genre *Leggada*. Révision générale portant sur l'analyse de 213 individus Rev. Suisse Zool. **73**, 585—607.
Nadler, Ch. F. (1969): Chromosomal Evolution in Rodents. In: Comparative Mammalian Cytogenetics. Ed.: K. Benirschke, Springer-Verlag, New York.
Nur, U., and Nevo, E. (1969): Caryologia **22**, 97.
Ray-Chaudhuri, S. P., Rangini, P. V., and Sharma, T. (1968): Karyological studies of 16 species of Indian mammals. Pers. comm. (MCNL, **9**, Nr. 2, April 1968).
White, M. J. D. (1968): New concepts suggest that the classical sympatric and allopatric models are not the only alternatives. Science **159**, 1065—1070.
Yong, H. S. (1969): Karyotypes of Malayan Rats (Rodentia-Muridae, Genus *Rattus* Fischer). Chromosoma (Berl.) **27**, 245—167.
Yong, H. S., and Dhaliwal, S. S. (1970): Chromosomal polymorphism in the Malayan house rat, *Rattus (rattus) diardii* (Jentik). Pers. comm. (MCNL, **11**, Nr. 1, January 1970).
Yosida, T. H., Nakamura, A., and Fukaya, T. (1965): Chromosomal polymorphism in *Rattus rattus* (L.) collected in Kusudomari and Misima. Chromosoma (Berl.) **16**, 70—78.
Yosida, T. H., Tsuchiya, K., Imai, H., and Moriwaki, K. (1969): New chromosome types of the black rat, *Rattus rattus*, collected in oceania and F_1 hybrids between Japanese and Australian rats. Japan. J. Genetics **44**, 89—91.

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Contribution to the knowledge of *Crocidura suaveolens* (Mammalia, Insectivora) from Greece, with a description of a new subspecies

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The taxonomy of the Lesser White-toothed Shrew *Crocidura suaveolens* Pallas, 1811 in Greece and in the southern part of the Balkan Peninsula is not well known. Miller (1912) has assigned two specimens from Corfu to the central European subspecies *C. s. mimula* Miller, 1901, which according to Niethammer (1962) belong to the Italian subspecies *C. s. debauxi* Dal Piaz, 1925. The similarity of the specimens from Corfu to those from Italy has been noted also by Witte (1964), who considers specimens from Dalmatia similar to these also. Specimens from Mt. Olympus, Thessaly

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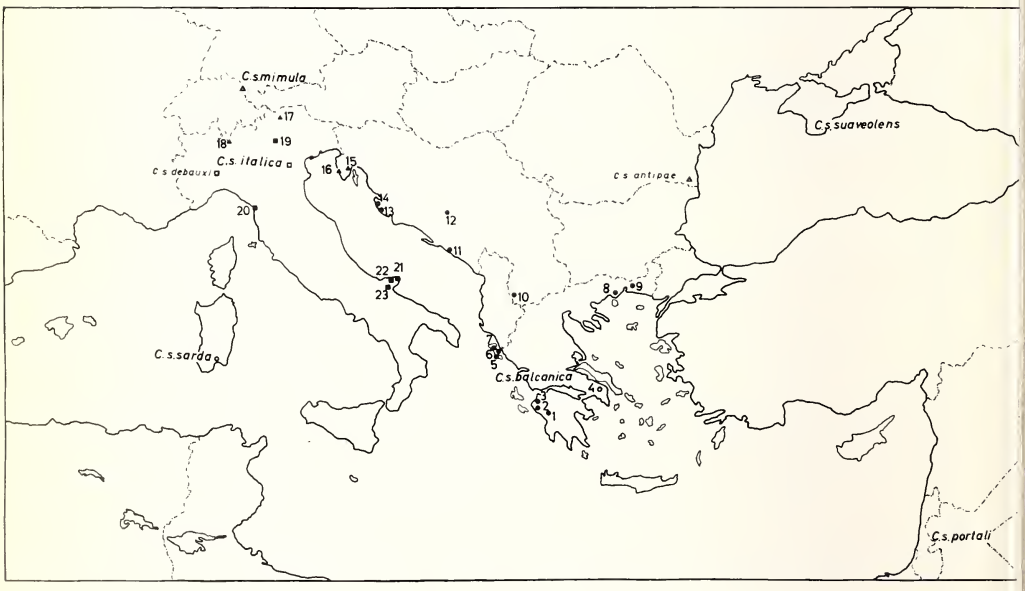
and Dirphys Mt., Euboea have been assigned to the central European subspecies by Chaworth-Musters (1932) and Wolf (in Peus, 1958). However Kahmann (1964) does not assign specimens from Peloponnesus to any subspecies.

Markov (1957) accepts in addition to *C. s. mimula,* which is distributed in the northwest part of Bulgaria, the subspecies *C. s. antipae* Matschie, 1901 which occurs in the southern and eastern part of that country. However according to Atanassov and Peschev (1963) the characteristics are not sufficient to distinguish these two subspecies, while Vasiliu and Sova (1968) consider *C. s. antipae,* of which the type locality is Siulnita and Barza, Rumania, as synonymous to *C. s. mimula.* Dulic (1961) accepts that the central European subspecies *C. s. mimula* occurs in Istria, Yugoslavia and not the Italian subspecies *C. s. italica* Cavazza, 1912 (= *C. s. debauxi* Dal Piaz, 1925), which might be supposed with regard to its geographical position.

In the present paper specimens from Greece are assigned to a new subspecies *C. s. balcanica* (see page 379), which is distributed in the southern part of the Balkan Peninsula. The new subspecies has a greater condylobasal length and tail length compared to the central European subspecies *C. s. mimula* Miller, 1901 and differs from the geographically disadjacent subspecies *C. s. italica* Cavazza, 1912 (= *C. s. debauxi* Dal Piaz, 1925) by having lighter upper and under parts as well as a bicolored tail.

In the present study the taxonomy and the variation of *C. s. suaveolens* from Greece were studied, based on specimens, which were collected in Greece (Fig. 1). In addition to them, specimens from Yugoslavia, Italy and Germany were examined as comparative material (page 375).

All measurements are in millimeters and numbers refer to specimens, which are mentioned in the text under the following abbreviations; Natur-Museum und Forschungs-Institut Senckenberg, Frankfurt a. M. (SMF), Zoological Laboratory of the University of Patras (ZLUP), Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (MAKB), Zoologische Staatssammlung, München (ZSM), and specimens from the private collections of Dr. Jochen Niethammer, Bonn (JNB), and Dr. H. Richter, Dresden (HRD).



Subspecies of *Crocidura suaveolens.* Empty symbols represent type localities of the indicated subspecies. Numbered solid symbols represent localities from which specimens of the corresponding subspecies are examined in this paper (see page 380)

The body and skull measurements are mentioned in the text under the following abbreviations in order to simplify tabulations (Table 1 and 2) and were taken in the way as it is given below.

1. Total length (head-body-tail HBT): from the tip of the nose to the tip of the tail excluding the terminal hairs. 2. Head and body length (HB): it is calculated from the total length minus the tail length. 3. Tail length (TL): from the anus to the tip of the tail excluding the terminal pencil. 4. Hind foot (HF): from the extremity of the heel behind the os calcis to the extremity of pulp of the longest digit. 5. Ear length (EL): from the lower edge of the ear aperture to the tip of the pinna excluding hairs. 6. Weight (W): in grams. 7. Greatest skull length (GSL): the greatest anterioposterior diameter of the skull taken from the most projecting point at each extremity in which the most projecting points of the incisors are included. 8. Condylobasal skull length (CBL): from the posterior extremity of the condyle to the anterior extremity of the premaxillary. 9. Palate length (PL): from the anterior extremity of the premaxillary to the posterior margin along the midline. 10. Palate width (PW) the maximal width across the palate at the region of molars. 11. Breadth of braincase (BB): the width of the braincase at the posterior roots of the zygomatic arches. 12. Length of upper toothrow-1 (UT-1): from the posterior molar to the extreme tip of the anterior incisor. 13. Length of upper toothrow-2 (UT-2): from the posterior molar to the anterior extremity of the premaxillary. 14. Interorbital constriction (IC): the smallest distance across the skull between the orbits. 15. Length of mandible (LM): from the angular process of the mandible to the most anterior part of the mandible excluding the incisor. 16. Length of lower toothrow (LT): from the posterior molar to the extreme tip of the lower incisor. 17. Preorbital width (PRW): the smallest width across the skull between the preorbital foramen.

The coloration of the pelage of the specimens is given by direct comparison with the colour plates of Ridgway (1912) and according to his terminology.

The coloration of the winter pelage of the adult specimens from Kryonerion, Attica taken in December and March, as well as, in April is brown on the upper parts of the head and body hair, ranging from olive brown to dark olive. The individual hairs of the back are slate grey at the proximal part, brownish at the distal part with increasing intensity of browness toward their tips. The coloration of the young specimens taken in March and April is darker and greyer on the upper parts tending to be not much different from the slate grey coloration of its underfur. The pelage of one specimen taken on April 5, shows on the dorsal side of the head, in the area between the ears and forward to the front, a concentration of pigment in the shape of an elongated projection. A similar pigmented path, but larger, is not sharply defined from the coloration of the upper parts along the sides. The flanks and abdominal region are covered with ash grey, due to the ash grey colour of the tips of the hairs, which is superimposed on the slate grey coloration of their bases.

The ears protrude markedly from the fur, almost naked olive brown. The feet in specimens taken in March are covered with dirty greyish white ranging from vinaceous buff to avellanous, while specimens taken in December are greyer, ranging from drab to smoke grey. The coloration of the tail is olive brown to dark olive above, light grey, olive to pale smoke grey below, tending to be obscurely bicolor to bicolor or having only the under proximal part more lightly colored.

The coloration of the summer pelage of the specimens taken in August and September varies in the upper parts from buffy brown to olive brown. In the under parts, the abdominal region, the breast and the throat, the coloration varies from light to slate grey turning progressively along the flanks and the sides of the body, to the coloration of the upperparts. The abdominal hairs are slate grey at the base becoming lighter grey whitish at their tips with a yellowish tone distributed locally or on the whole belly, although in some specimens the hairs of the chest, throat and chin are devoid of any slate grey coloration turning to whitish at their bases. Specimens collected in Olympia, in Kavassila (SMF), in Varda (ZLUP), in Peloponnesus on September 7, 8, and 17 respectively are still ranging in summer pelage. The upper parts of the feet are olive buff and wood brown to smoke grey. The fur of the upper parts of the tail is darker in colour and has sparsely distributed longer whitish hairs.

In the examined specimens the coloration of the summer pelage of those taken in August is distinguished by the lighter coloration compared to specimens taken in winter and spring, in the months of December, March and April.

In the coloration of the upper parts, specimens from Mt. Gargano, Italy (MAKB), collected in May, June and August, are darker brown compared with the lighter brown to grey brown specimens from Greece, collected in August and September. In the coloration of the under parts, the specimens from Gargano are greyer compared to the light greyish with a yellowish tone on the underpart and with whitish colored throat and chin specimens from Greece. Specimens from Yugoslavia (SMF), taken from Ohrid and Sarajevo on 17th and 27th of September, from Ombla Tal, Dubrovnik (MAKB) between the 7th and 9th of June and from Sarajevo being in summer pelage, resemble the specimens from Greece rather than the specimens from Gargano, Italy. Specimens form Corfu, taken on 21st, 23rd and 24th of April (CNB) being in summer pelage are devoid of the browning tone and are darker and greyer on the upper parts compared to the specimens from Gargano (MAKB). On the under parts, they are similar to the specimens from Gargano by being greyer and not having the whitish throat and chin, as are the specimens from west Yugoslavia and Greece.

The coloration of the summer pelage of the specimens collected on the mainland of Greece, with the light grey under parts and the superimposed yellowish tone on the belly and throat and whitish colored throat and chin, is the same as in the specimens from southern Yugoslavia and Dalmatia. However the specimens from Corfu have the yellowish tone less expressed on the under parts, in which feature, they resemble more the specimens from Gargano, Italy *(C. s. italica),* but from which they are distinguished on the basis of the lighter colored underpart of the tail, wherein they resemble the specimens from the southern and western parts of the Balkan peninsula *(C. s. balcanica).* Von Lehmann (1963) has also observed that specimens from Vaduz, Liechtenstein *(C. s. mimula)* are overlaid on the breast with yellowish coloration as are specimens from Lugano Lake. One male specimen in summer pelage from Porlezza Como, North Italy (SMF 5680) exhibits the yellowish coloration on the under parts as do the specimens from Lugano Lake, according to the description of von Lehmann (1963), and which is more brownish in the upperparts with bicolored tail. Similar to the specimens from Porlezza is also one specimen from Meran, South Tirol, Italy (JNB 880). I consider both these specimens as belonging to the central European subspecies *(C. s. mimula),* as exhibiting a bicolor tail, although they have large condylobasal length (17.7 mm). Very probably they come from the region from which the large Italian subspecies *(C. s. italica)* comes, in contact to the central European subspecies *(C. s. mimula).*

In the under parts the series of specimens from Greece are lighter and greyer compared to the dark grey specimens from Toskana, Italy. The coloration of the belly is becoming lighter, grey whitish forward on the throat and whitish in the chin. In this feature a series of six specimens from Ohrid, Macedonia also agrees except that one of them (SMF 23611) is darker. However, also, this is easily distinguished from the specimens from Italy, on the basis of the bicolored tail. The whitish tone on the throat and especially in the chin is well expressed in specimens from Zadar, Polienik (SMF) and Ombla-Tal (MAKB) Dalmatia. Specimens from northern Italy, Calliano and Trento *(C. s. italica)* are distinguished from the specimens from Istria *(C. s. mimula)* and the specimens from the southwest of Yugoslavia and Greece *(C. s. balcanica)* by the uniform coloration of the tail.

The feet of the specimens taken in March are covered with dirty greyish white ranging from vinaceous buff to avellaneous, while specimens taken in December are greyer, ranging from drab to smoke grey. In the coloration of the feet the specimens from Kryonerion (Attica) are similar to specimens from Olympia, Kavassila (Peloponnesus), from Ohrid (Macedonia), Ombla-Tal, Zadar and Biograd (Dalmatia). Speci-

mens from Corfu have the upper parts of the feet greyer and whiter compared to the specimens from Toskana, Italy. In a series of specimens from Toskana, Italy (JNB) the coloration of the upperparts of the feet are distinctly browner. In this feature the specimens from Corfu resemble more the specimens from Italy than the specimens from Greece. In specimens from Istria *(C. s. mimula)* the coloration of the upper parts of the feet is more similar to that of the specimens of the western and southern parts of the Balkan Peninsula than to specimens from Toskana. However specimens in summer pelage from Mt. Gargano, Italy, (MAKB) habe the upper part of the feet whiter and greyer colored than the specimens in winter pelage from Toskana (JNB). In this feature the previous specimens in the summer pelage from May, resemble to specimens from the Balkan Peninsula from which however they can be separated on the basis of the coloration of the tail.

The bicolored tail of the specimens from Kryonerion, Attica, which have the whole or part of the under parts of the tail lighter colored, compared to the coloration of the upper part, occurs also in the specimens from Peloponnesus, Macedonia, Thrace and Corfu, as well as in specimens from the southern and western parts of Dalmatia, Yugoslavia. Specimens from Olympia, Kavassila (Peloponnesus), Ohrid, Macedonia and Thrace; Ombla-Tal, Polienik, Zadar, Biograd (Dalmatia) have the under part of the tail lighter colored compared to its upper parts. In most of the cases the whole under part of the tail is lighter colored compared to its upper part, in a such a way that by describing it, one should attribute different coloration to the upper and under part of the tail. The coloration of the tail of specimens of *C. s. italica* from Mt. Gargano is unicolor. In a series of 28 specimens from Toskana (JNB) only 4 have an indication of slightly lighter colored under part of the tail. Specimens from Calliano, Trento have also the unicolor tail. However two specimens from the extreme northern Italy, which belong to intermediate forms between *C. s. mimula* and *C. s. italica* show a difference from the previous specimens from the northern and southeastern parts of Italy as fellows: the proximal underpart of the tail of one of them (♂ Porlezza, Como) is lighter colored, while the other (♂ Meran, South Tirol, Italy) is slightly bicolored.

In head body length, specimens from Kryonerion range from 53 to 75 mm and average 63 mm, n = 23. In this range of variation fall the measurements given by Markov (1962 and 1964) from southern Bulgaria ($\bar{x}$ = 64.4 mm, 58—68 mm, n = 10 and $\bar{x}$ = 64.5 mm, 55—74 mm, n = 18), by Felten and Storch (1965) from southwestern Yugoslavia (57.7 mm, 52—60 mm, n = 6 and 63.8 mm, 60.0—70.5 mm, n = 3 respectively), and by Witte (1964) from Dubrovnik, Dalmatia (66—75 mm, n = 2).

In tail length, specimens from Kryonerion average 42.5 mm and range from 36 to 51 mm, n = 24, while specimens from Thrace range still larger 38 to 58 mm, n = 4. This is in accordance with specimens from central Greece ($\bar{x}$ = 40 mm, 32.5—44.0 mm, n = 4, Richter, 1966), from Peloponnesus ($\bar{x}$ = 39 mm, Kahmann, 1964), from Corfu (41.4 mm, 38—43 mm, n = 8, Niethammer, 1962), from southwestern Bulgaria ($\bar{x}$ = 40.5 mm, 37—43 mm, n = 10), from Istanbul and Izmir, Turkey ($\bar{x}$ = 38.7 mm, 35—42 mm, n = 10, Osborn, 1965). However specimens from southeastern Bulgaria ($\bar{x}$ = 36.3 mm, 32.3—40.0 mm, n = 18, Markov, 1964) and central Bulgaria ($\bar{x}$ = 34.7 mm, 30—39 mm, n = 23; $\bar{x}$ = 30.5 mm, 22—40 mm, n = 24, Markov, 1957) average and range smaller in tail length.

Statistically smaller compared to the Greek specimens in tail length average and range specimens from Austria *(C. s. mimula* :$\bar{x}$ = 34.6 mm, 31—38 mm, n = 15, Bauer, 1960), from Poland *(C. s. suaveolens* :$\bar{x}$ = 32.9 mm, 30—37 mm, n = 31, Huminski and Wojcin-Migala, 1967) and from Russia *(C. s. suaveolens* :$\bar{x}$ = 29.04 mm, 25.5—33.5 mm; $\bar{x}$ = 29.3 mm, 26.5—32.0 mm, Ognev, 1928).

In a comparison of the tail length of a series of specimens from Dresden and Thazardt, Germany *(C. s. mimula* : $\bar{x}$ = 35.44 mm, 31—41 mm, n = 18), with those

from Kryonerion, Greece (Table 2) a considerable statistical difference has been proved because the calculated value of t (5.26) is greater than t (0.01) = 2.75 for 40 degrees of freedom. Since the difference is significant at the 1 per cent level, the difference in tail length reflects a real difference between the population from Kryonerion, Attica, Greece (*C. s. balcanica* and that of *C. s. mimula).*

The measurements of the hind foot length (HF) and ear length (EL) and the weight of the specimens from Greece are given in Table 1 and 2.

The average values and range of variations of the skull measurements of the specimens from Greece, are similar to those from southern Yugoslavia and Bulgaria. There is no statistical difference in skull measurements among the specimens from Greece, Bulgaria and the southern and western parts of Yugoslavia.

In condylobasal length the examined specimens from Kryonerion, Attica average 17.1 mm and range from 16.5—18.0 mm, n = 18, while four specimens from Thrace range from 17.2—18.0 mm. These measurements are in agreement with specimens taken in the Peloponnesus (17.0—17.6 mm, n = 5, KAHMANN, 1962), from central Greece ($\bar{x}$ = 17.68 mm, 17.5—18.0 mm, n = 4, RICHTER, 1966), from Corfu ($\bar{x}$ = 17.2 mm, 16.4—18.2 mm, n = 10, NIETHAMMER, 1962), from Macedonia ($\bar{x}$ = 17.2 mm, 16.8—17.6 mm, n = 6, FELTEN and STORCH, 1965), from Dalmatia ($\bar{x}$ = 17.4 mm, 17.1—17.7 mm, n = 3), from Sarajevo ($\bar{x}$ = 17.1 mm, 16.3—17.7 mm, n = 14, WITTE, 1964), from southwestern Bulgaria ($\bar{x}$ = 17.35 mm, 16.0—17.8 mm, n = 10, MARKOV, 1964), from Bulgaria ($\bar{x}$ = 17.0 mm, 16.0—18.0 mm, n = 21; $\bar{x}$ = 17.0 mm, 16.0—17.5 mm, n = 25, MARKOV, 1957), from Istanbul and Izmir, Turkey ($\bar{x}$ = 17.4 mm, 16.7—18.4 mm, n = 10, OSBORN, 1965).

However specimens from Istria, northwestern Yugoslavia ($\bar{x}$ = 16.6 mm, 16.4—17.1 mm, n = 8, DULIC, 1961), from Austria ($\bar{x}$ = 16.5 mm, 15.9 = 17.3 mm, n = 26, BAUER, 1960), from Switzerland (16.0—17.4 mm, n = 5, MILLER, 1912), from BAVARIA ($\bar{x}$ = 16.9 mm, 16,6—17.3 mm, n = 13, KAHMANN, 1952) belong to the central European subspecies *C. s. mimula* Miller, 1901, for which type locality is Züberwangen, St. Gallen, Switzerland. ELLERMANN and MORRISON-SCOTT (1951) think that *C. s. mimula* is extended to Yugoslavia, Bulgaria, Greece and Italy. In the present paper it is considered that the smaller sized subspecies *C. s. mimula* is extended only to northern Italy, northern and northeastern Yugoslavia, and northern Bulgaria, while the larger sized subspecies *C. s. italica* CAVAZZA, 1912 (= *C. s. debauxi* Dal Piaz, 1924) occurs in Italy and *C. s. balcanica* (page 379) in southwestern and southern Yugoslavia, southern Bulgaria, Greece, European Turkey and probably farther to the east, in Minor Asia.

Specimens from Russia average in condylobasal length less than 16.5 mm and range from 15.4 mm to 17.2 mm (OGNEV, 1928), from Poland average $\bar{x}$ = 16.4 mm, and range from 15.4 to 17.3 mm, n = 31 (HUMINSKI and WOJCIK-MIGALA, 1967). Similar to specimens from Russia and Poland are also specimens from Ukraine ($\bar{x}$ = 16.7 mm, 16.3—17.0 mm, n = 10). These specimens belong to the Russian subspecies *C. s. suaveolens* Pallas, 1811, for which the type locality is Crimea, in southern Russia. According to HUMINSKI and WOJCIK-MIGALA (1967) the typical subspecies extends to Poland as well as to Slovakia (Fig. 1).

In breadth of brain case (skull width) specimens from southern Bulgaria ($\bar{x}$ = 8.3 mm, 8.9—9.0 mm, n = 22, MARKOV, 1957; 8.4 mm, 8.0—8.8 mm, n = 15, MARKOV, 1964), from southern Yugoslavia ($\bar{x}$ = 8.3 mm, 8.1—8.5 mm, n = 6, FELTEN and STORCH, 1965), from Dalmatia ($\bar{x}$ = 8.5 mm, 8.4—8.5 mm, n = 3, FELTEN and STORCH, 1965), average and range similar to specimens from Greece (Table 1 and 2). Also specimens from Istanbul and Izmir, Turkey average and range ($\bar{x}$ = 8.5 mm, 8.4—8.6 mm, n = 10, OSBORN, 1965) similar to the mentioned specimens from the Balkan Peninsula. Three specimens from Izmir, Turkey have a width of skull of

8.4, 8.5 and 8.5 mm (Osborn, 1965) which support the fact that in size they are more related to the southern Balkan specimens than to the small size specimens of *C. s. portali* which is distributed in Israel.

In palate breadth specimens from Greece range from 5.2 to 6.1 mm, while specimens from Kryonerion average 5.7 mm, n = 22 (Table 1 and 2). Specimens from Istanbul and Izmir, Turkey average and range ($\bar{x} = 5.6$ mm, 5.4–5.9 mm, n = 10, Osborn, 1965) similar to specimens from Greece. Although the subspeciation of the specimens from Turkey is not known, the large size of the specimens from Istanbul and Izmir, Turkey according to measurements of Osborn (CBL $\bar{x} = 17.4$ mm, 16.7–18.4 mm, n = 10) however supports the fact that these specimens do not belong to the smaller sized subspecies *C. s. portali* which is known from Israel.

The measurements of the Greatest skull length (GSL), Palate length (PL), length of upper toothrow 1 and 2 (LT–1 & LT–2), Interorbital constriction (IC), length of mandible (LM), length of lower toothrow (LT) and the Preorbital width (PRW) of the examined specimens from Greece are given in Table 1 and 2.

In the majority of the examined specimens the first premolar is equal to the anterior cusp of the second premolar. The twenty of the twenty six specimens from Kryonerion fall in this case (76.5 %), while the first premolar is lower in four instances (15.3 %) and it is higher only in two instances (7.7 %). In the relatively young specimens with less worn teeth and small condylobasal length the tip of the first premolar is equal to the anterior cusp of the second premolar, while in the oldest specimens, with much worn teeth and large condylobasal length, the first premolar is lower than the anterior cusp of the second premolar. This is in agreement with the fact that in general in *Crocidura suaveolens* the first premolar is equal to the anterior cusp of the second premolar, while with the age the first premolar is worn faster in such a way that the older specimens have a shorter first premolar in comparison to the anterior tip of the second premolar (Niethammer, 1962). However Markov (1957) has found in specimens from Bulgaria which according to him belong to *C. s. mimula,* that none of them have the first premolar higher than the anterior cusp of the second premolar, while specimens which belong to *C. s. antipae* have the above described morphology of the teeth in a ratio of 76 %. Niethammer (1962) has found a percentage 27.3 % for specimens from Corfu in which were included relatively young specimens with little or medium worn teeth and none with much worn teeth. Ognev (1928) has observed in *C. s. suaveolens* that the ratio in which the first premolar is higher than the anterior tip of the second premolar is the highest 50 % and in *C. s. iliensis* reach the 70 %. Also according to Huminski and Wojcik-Migala (1967) in specimens of the nominal subspecies from Poland more frequently the first premolar is higher. According to Ognev (1928) the height of the first premolar in relation to the anterior cusp of the second premolar is subject to a great variation and tends to be of little use as areliable diagnostic feature. According to Ognev (1928) a definite type of tooth-length ratio is not dependent on locality and the ratio is not related to either sex or age. It is a character with wide individual variation.

Key to the identification of the subspecies *Crocidura suaveolens* Pallas, 1811 in central and southeastern Europe

1. Skull relatively small, condylobasal length 15.4–17.4 mm averaging less than 16.6 mm 2
   2. Tail very short, 25.5–37.0 mm averaging less than 33 mm . . . . . *C. s. suaveolens* Pallas, 1811
   2. Tail longer, 30.0–38.0 mm averaging more than 33 mm . . . . . *C. s. mimula* Miller, 1901

Table 1

Body and skull measurements of specimens of *C. s. balcanica* form Kryonerinon, Attica

No ZLUP	Sex	Date	HBT[1]	HBL	TL	HF	EL	W	GSL	CBL	PL	PB	BB	UT-1	UT-2	IC	LM	LT	PRW
1127	♀	5.4.62	111	66	45	11	8	8.0	—	—	—	—	—	—	—	—	—	—	—
1555	♀♀	9.3.63	—	—	—	—	—	—	18.1	17.0	6.9	5.7	8.3	7.5	6.8	4.0	8.3	7.1	3.1
1563	♀♀	10.3.63	100	53	47	12	7	7.0	18.0	17.0	7.8	5.7	8.2	7.8	6.9	3.8	8.1	7.2	3.2
1564	♂♀	10.3.63	110	64	46	12	8	8.0	18.9	17.7	7.6	5.7	8.5	7.6	7.3	3.9	9.1	7.3	3.2
1576	♀♀	11.3.63	113	63	50	12	7	7.9	18.3	18.0	7.7	5.8	8.6	7.5	7.2	4.2	9.1	7.0	—
1577	♀♀	12.3.63	105	61	44	12	7	7.0	—	—	—	—	—	—	—	—	—	—	—
1593	♂♀	13.3.63	109	71	38	11	8	7.3	—	—	7.9	5.6	8.2	7.7	7.0	4.0	8.7	7.2	3.1
1594	♀♀	13.3.63	108	70	38	11	8	5.5	17.0	16.5	7.2	5.2	7.9	7.3	6.9	3.8	8.3	6.7	3.0
1624	♂♀	19.3.63	100	64	36	11	7	7.7	17.1	16.6	6.7	5.0	8.0	7.3	7.0	3.6	7.6	6.9	3.0
1625	♀♀	19.3.63	100	59	41	11	7	7.5	17.8	16.7	7.0	5.7	8.2	7.8	7.3	3.9	8.4	7.2	3.0
2820	♂♀	2.12.64	97	61	36	10	6	5.7	—	—	7.1	5.5	—	—	—	4.1	7.9	6.9	3.1
2821	♀♀	2.12.64	105	66	39	11	6	7.0	18.0	17.2	7.3	5.6	8.2	7.2	—	3.8	8.8	6.7	3.1
2822	♀♀	2.12.64	101	63	38	11	7	6.4	17.7	16.8	7.5	5.7	8.6	8.0	7.3	4.0	8.5	7.3	3.1
2823	♀♀	2.12.64	110	65	45	12	6	6.5	18.2	17.5	7.6	5.7	8.5	7.8	—	4.0	9.4	7.2	3.2
2827	♀♀	7.12.64	103	63	40	11	9	5.5	17.6	16.7	7.4	5.6	—	7.5	6.7	3.8	8.2	7.2	3.2
2828	♂♀	7.12.64	95	58	37	11	7	5.4	17.6	16.9	7.5	5.5	8.0	7.6	7.2	3.8	7.9	7.2	3.1
2908	♂♀	2.3.65	110	54	46	13	7	8.2	—	—	7.7	6.0	8.5	7.8	7.5	4.2	9.0	7.2	3.2
2909	♀♀	2.3.65	104	59	45	13	7	7.8	18.0	17.2	7.6	5.7	8.4	7.4	7.1	3.9	8.1	7.1	3.2
2931	♀♀	3.3.65	125	74	51	12	10	7.8	18.6	17.8	7.8	5.7	8.3	7.9	7.4	4.1	8.6	7.5	3.1
2945	♂♀	5.3.65	109	64	45	12	9	7.5	—	—	7.4	5.7	—	7.7	7.2	4.0	8.5	7.3	3.1
2973	♀♀	10.3.65	117	75	42	11	7	6.7	17.9	17.3	7.2	6.0	8.2	7.7	7.4	4.0	8.3	7.2	3.2
2982	♂♀	12.4.65	105	60	45	12	9	7.2	18.4	17.8	7.7	5.6	8.3	7.8	7.3	3.9	8.6	7.2	3.1
2983	♀♀	12.4.65	98	56	42	12	9	9.5	18.4	17.7	7.4	6.1	8.0	7.7	—	4.1	9.5	7.2	3.1
2984	♂	12.4.65	90	49	41	11	9	5.8	17.3	16.6	6.9	5.5	7.9	7.3	6.8	3.8	8.5	7.0	3.1

[1] See text on Page 373 for explanation of the abbreviations.

1. Skull relatively large, condylobasal length up to 18.5 mm and averaging more than 16.9 mm 3
   3. Tail univolor and only very seldom, obscurely bicolor. Feet with dark clouding . . . . . *C. s. italica* Cavazza, 1912
   3. Tail bicolor and only very seldom obscurely unicolor. Feet whitish . . . . . *C. s. balcanica* n. subsp.

Crocidura suaveolens balcanica new subspecies

Type: Female, adult skin und skull; No 2821 ZLUP; from 1 klm west of Kryonerion, Attica, Greece; obtained on December 2, 1964, by J. C. Ondrias.

Geographical distribution: Greece, southern Yugoslavia, Dalmatia, very probably Albania, extreme southern part of Strymon valley in southwestern Bulgaria and the most southern part of southeastern Bulgaria, European Turkey and probably Asiatic Turkey.

Diagnosis: Upper parts, hair brown, ranging from olive brown to dark olive, individual hairs slate grey at the proximal part, brownish at the distal part with increasing intensity of browness toward their tips. The under parts ash grey, due to the ash grey colour of the tips of the hairs, which is superimposed on the slate grey coloration of their bases; feet drab to smoke grey; tail bicolor dark olive brown above, light grey below.

Comparisons: *C. s. balcanica* differs from specimens of *C. s. mimula* Miller, 1903, the subspecies geographically adjacent to the north, as follows: size of skull larger (condylobasal length up to 18.2 mm instead of 17.3 mm), length of tail averaging more than 38 mm instead of less than 33 mm, upper parts lighter and greyish instead of dark brown, under parts ligther and whiter. The subspecies *C. s. balcanica* differs

Table 2

Body and skull measurements of *C. s. balcanica* from Greece

	Kryonerion, Attica			Chrysoupolis and Comotini, Thrace			Olympia Peloponnesus
	Mean	Range	n	Mean	Range	n	n=1
1. (TBT)[1]	106.1	95.0—125.0	23	110.0	103.0—117.0	4	94.0
2. (HBL)	63.0	53.0—75.0	23	63.7	59.0—70.0	4	55.0
3. (TL)	42.5	36.0—51.0	24	46.2	38.0—58.0	4	39.0
4. (HF)	11.5	11.0—13.0	24	12.5	12.0—13.0	4	11.0
5. (EL)	7.6	6.0—10.0	24	7.2	7.0—8.0	4	8.0
6. (W)	7.1	5.4—9.5	24	9.5	9.0—11.0	4	5.0
7. (GSL)	17.9	17.0—18.9	18	18.1	17.5—18.9	4	—
8. (CBL)	17.1	16.5—18.0	18	17.5	17.2—18.0	4	—
9. (PL)	7.4	6.7—7.9	18	7.4	7.2—7.6	4	7.0
10. (PB)	5.7	5.2—6.1	22	5.6	5.4—5.9	4	5.6
11. (BB)	8.2	7.9—8.6	19	8.4	8.2—8.5	4	—
12. (UT-1)	7.6	7.2—8.0	21	7.6	7.2—8.1	4	8.0
13. (UT-2)	7.1	6.7—7.5	18	7.0	6.8—7.3	3	7.2
14. (IC)	3.9	3.6—4.2	22	4.0	3.8—4.2	4	3.8
15. (LM)	8.5	7.6—9.5	22	8.7	8.6—8.9	4	7.9
16. (LT)	7.1	6.7—7.5	22	7.0	6.2—7.5	3	—
17. (PRW)	3.1	3.0—3.2	22	3.1	3.0—3.2	4	3.2

[1] See text on page 373 for explanation of the abbreviations.

from specimens of *C. s. italica (= C. s. debauxi)* geographically disdjacent to the west as follows: upper parts averaging grey brown instead of dark brown, under parts light grey instead of darker grey, tail bicolor or obscurely bicolor instead of unicolor; feet greyer and whiter instead of dark brownish.

Measurements: see Table 1 and 2.

Remarks: *C. s. balcanica* is characterized by the combination of large size, light brown colour on the upper parts and light grey on the under parts, by the bicolor coloration of the tail.

Intergradation between *C. s. balcanica* and *C. s. mimula* occurs in Sarajevo, Bosnia and probably farther to the south in Yugoslavia and the southern part of Bulgaria, from which places some specimens are smaller in skull length and have shorter the tail length.

Specimens from the Balkan Peninsula, which were assinged to *C. s. italica (= C. s. debauxi)* by Niethammer (1963) and Witte (1964) are assigned to *C. s. balcanica* on the basis of relatively lighter upper and under parts as well as on the slightly bicolor tails.

Specimens examined (Fig. 1): A total of ninety two. *C. s. balcanica:* 1. two specimens SMF and ZLUP from Olympia, Elis; 2. one specimen ZLUP from Varda, Elis; 3. one specimen SMF from Kavassila, Elis, Peloponnesus; 4. twenty four specimens ZLUP from Kryonerion, Attica; 5. three specimens JNB from Kanali, Corfu; 6. three specimens JNB from Kanoni, Corfu; 7. one specimen JNB from Agios Onuphrios, Corfu; 8. one specimen ZLUP from Chrysoupolis and 9. three specimens ZLUP from Komotini, Thrace, Greece; 10. six specimens SMF from Ohrid Lake southern Yugoslavia; 11. two specimens MAKB from Obla Valley, Dubrovnik; 12. one specimen MAKB from Sarajevo, Bosnia; 13. two specimens SMF from Biograd and Polienik, Dalmatia; 14. one specimen SMF from Zadar, Dalmatia. *C. s. mimula* Miller, 1901: 15. one specimen SMF from Medveja, Istria; 16. four specimens JNB from Rovinij, Istria; 17. one specimen JNB from Meran, South Tirol, Italy; 18. one specimen SMF Porlezza, Como, Italy. *C. s. italica* Cavazza, 1912: 19. three specimens SMF from Calliano, Trento; 20. twenty eight specimens JNB from Viareggio, Toskana; 21. one specimen MAKB from Peschici, Gargano; 22. one specimen MAKB from Ischitella, Gargano and 23. one specimen MAKB from Javoliere di Puglia.

Summary

A new subspecies of *Crocidura suaveolens* from Kryonerion, Attica, Greece is described and its geographical distribution in the Balkan Peninsula is determined. The new subspecies is compared with *C. s. suaveolens, C. s. mimula* and also with *C. s. italica.* The intraspecific variation of the body and skull measurements as well as of the coloration of the pelage are discussed.

Zusammenfassung

Eine neue Unterart von *Crocidura suaveolens* von Kryonerion (Attica, Griechenland) und ihre geographische Verbreitung auf dem Balkan werden beschrieben. Die neue Unterart wird verglichen mit *C. s. suaveolens, C. s. mimula* und *C. s. italica.* Die intraspezifische Variation von Körper- und Schädelmaßen sowie der Fellfärbung wird diskutiert.

Literature

Athanassov, N., und Peschev, Z. (1963): Die Säugetiere Bulgariens. Säugetierk. Mitt. München **12**, 101—112.

Bauer, K. (1960): Die Säugetiere des Neusiedlersee-Gebietes (Österreich). Bonn. zoll. Beitr. **11**, 141—344.

Cavazza, F. (1912): Richerche intorno alle specie italiane del genere *Crocidura*.. Boll. Mus. Zool. Anat. Comp. Univ. Torino **27**, 1—16.
Chaworth-Musters, J. L. (1932): A contribution to our knowledge of the Mammals of Macedonia and Thessaly. Ann. Mag. Nat. Hist. London **9, 10**, 166—171.
Dulic, B. (1961): New data concerning mammals of Istria. Bull. Sci. Zagreb **6**, 11—14.
— (1962): Contribution à l'étude des petits mammifères dans le Karst d'Istrie. Jugosl. Akad. Znanosti Umjetnosti 3 Zagreb, 71—88.
Ellerman, J. R., and Morrison-Scott, T. C. S. (1951): Checklist of Palaeartic and Indian Mammals 1758 to 1946. Brit. Mus. Nat. Hist. London.
Felten, H., and Storch, G. (1965): Insektenfresser und Nagetiere aus N-Griechenland und Jugoslawien (Mammalia: Insectivora und Rodentia). Senck. biol. Frankfurt a. M. **46**, 5, 341—367.
Huminski, S., and Wojcik-Migala (1967): Note on *Crocidura suaveolens* from Poland. Acta Theriologica Bialowieza **12**, 168—171.
Kahmann, H. (1920): Beiträge zur Kenntnis der Säugetierfauna in Bayern. Natur. Ges. Augsburg, 147—170.
— (1964): Contribution à l'étude des mammifères du Péloponèse. Mammalia, Paris **28**, 110—136.
Kahmann, H., und Eirlechner, J. (1959): Bionomische Untersuchung an der Spitzmaus *(Crocidura)* der Insel Sardinien. Zool. Anz., Leipzig **162**, 63—83.
Lehmann, E. v. (1963): Die Säugetiere des Fürstentums Liechtenstein. Jahrbuches Hist. Ver. Fürstentum Liechtenstein, 159—362.
Malec, F., und Storch, G. (1968): Insektenfresser und Nagetiere aus dem Trentino, Italien (Mammalia: Insectivora und Rodentia). Senckenbergiana biol. Frankfurt a. M. **49**, 89—98.
Markov, G. (1957): Die insektenfressenden Säugetiere in Bulgarien. Bulg. Akad. Wiss. Sofia.
— (1962): Ökologisch-faunistische Untersuchungen der Insectivora und Rodentia in den Gebieten von Petric und Goce Delcev (Südwestbulgarien). Bulg. Acad. Sci. Zool. Inst. Mus. 5—30.
— (1964): Insektenfressende Säugetiere und Nagetiere in Thrakien (Südbulgarien). Bulg. Acad. Sci. Zool. Inst. Mus. 19—53.
Miller, G. S. (1912): Catalogue of the Mammals of Western Europe. Brit. Mus. Nat. Hist. 1—1019.
Niethammer, J. (1962): Die Säugetiere von Korfu. Bonn. zool. Beitr., 1—49.
Ognev, S. I. (1928, 1962): The mammals of eastern Europe and northern Asia, vol 1, Insectivora and Chiroptera. Israel Programm for Sci. Translations, Jerusalem.
Ondrias, J. C. (1965): Die Säugetiere Griechenlands. Säugetierk. Mitt. München **13**, 3, 109 bis 127.
— (1969): Some observations on *Crocidura leucodon* Hermann, 1780 (Insectivora, Mammalia) from the mainland of Greece. Biologia Gallo-Hellenica **2**, 1, 45—48.
— (1969): Die Groß-Spitzmaus, *Crocidura lasiura* Dobson, 1890, der Ägäischen Insel Lesbos. Zeit. Säugetierk. Hamburg, 353—358.
Osborn, J. D. (1965): Hedgehogs and shrews of Turkey. Proc. U.S. Nat. Mus. Washington **117**, 553—566.
Peus, F. (1958): Flöhe aus dem Mittelmeergebiet (Ins. Siphonapt.). II. Griechenland. Mitt. Zool. Mus. Berlin **34**, 135—171.
Richter, H. (1953): Zur Kenntnis mittelsächsischer Soriciden. Zeit. Säugetierk. Berlin **18**, 171 bis 181.
— (1966): Eine Serie *Crocidura gueldenstaedti* (Pallas, 1811) (Mammalia, Insectivora) von der griechischen Insel Samos. Beaufortia, Amsterdam **13**, 109—115.
Vasiliu, G., and Sova, C. (1968): Fauna Vertebratica Romaniae. Museul Judetean Bacäu, part II a.
Witte, G. (1964): Zur Systematic der Insektenfresser des Monte-Gargano-Gebietes (Italien). Bonn. zool. Beitr. 1—35.
— (1965): Ergebnisse neuer biogeographischer Untersuchungen zur Verbreitung transadriatischer Faunen- und Floren-Elemente. Bonn. Zool. Beitr. **16**, 165—248.

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