

Taxonomic Status and Karyotype of *Rhinolophus ferrumequinum* (Schreber, 1774) from Turkey (Rhinolophidae, Chiroptera)

Türkiye'deki *Rhinolophus ferrumequinum* (Schreber, 1774)'un karyotipi ve taksonomisi (Rhinolophidae, Chiroptera)

Research Article

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ABSTRACT

This study is based on karyological analyses of nine *Rhinolophus ferrumequinum* specimens collected from Turkey between 2000 and 2004. It was determined that the diploid chromosome number (2n) is 58 and number of autosomal arms (NFa), 60 in this species. For taxonomical evaluation of *R. ferrumequinum*, a total of 239 specimens, collected from Turkey between 1974 and 2000, were studied. Our karyotypic and morphometric data were compared with the relevant literature and the results showed that the Turkish *R. ferrumequinum* seems to be represented by the nominate form.

Key Words

Rhinolophus ferrumequinum, taxonomy, karyology, Turkey

ÖZET

Bu araştırma 2000 ve 2004 yılları arasına Türkiye'den toplanan 9 *Rhinolophus ferrumequinum* örneğinin karyolojik analizine dayanmaktadır. Bu türde diploid kromozom sayısı (2n) 58 ve otomozal kol sayısı 60 olarak bulunmuştur. *Rhinolophus ferrumequinum*'un taksonomik revizyonu için 1974 ve 2000 yılları arasında Türkiye'den toplanan toplam 239 örnek incelendi. Karyolojik ve morfometrik verilerle literatür verileri karşılaştırılmış ve Türkiye'deki *Rhinolophus ferrumequinum*'un nominatif form ile temsil edildiği sonucuna varılmıştır.

Key Words

Rhinolophus ferrumequinum, taksonomi, karyoloji, Türkiye

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INTRODUCTION

Rhinolophus ferrumequinum was recorded from all over Turkey by some authors (Strinati, 1959; Osborn, 1963; Çağlar, 1965; Albayrak, 1985, 1990, 1993; Steiner & Gaisler, 1994, Benda & Horáček, 1998). While describing *R. ferrumequinum irani* from Shiraz, a province of Iran, Cheesman (1921) stated that the specimens from Asia Minor belonged to the nominate form. Kumerloeve (1975) reported that the nominate form was distributed in the Turkish Thrace while *R.f. irani*, in Eastern Anatolia. Felten et al., (1977) pointed out that West Anatolian specimens belonged to the nominate form and this subspecies was possibly exist in Eastern Anatolia. DeBlase (1980) also stated that *R. ferrumequinum irani* is distributed in Eastern Anatolia. Kryštufek (1993) stated that *R. ferrumequinum irani* was distributed in Iran and Iraq, *R. f. insularis* and *R. f. obscurus*, in Western Europe and *R.f. martinoi* and *R.f. creticum*, in Southeastern Europe. Steiner and Gaisler (1994) determined that the specimens collected from Northeastern Turkey are *R.f. ferrumequinum*.

The aim of this study is to give, for the first time, the karyotype of *R. ferrumequinum* in Turkey.

MATERIALS AND METHODS

A total of nine specimens were caught by using Japanese mist net, aerial net and gloves between 2000 and 2004. The karyological analysis was carried out according to Baker et al. (1982). At least 10 slides were prepared and 10 to 25 well stained metaphase spreads were examined from each slide. The specimens were skinned, stuffed and prepared as conventional museum type after being karyotyped. In this study, also the morphometric data, habitat and pelage colour of 239 specimens collected from Turkey between 1974 and 2000 were also recorded. Baculum was extracted according to Topal (1958). Pelage colour was recorded according to the colour definitions of Ridgway (1886). Diagnostic characters, habitat, pelage colour, measurements, karyology and collection localities of the species were recorded. Mann-Witney U test of nonparametric alternatives

was applied to detect the statistical differences on each variable between males and females because the distribution of the data for the measured variables did not meet the normality assumption. Results that yielded $p < 0.05$ were considered statistically significantly different (Campbell, 1990). All the specimens examined are deposited at the Department of Biology, Faculty of Science and Art, University of Kırıkkale.

Specimens examined (9): Burdur, Kumluca Köyü, 1 (04012 ♂, 25 April 2004); Erzincan, Tercan, Köroğlu dağları, 2 (2021 ♀, 2022 ♂, 19 September 2000); Eskişehir, Alpu, Kelkaya Göleti, 1 (2011 ♀, 29 April 2000); Gaziantep, İslahiye, Boğaziçi Beldesi, 1 (02024 ♂, 6 June 2002); Hatay, Belen, Kömürçukuru Köyü, 1 (04002 ♂, 13 April 2004); İzmir, Gümlüdere, Madenler, 1 (2016 ♂, 14 May 2000); Kırıkkale, Keskin, 2 (04020 ♂, 04021 ♀, 17 May 2004) (Figure 1).

RESULTS

In this study, karyological analyses of nine *R. ferrumequinum* specimens were carried out and some ecological and taxonomical features of the species were recorded.

Rhinolophus ferrumequinum (Schreber, 1774)
1774. *Vespertilio ferrum-equinum* Schreber, Säugeth., Deutschland, 153:174

Type locality: Burgundy, France

1853. *Rhinolophus ferrumequinum*, Blasius, Wiegman's Arch. Naturgesch., 19(1):51-52.

Diagnostic characters: Upper process of sella is broadly rounded or blunted and lower ones is relatively pointed (Miller, 1912; Ognev, 1928). Forearm length, 50.0-61.0; greatest skull length 22.0-24.8; condylobasal length, 19.0-21.6; zygomatic breadth, 11.4-12.7; maxillary toothrow length, 8.1-9.1; mandibular toothrow length, 8.6-9.8; mandible length 14.9-17.0 mm. Variation limits of lengths are between 3.75 and 4.60 mm ($x=4.20$) and widths, 0.85 and 1.50 mm ($x=1.28$) in three bacula specimens. The shape of baculum, a diagnostic character in *R. ferrumequinum*, is shown in Figure 2.

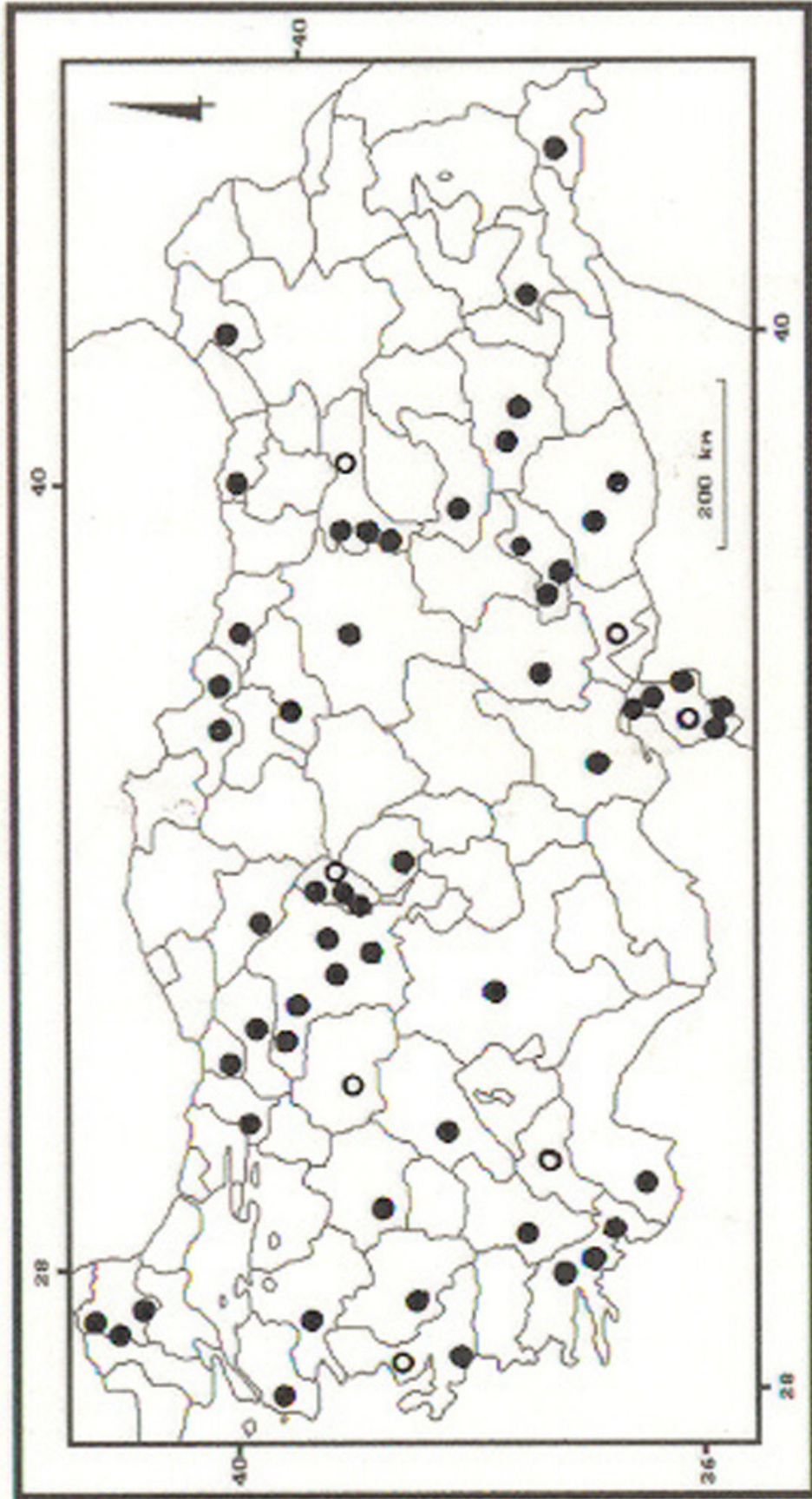


Figure 1. Distributional area of *R. ferrumequinum* in Turkey; previous records (●) and localities where the specimens have been obtained for the present karyological study (○).

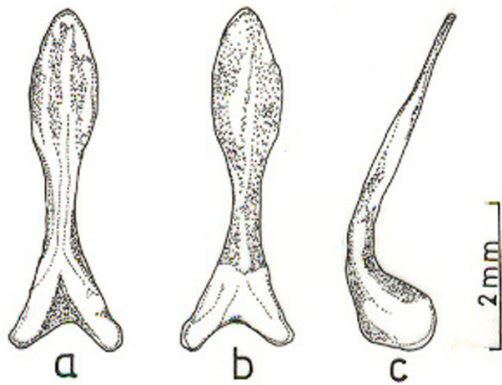


Figure 2. The shape of baculum of *R. ferrumequinum* from Turkey; dorsal view (a), ventral view (b) and lateral view (c).

Habitat: It lives either solitarily or form colonies in big caves, stables, pens, dens, crevices, tunnels and cellars of castle, inns, abandoned caravansaries and water wells.

Pelage colour: Dorsal colour of adults varies from yellowish brown-grey to yellowish grey tinged somewhat brown and vetral colour varies from yellowish grey to pale yellowish grey.

Measurements: External and cranial measurements and weights of the Turkish *Rhinolophus ferrumequinum* specimens are given in Table 1.

The mean values of greatest skull length, interorbital constriction breadth, braincase breadth, mastoid breadth, skull height and mandible length were significantly higher while the mean values of forearm length and weight were significantly lower in males than those in females ($P < 0.05$).

Karyology: Six male and three female specimens obtained from western, central, eastern and southern Anatolia were karyotyped. It was determined that the diploid number is 58, and fundamental number, 60. The chromosome set consists of two metacentric and 26 acrocentric autosome pairs. The X chromosome is submetacentric and Y, acrocentric. In addition, a secondary constriction at one of the medium-sized acrocentric pair was also determined (Figure 3).

DISCUSSION

The morphometric data of the Turkish *R. ferrumequinum* specimens were compared with those given by Miller (1912), Ognev (1928) and Harrison (1964), and no statistically significant differences were found between them (Figure 4).

Our karyological data were compared with those from Switzerland, Italy, Yugoslavia, Japan, Taiwan, Azerbaijan, Caucasia, Korea, Greece and Crete, Bulgaria (Ando, et al., 1983; Zima et al., 1992), Tunisia (Baker et al., 1974), Czechoslovakia (Zima, 1982), Jordan (Qumsiyeh et al., 1986), Southern Kirghizia (Zima et al., 1991, 1992) (Table 2).

Taking into account the similarity of diploid number, number of autosomal arms, metacentric or submetacentric and acrocentric autosome pairs, the Turkish *R. ferrumequinum* specimens are similar to the ones from Yugoslavia, Czechoslovakia, Italy, Bulgaria, Azerbaijan, Korea, Japan, Tunisia, Jordan and Southern Kirghizia. Also the X and Y chromosomes are similar to Tunisia and Southern Kirghizia (1992).

Morphometric and karyotypic data resulted

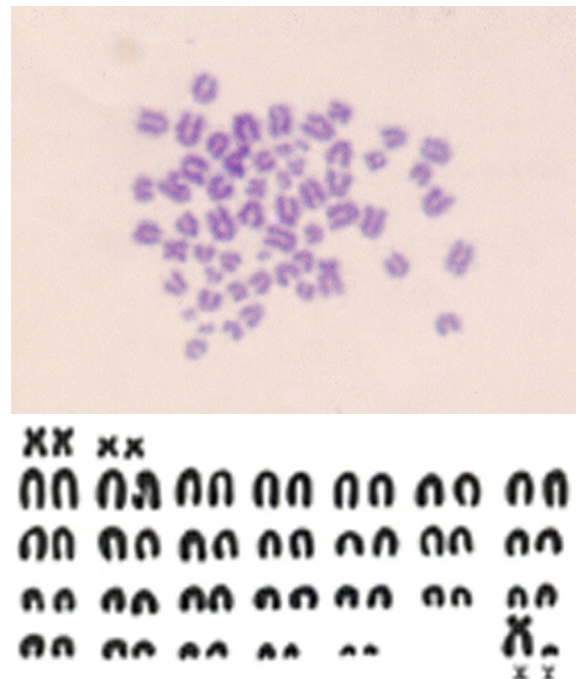


Figure 3. Metaphase spread (above) and idiogram (below) of Turkish *R. ferrumequinum*.

Table 1. The weight (gr), external and cranial measurements (mm) of adult male and female *R. ferrumequinum*; number of individuals (n), range (r), mean (m), standard deviation (\pm SD).

Measurements	Male				Female			
	n	min-max	\bar{x}	SD	n	min-max	\bar{x}	SD
Total length	57	84.0-118.0	109.0	5.56	106	98.0-22.0	110.1	4.62
Head and body length	56	62.0-82.0	72.2	3.93	106	63.0-80.0	72.7	3.12
Tail length	56	33.0-44.0	37.9	3.46	106	28.0-44.0	37.3	3.15
Hindfoot length	57	11.0-15.0	13.8	0.87	106	10.0-16.0	13.9	0.89
Ear length	58	19.0-29.0	25.2	1.87	106	16.0-28.0	24.9	1.79
Weight	54	13.5-28.0	19.3	3.76	99	13.0-28.0	22.0	3.52
Forearm length	55	51.0-61.0	53.3	1.72	100	50.0-58.0	53.8	1.32
Greatest skull length	43	23.0-24.8	23.8	0.45	80	22.0-24.5	23.6	0.41
Total skull length	57	21.1-23.3	22.2	0.47	107	21.0-23.0	22.1	0.39
Condylbasal length	56	19.4-21.6	20.4	0.46	103	19.0-21.6	20.3	0.40
Zygomathic breadth	58	11.4-12.7	12.0	0.31	107	11.4-12.7	12.0	0.24
Interorbital constriction	58	2.2-2.9	2.5	0.17	109	2.1-2.9	2.5	0.15
Braincase breadth	59	9.7-10.8	10.2	0.26	109	8.9-10.5	10.0	0.26
Mastoid breadth	50	10.1-11.0	10.4	0.21	106	9.2-10.8	10.3	0.19
Skull height	53	9.3-10.3	9.7	0.24	104	9.0-10.7	9.6	0.25
Maxillary tooththrow length	55	8.2-9.1	8.6	0.18	108	8.1-9.1	8.5	0.19
Mandibular tooththrow length	57	8.7-9.8	9.2	0.25	107	8.5-9.7	9.1	0.25
Mandible length	54	15.3-16.7	15.9	0.35	109	14.9-17.0	15.8	0.31

Table 2. Karyotypic characteristics of *R. ferrumequinum* from Switzerland, Italy, Yugoslavia, Japan, Taiwan, Tunisia, Azerbaijan, Caucasus, Korea, Czechoslovakia, Jordan, Greece and Crete, Bulgaria, Southern Kirghizia (2n: Diploid chromosome number, FN: number of autosomal arms, M: Metacentric, ST: Subtelocentric, A: Acrocentric, D_M: Dot-like metacentric, D_A: Dot-like acrocentric, X: X chromosome, Y: Y chromosome. M, ST, A, D_M and D_A are in pairs).

Country	Species or subspecies	2n	FN	M/SM	ST	A	X	Y
Switzerland (Bovey, 1949)	<i>R. f. ferrumequinum</i>	58	-	-	-	28	M	D
Italy (Capanna & Civitelli, 1964)	<i>R. f. ferrumequinum</i> (5 ♂♂, 3 ♀♀)	58	62	2	-	26	M	D _A
Yugoslavia (Dulic 1966, 1967)	<i>R. f. ferrumequinum</i> (4 ♂♂, 4 ♀♀)	58	60	-	-	-	M	A
Japan (Tsuchiya et al., 1971)	<i>R. ferrumequinum</i>	58	60	2	-	26	M	A
Japan (Harada, 1973)	<i>R. ferrumequinum</i>	58	-	3	-	25	M	A
Taiwan (Ando & Uchida, 1974)	<i>R. ferrumequinum</i>	58	-	3	-	25	M	A
Tunisia (Baker et al., 1974)	<i>R. ferrumequinum</i> (2 ♂♂)	58	60	-	-	-	SM	A
Azerbaijan (Kulijev and Fattajev, 1975)	<i>R. ferrumequinum</i>	58	60	2	-	26	M	A
Caucasus (Fattajev, 1978)	<i>R. ferrumequinum</i>	58	-	3	-	25	M	A
Korea (Park & Won, 1978; Lee & Son, 1988)	<i>R. ferrumequinum</i>	58	60	2	-	26	M	A
Czechoslovakia (Zima, 1982)	<i>R. f. ferrumequinum</i> (3 ♂♂, 1 ♀)	58	60	2	-	26	M	M
Japan (Ando et al., 1983)	<i>R. f. nippon</i> (7 ♂♂, 6 ♀♀)	58	62	3	-	25	ST	A
Jordan (Quemsiyeh et al., 1986)	<i>R. f. ferrumequinum</i> (12 ♂♂, 10 ♀♀)	58	60	2	-	26	M	A
Greece, Crete (Iliopoulou-Georgudaki, 1986)	<i>R. f. creticum</i>	58	-	3	1	24	M	A
Bulgaria (Belcheva et al., 1990)	<i>R. f. ferrumequinum</i>	58	60	2	-	26	M	A
Southern Kirghizia (Zima et al., 1991, 1992)	<i>R. ferrumequinum</i> (1 ♂)	58	60	2	-	26	SM	D
Turkey (Our study)	<i>R. ferrumequinum</i> (5 ♂♂, 3 ♀♀)	58	60	2	-	26	SM	A

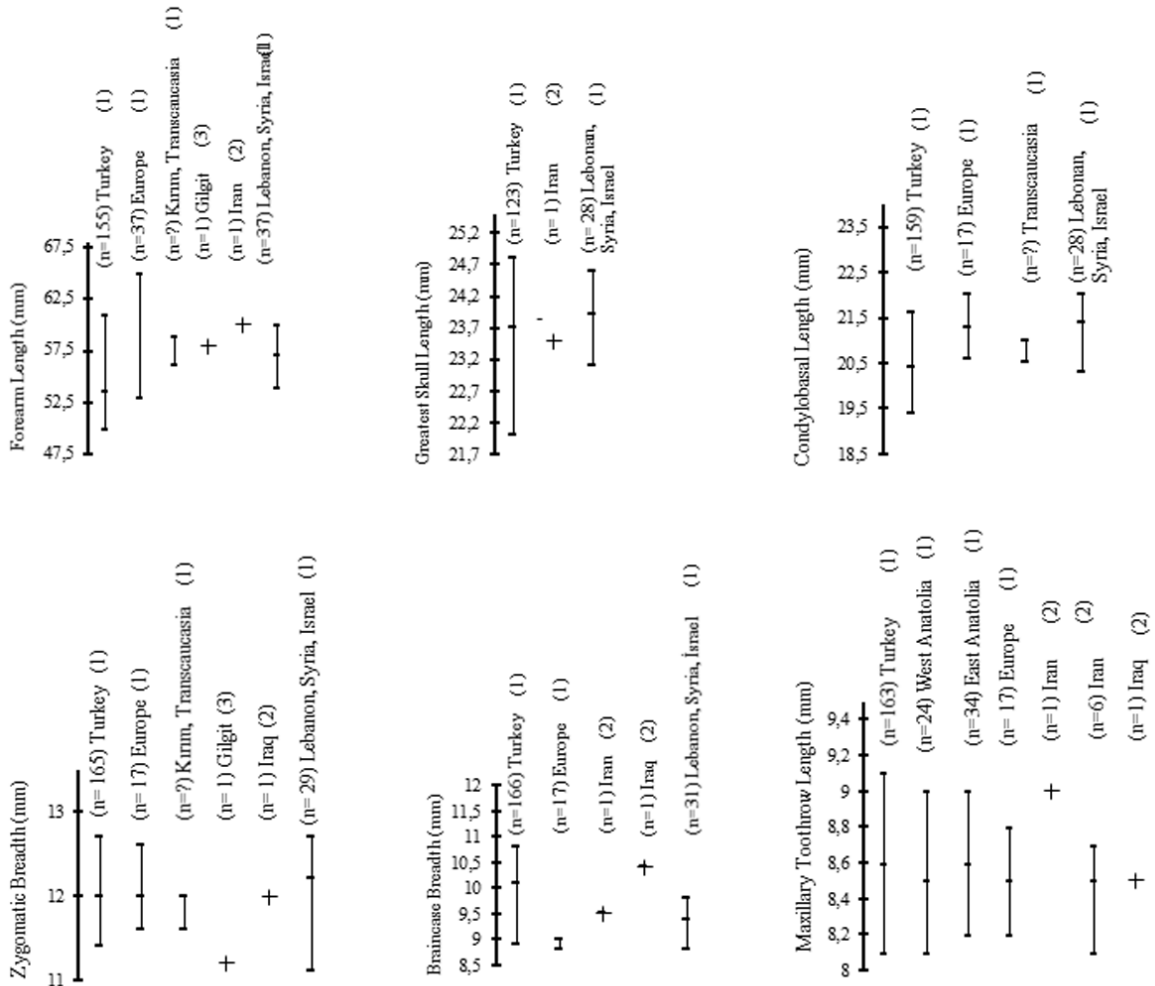


Figure 4. Comparison of external and skull measurements of *Rhinolophus ferrumequinum* from Europe, Crimea, Transcaucasia, Gilgit, Iran, Iraq, Lebanon, Syria and Israel and Turkey [*R. f. ferrumequinum* (1), *R. f. irani* (2), *R. f. proximus* (3)].

in all Turkish specimens from different regions show that *R. ferrumequinum* is represented by the nominate form in Turkey.

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