

The Distribution Problem of *Crocidura russula* (Hermann, 1780) (Mammalia: Insectivora) in Turkey

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Abstract: In this study, to elucidate distribution problem of *Crocidura russula* (Hermann, 1780) species, 298 samples were taken from different geographical areas, type localities and record areas of Turkey, which were morphologically similar to *C. russula* were studied. The karyotypical and morphological characteristics of collected samples have been examined in detail. Those examined characteristics have been compared among themselves and compared to literature data. According to the comparative results, *C. russula* species is not distributed in Turkey and the Populations of *C. russula* reported previously in Turkey were belong to *Crocidura suaveolens* (Pallas, 1811).

Key Words: *Crocidura russula*, *Crocidura suaveolens*, Karyology, Taxonomy, Turkey

Türkiye'de *Crocidura russula* (Hermann, 1780) (Mammalia: Insectivora)'nın Yayılış Problemi

Özet: Bu çalışmada, *Crocidura* Wagler, 1832 cinsine ait Türkiye'den tip yerleri, kayıt yerleri ve değişik coğrafik bölgelerden toplanan 298 örnek üzerinde çalışılmıştır. Toplanan örneklerin karyolojik ve morfolojik özellikleri ayrıntılı bir şekilde incelenmiştir. İncelenen örnekler önce kendi aralarında, daha sonra literatür verileriyle karşılaştırılmıştır. Karşılaştırma sonuçlarına göre, *Crocidura russula* (Hermann, 1780) türü Türkiye'de yayılış göstermiyor ve daha önceleri Türkiye'den verilen *C. russula* populasyonları *Crocidura suaveolens* (Pallas, 1811)'e aittir.

Anahtar Sözcükler: *Crocidura russula*, *Crocidura suaveolens*, Karyoloji, Taksonomi, Türkiye

Introduction

By defining *Crocidura russula monacha* Thomas, 1906 subspecies from Trabzon (Maçka, Altındere) Thomas (1) has given *Crocidura russula* (Hermann, 1780) record for the first time in Turkey. After this first research on Turkish *Crocidura*'s, Satunin (2) has expanded the spreading area of *Crocidura russula* further up to Iran and Russia border by defining the *Crocidura russula aralychensis* Satunin, 1914 subspecies from Aralık near Iğdır (previously known as Kars-Aralık).

In the following taxonomic studies, new distribution areas for *C. russula* were reported for almost every part of Turkey (3-11). Catzefflis et al. (12) and Vogel et al. (13), performing karyotypical and biochemical researches on East Mediterranean populations based on the samples that they studied in four different localities of Turkey (İzmir, Kavak-Samsun, Maçka-Trabzon and Rize) stated that in these regions *C. russula* populations were not distributed. Genoud and Hutterer (14) and Hutterer (15)

stated that *C. russula* has distributed in the West Europe, therefore it is unlikely to exist in Turkey. Zaitsev (16) has not marked *C. russula* in Turkish part of distributional map he drew up for Palaearctic region *Crocidura*'s. Based on the data from Catzefflis et al. (12), Vogel and Sofianidou (17) have put forward that the subspecies given from Turkey as *C. russula monacha* must in fact be *C. suaveolens monacha*. Similarly, Sara and Vogel (18) have pointed out that this species spreads only in West Europe with Pantellaria Island and Germany being the most extreme points eastward.

As it can be understood from the given information above, the existence of *C. russula* populations in Turkey is unclear. In this study, we tried to bring clarity to Turkey's *C. russula* problem by examining the karyotypical and morphological characteristics of the sample series mainly type localities of *monacha* and *aralychensis* collected throughout Turkey (Fig. 1) including the reported spots.

Materials and Methods

This study was carried out on 298 samples resembling *C. russula* in terms of morphological characters collected between 1994-1996 and the field records.

Due to the storage difficulty of *Crocidura* samples, in the temporary laboratories set up on the field, chromosome preparats were prepared from the bone marrow of the sample by the method of Ford and Hamerton's (19) "Colchicine-Hypotonic-Citrate." In 50 preparats prepared from each sample, chromosome measurements were taken, chromosome morphologies were determined and karyotypes were prepared. Samples were divided into two age groups with a view of reducing the variation depending on age up to a minimum in comparisons among sample groups.

1. Young-Young adult: Samples with no distinctive wear trace in molars and mastoid project in a slight mark, whose first premolar corollas height is higher than its second premolars paracon and which do not indicate much signs of sexual development.

2. Adult-Old adult: Samples with a rather distinctive wear in molars, whose mastoid project have developed distinctively, whose first premolar corollas height are equal to the paracon of second premolar or wore further, with the traces of embryo and birth.

t-test and discriminant analysis techniques were employed in comparisons among sample groups.

Results and Discussion

Thomas (1) has defined the subspecies of *Crocidura russula monacha* by expressing the fact that the tail length of the female sample that he obtained from Trabzon's Maçka districts Altındere (scalita) locality was different than those that obtained from Europe. With this definition, for the first time in Turkey *C. russula* existence has been reported. In the same way, Satunin (2) has defined *Crocidura russula aralychensis* subspecies with a characteristic back side coloration from Kars, Aralık district (today Iğdır's Aralık district). Ognev (3) stated that these two subspecies are variations of *Crocidura russula gueldenstaedtii* Pallas, 1811 and he has proposed that *monacha* and *aralychensis* are a synonym for *C. r. gueldenstaedtii*. Revising the Palaearctic region, Ellerman and Morrison-Scott (20) accepted the *monacha* as a valid subspecies, and they stated that *aralychensis* is a synonym for *C. r. gueldenstaedtii*. Bobrinsky et al. (21) and Harrison (22) based on the samples collected by Thomas (1); Osborn (4) on those he collected at Lake Sapanca, İzmir and Manisa; Lay (5) on those he obtained

at Bolu, Bursa and Ankara have stated that *C. russula* is widespread in Turkey. Richter (23), saying that *gueldenstaedtii* is not a subspecies of *russula* has put forward that the samples whose tail length is %60 smaller than the ratio of head to body length are *C. russula* and those bigger than that ratio are *Crocidura gueldenstaedtii* (Pallas, 1811). While Lehmann (24) agrees with this idea, Spitzenberger (6) stating that this criteria can not be valid, has considered it suitable to name *gueldenstaedtii* as subspecies of *C. russula*. On the other hand, Spitzenberger (6) has reported existence of *C. r. gueldenstaedtii* from the Black Sea coastal stripe (from Bolu up to Borçka) and from Erzurum, Mersin and Antalya. In the same way, Kock et al. (7) and Felten et al. (8) have stated the samples they collected respectively from Elazığ and from İzmir, İstanbul, Manisa and Antalya according to their morphological characteristics as *C. r. gueldenstaedtii*. Jenkins (9) has claimed the existence of *C. russula* in Turkey since in P⁴ lingual part of Turkish *Crocidura*'s is narrow and lobed and their upper unicuspid labial length is more than 1.8 millimeters.

Şimşek (10) who did the most detailed research on Turkish *Crocidura*'s, giving existence of *C. russula* from almost every part of Turkey except for Thrace and Aegean coastal stripe, has stated that *monacha* and *aralychensis* are valid subspecies of *C. russula*. Şimşek (10) has stated that *C. russula* is very similar to *Crocidura suaveolens* (Pallas, 1811) and that these two species can be distinguished from one another through discriminant analyze. Şimşek (10) has considered the samples whose discriminant values are smaller than 2.062 as *C. suaveolens* and those bigger than that of 2.062 as *C. russula*. Catzefflis et al. (12) have put forward the karyotype characteristic of the samples they studied from İzmir, Kavak-Samsun, Maçka-Trabzon and Rize is not similar to the karyotype of *C. russula* and that in these parts *C. suaveolens* species with 2n=40 karyotype is existent. Genoud and Hutterer (14), Hutterer (15), Sara and Vogel (18) have claimed that *C. russula* species is existent in West Europe and non-existent East Europe and for this reason *C. russula* populations are not existent in Turkey. Researchers have put forward their ideas according to the results of Catzefflis et al.'s (12) studies.

In the karyotypical analyses carried on the *C. russula* samples, for the first time Bovey (25) has brought up that this species has 2n=42 karyotype. Later, Meylan (26) has stated that in the karyotype of this species, which is composed of 2n=42 chromosomes, five pairs of autosomes are meta or submetacentric, four pairs are subtelocentric, 11 pairs are acrocentric, X chromosome is big subtelocentric and Y chromosome is small acrocentric

and $NFa=58$. In the same way, Schmid (27) from Switzerland, Meylan and Hausser (28) from Tessin district of Switzerland, Catzeflis (29) from Italy (Sardinia) and Hutterer et al. (30) from Canary Islands, Maddalena (31) from West Europe have reported that they obtained *C. russula* with $2n=42$ karyotype.

According to the morphological studies, while *C. russula* is distributed in Turkey, karyological studies indicated that this species is distributed in the west Europe but is not distributed in Turkey.

As a conclusion, whether *C. russula* is distributed or not distributed in Turkey is in debate, because there is no comprehensive study about distribution of this species.

In this study, karyotypical analyses of the samples collected from *C. r. monacha* and *C. r. aralychensis* type localities and from existent localities of the above

mentioned researchers and several areas in Turkey (Fig. 1) have been studied in detail. As a result of these analyses, it has been determined that *C. russula* populations with $2n=42$ karyotype are not distributed in Turkey. Samples given as *C. russula* according to their morphological characteristics in previous studies were in fact belonging to *C. suaveolens* with $2n=40$ karyotype (Fig. 2). In addition, in this study, individual, sexual, seasonal and regional variations of the samples collected almost every part of Turkey which were determined as *C. suaveolens* were investigated. The samples determined as *C. suaveolens* were compared among themselves and the morphological characteristics that were provided by other studies. We did not see any important taxonomically differences among the samples studied.

As a result of this research, variations of *C. suaveolens* within population has shown great regional and individual

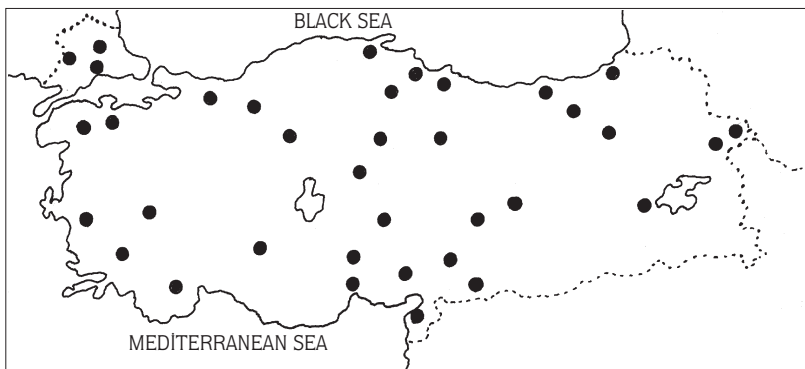


Figure 1. The distributional map of Turkey showing the existence localities of *Crocidura* samples.

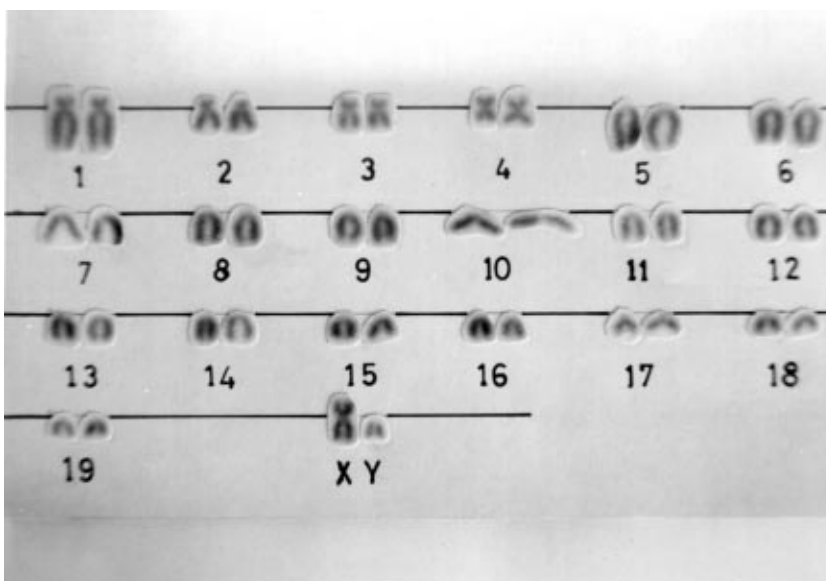


Figure 2. $2n=40$ karyotype belonging to *C. suaveolens* obtained from the samples collected from the localities in figure 1 (Maçka, Trabzon, Male).

differences; thus, this species is a polymorphic species. In addition, the discriminant analyze results performed on Turkish *Crocidura*'s with $2n=40$ karyotype have brought out that these samples with $2n=40$ karyotype constitute a collective group at %96 percent (Fig. 3) and can not be divided into two separate species of taxa.

Researchers studying on inadequate number of *C. suaveolens* samples (with the exception of Şimşek (10)) have named their regional variations as *C. russula* and have given the existence of *C. russula* from Turkey, therefore, they caused a complication in the taxonomy of

this species. Finally, according to these results, the species of *C. russula* is not distributed in Turkey and the populations previously known as *C. russula* were belong to *C. suaveolens*. In addition, for the first time, *C. russula monacha* and *C. russula aralychensis* were determined as a synonym of *C. suaveolens*.

Specimens examined: 298 distributed as follows:

Osmaniye: Toprakkale, 2. Ağrı: Doğubeyazıt, 2 km. E., 4. Amasya: 5 km. N., 2; 12 km. Fındıklı köyü, 6; Harmanağıl köyü, 2; Merzifon, Ankara yolu kenarı, 2. Ankara: Kızılcahamam, 2 km. S., 2. Antalya: Elmalı,

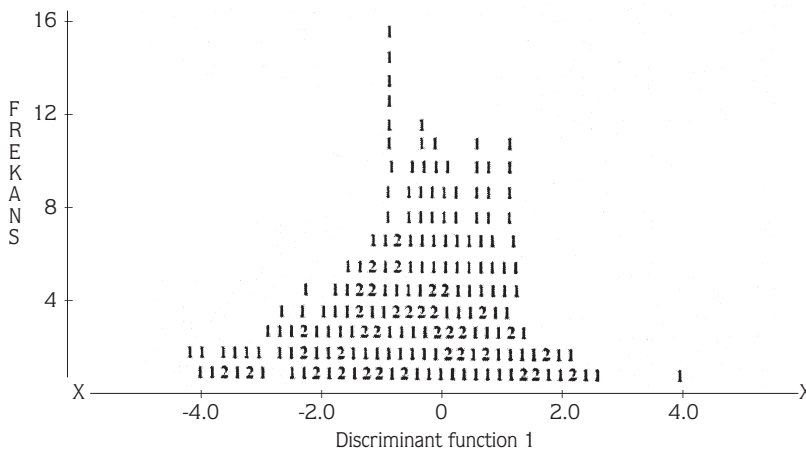


Figure 3. Discriminant analyze histogram in Turkey *Crocidura* samples with $2n=40$ karyotypes (Anatolia (1) and Thrace (2)).

3 km. S., 2. Artvin: 4 km. E., 2: Hopa, Sugören köyü, 1. Balıkesir: Değirmenboğazı, 4; Bandırma, Kuş gölü kenarı, 6. Bayburt: Demirözü, 5 km. E., 2. Bitlis: Tatvan, Küçükusu, 3. Bolu: Abant yolu kenarı, 2. Bursa: Karacabey, Karadere kenarı, 4; Hara, 5. Denizli: Pamukkale, 1 km., 6. Edirne: Keşan, 2, Uzunköprü, Kırkkavak köyü, 3. Elazığ: Sivrice, 3 km. N., 2. Erzurum: Aşkale, 4 km. N., 2; 3 km. E., 1. Gaziantep. Oğuzeli, 3 km. S., 2. Hatay. İskenderun, 2; Reyhanlı, 5 km. W., 3. Iğdır: Aralık, D.Ü.Ç., 7. İçel: Tarsus, 3; Erdemli, 4. İzmir. Bayındır, 3 km. S., 2, Erbeyli, 3. Kahramanmaraş: Türkoğlu, 5 km. S., 3. Kayseri: Şeker fabrikası, 19; Yem Bit. Ars. İst., 4. Kırklareli: Lüleburgaz, Türkgeldi D.Ü.Ç., 3; Kırıkköy, 1 km. W., 5; Dere, 3; Mezarlık, 3; Hamitabat köyü, 1 km. S., 3, Babaeski, Müsellim köyü, 3; Demirköy, Iğneada, 5. Kırşehir: Çiçekdağı, 7. Konya: Akşehir, Doğrugöz,

7. Malatya : Akçadağ, 2. Niğde: Ulukışla, Madenköy, 27. Ordu: Eski cezaevi yanı, 3, Uzunisa köyü, 3; Boztepe köyü, 1. Sakarya: Akyazı, Kuzuluk, 2. Samsun: Kurupelit, Üniversite kampüsü, 18; Kavak, 4 km. E., 13; Germiyan köyü, 7; Asarcık, 22; Yeniköy, 5; Havza, Ankara yolu kenarı, 2. Sinop: Karasu çayı kenarı, 4; Gerze, 4 km. W., 2; 3 km. E., 3. Sivas: Hafik, Celalli köyü, 2. Tekirdağ: Marmara Ereğlisi, 2; Muratlı, 2 km. N., 3. Trabzon: Şana deresi, 2; Maçka, Coşandere, 4; Altındere, 2; Meryemana, 9. Uşak: Güre, 2. Yozgat: Akdağmadeni, 2.

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References

1. Thomas, O., New Insectivores and Voles collected by Mr. A. Robert near Trebizond. Ann. Mag. Nat. Hist. London, 7(17): 415-421, 1906.
2. Satunin, K. A., New Mammals from Transcaucasia. Mit. Kaukas. Mus., 8(1-2): 92, 1914.
3. Ognev, S.I., Mammals of eastern Europe and northern Asia, Vol. 1, Insectivora and Chiroptera. Israel Program for Sci. Translations. Jerusalem 1962, 1-487, 1928.
4. Osborn, D.J., Hedgehogs and shrews of Turkey. Proc. U. S. Nat. Mus. Washington, 117: 553-566, 1965.
5. Lay, D. M., A study of mammals of Iran. Fieldiana, Zool., 54: 3-282, 1967.
6. Spitzenberger, F., Zur Vorbereitung und Systematik türkischer Crocidurinae (Insectivora, Mammalia). Ann. Naturhist. Mus., Wien, 74: 233-252, 1970.
7. Kock, D; Malec, F. und Storch, G., Rezenten und subfossile Kelinsäuger aus dem Vilayet Elaziğ. Ostanatolien. Z. Säugetierkunde 37(4): S. 204-209, 1972.
8. Felten, H., Spitzenberger, F. and Storch, G., Zur Kleinsäuger fauna West-Anatoliens. Teil II. Senckenbergiana biol. 54(4/6): 227-290, 1973.
9. Wenkins, P.D., Variation in Eurasian shrews of the genus *Crocidura* (Insectivora: Soricidae). Bull. of the British Mus. (Nat. Hist.) Zoology, 30: 269-309, 1976.
10. Şimşek, N., Türkiye *Crocidura* (Mammalia, Insectivora)'larının Taksonomik Durumları ve Yayılışları. Doktora Tezi, Ank. Üniv. Fen Fak., 1-72, 1979.
11. Doğramacı, S., Türkiye Memeli Faunası. Ond. Mayıs. Üniv. Fen Der., 1(3): 107-136, 1989.
12. Catzeflis, F., Maddalena, T., Hellwing, S. and Vogel, P., Unexpected findings on the taxonomic status of East Mediterranean *Crocidura russula* auct. (Mammalia, Insectivora). Z. Säugetierkunde 50, 185-201, 1985.
13. Vogel, P., Maddalena, T. and Catzeflis, F., A Contribution on the Taxonomy and Ecology of shrews (*Crocidura zimmermanni* and *C. suaveolens*) from Crete and Turkey. Acta Theriologica Vol. 31, 537-545, 1986.
14. Genoud, M. and Hutterer, R., *Crocidura russula* Hausspitzmaus. In: Niethammer, J., Krapp, F., eds. Handbuch der Säugetiere Europas, Wiesbaden: Aula Verlag, 429-452, 1990.
15. Hutterer, R., Mammals of the Worlds (edit. Wilson, D.E. and Reeder, D.A.M., A Taxonomic and Geographic reference 2nd Ed. Smithso. Inst. Press. Washington and London, 1-1203, 1993.
16. Zaitsev, M. V., Species Composition and Questions of Systematics of White-Toothed Shrews (Mammalia, Insectivora) of the Fauna USSR. USSR. Acad. of Sci. Proc. of the Zool. Inst. Vol. 243: 3-46, 1991.
17. Vogel, P. and Sofianidou, T. S., The Shrews of the genus *Crocidura* on Lesbos an eastern Mediterranean Island. Bonn Zool. Beitr. Bd. 46(1-4): 339-347, 1996.
18. Sara, M. and Vogel, P., Geographic variation of the greater white-toothed shrew (*Crocidura russula* (Hermann, 1780) (Mammalia, Soricidae)). Zoll. J. Of the Linn. Soc. 116: 377-392, 1996.
19. Ford, C. E. and Hamerton, J. L., A "Colchicine-Hypotonic-Citrate" Squash sequence for Mammalian Chromosomes, Stain Technol., 31: 247-251, 1956.
20. Ellerman, J. R. and Morrison-Scott, T. C. S., Checklist of Palearctic and Indian Mammals. Brit. Mus. London, 1-810, 1951.
21. Bobrinsky, N., Kutnetzov, B. and Kuzyakin, A., Mammals of USSR. Moskova (Rusça), 1-440, 1944.
22. Harrison, D.L., The Mammals of Arabia. Vol. 1, Insectivora. Chiroptera. Primates. London, 1-192, 1964.
23. Richter, H., Eine serie *Crocidura guldensstaedti* (Pallas, 1811) (Mammalia, Insectivora) von der griechischen Insel Samos. Beaufortia, 13(157): 109-115, 1966.
24. Lehmann, E., Taksonomische Bemerkungen zur Säugeusbeute der Kumerloeveschen Orientreisen, 1953-1965, Zool. Beitr. (N.F.), 12(2): 254-258, 1966.
25. Bovey, R., Les chromosomes des Chiropteres et des Insectivores. Revue suisse de Zoologie, 56: 371-460, 1949.
26. Meylan, A., Le polymorphisme chromosomique de *Sorex araneus* L. (Mammalia-Insectivora). Rev. Suisse Zool., 71: 903-983, 1964.
27. Schmid, W., The Chromosomes of *Crocidura russula* (Soricidae-Insectivora). Mamm. Chrom. Newsl., 9: 69, 1968.
28. Meylan, A. And Hausser, J., Position cytotonomique de quelques musaraignes du genre *Crocidura* au Tessin (Mammalia, Insectivora). Rev. Suisse Zool. 81: 701-710, 1974.
29. Catzeflis, F., Relations genetiques entre trois especes du genre *Crocidura* (Soricidae, Mammalia) en Europe. Mammalia 47: 229-236, 1983.
30. Hutterer, R., Lopez Jurade, L. F. and Vogel, P., The Shrews of the eastern Canary Islands: A new species (Mammalia: Soricidae). J. of Nat. Hist., 21: 1347-1357, 1987.
31. Maddalena, T., Systematique, evolution et biogeographie des musaraignes Afrotropicales et Palaearctiques de la sous-famille des Crocidurinae. Une approche genetique. Unpubl. Ph. D. Dissert., Univ. of Loussanne, 172, 1990.