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Geographic Variations and Taxonomic Status of *Miniopterus schreibersi* (Kuhl, 1819) in Turkey (Chiroptera: Vespertilionidae)

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Abstract: This study is a taxonomical revision of 257 specimens of *Miniopterus schreibersi* (Kuhl, 1819) collected from Turkey between 1974 and 1994. A total of 30 external and cranial measurements and weights and the ages of the specimens were determined. Diagnostic characters, habitat, and measurements of subspecies were recorded. The specimens collected in Turkey were evaluated by comparison with the nominate form distributed nearby, *Miniopterus schreibersi pallidus* Thomas, 1907, and synonyms. It was determined that both the nominate form and *Miniopterus schreibersi pallidus* exist in Turkey.

Key Words: *Miniopterus schreibersi schreibersi*, *Miniopterus schreibersi pallidus*, subspecies, taxonomy, Turkey.

Türkiye'deki *Miniopterus schreibersi* (Kuhl, 1819)'nin Coğrafik Varyasyonları ve Taksonomik Durumu (Chiroptera: Vespertilionidae)

Özet: Bu araştırma 1974 ve 1994 yılları arasında tüm Türkiye'den toplanan ve koleksiyonda bulunan 257 *Miniopterus schreibersi* örneğinin taksonomik bir revizyonudur. Toplam 30 dış ve iç karakter ölçüsü ile ağırlık verilmiş ve örneklerin yaş tayinleri yapılmıştır. Alttürlerin ayrıntı özellikleri, habitat ve ölçüleri kaydedilmiştir. Türkiye örnekleri en yakın coğrafyada yayılış gösteren nominatif form, *Miniopterus schreibersi pallidus* Thomas, 1907 ve sinonimlerle karşılaştırılarak değerlendirilmiştir. Türkiye'de hem nominatif formun hem de *M.s.pallidus*'un var olduğu tespit edilmiştir.

Anahtar Sözcükler: *Miniopterus schreibersi schreibersi*, *Miniopterus schreibersi pallidus*, alttür, taksonomi, Türkiye.

Introduction

In Turkey, there exist a total of 30 bat species, one of which is frugivorous and the rest of which are insectivorous (1-28). Of these insectivorous species, *Miniopterus schreibersi* is the most common and abundant.

There are three valid records concerning subspecies of *M.schreibersi* in the Palaearctic Region (29): the range of *M.s.fulgunesus* is from India to China and Japan; *M.s.pallidus* is distributed within Northern Iran, Turkmenia, the Caucasus, Palestine and Asia Minor; and the nominate form is distributed within Europe and Northern Africa (29).

Strinati (6) initially recorded species of *M.schreibersi* from Bursa and İstanbul Provinces as the nominate form. Then, Corbet (29) stated that Turkey was within the distribution areas of *M.s.pallidus*. Steiner and Gaisler (27) reported that there were two subspecies, the nominate form and *pallidus*, in Turkey.

The purpose of this study was to determine the geographic variations of the species and the regional distribution of the subspecies.

Material and Method

This study was based on 257 specimens of *M.schreibersi* obtained from areas throughout Turkey. The specimens were divided into three age groups: adult, subadult, and juvenile (30, 31, 32). The adult group was used only for comparison and evaluation. The weight, 18 external measurements and 12 cranial measurements taken from each specimen were recorded.

Statistically significant differences between females and males, and adults and subadults were tested for (33). Since no difference was detected between the adults and subadults, both groups were evaluated together in tables. In this study, the diagnostic characters, habitat, fur colour, measurements and collection localities of the

species were examined and the results are discussed below. Moreover, a distributional map for the subspecies is also presented. A test for significant differences between the means of the nominative form and those of *pallidus* was also carried out on the basis of morphometric values (33) (t test, $P > 0.05$).

Colour descriptions were compared and evaluated according to Ridgeway (34). The data from our material were compared with relevant literature. The letters given in parentheses in the discussion chapter refer to the location of provinces within Turkey (N: north, S: south, E: east, W: west, C: central).

Result

It was determined that *Miniopterus schreibersi* is represented by two subspecies, *M.s.schreibersi* and *M.s.pallidus*, in Turkey.

Miniopterus schreibersi schreibersi (Kuhl, 1819)

1819. *Vespertilio schreibersi* Kuhl. Ann. Wetterau, Ges, Naturk, 4(2):185.

Type locality: Kulumbazer Cave, Hungary.

1857. *Miniopterus schreibersi*, Blasius, Saeugeth. Deutschlands, 46-48.

Diagnostic Characters: The dorsal colour is very slightly brownish light gray with slightly grayish light brown on the head and nape. The ventral colour is ash-gray with slightly yellowish gray-brown from under the chin to the chest. The ears, wings and flight membranes are very slightly grayish light brown.

Habitat: This subspecies forms colonies in caves. It is sympatric with *Rhinolophus ferrumequinum*, *Rhinolophus hipposideros* and *Rhinolophus blasii*. It enters hibernation after November and this lasts until April. Reproductive colonies are formed around June and only one infant is born a year.

Measurements: External and cranial measurements, and weights of the nominate form are given in Table 1.

Collection localities and specimens examined (total, 7): Kırklareli, Demirköy, İğne Ada, Tripez Mağarası, (5); Kırklareli, Demirköy, Samandere Köyü, Kız Mağarası, (2) (Fig. 1).

Miniopterus schreibersi pallidus Thomas, 1907

1907. *Miniopterus schreibersi pallidus* Thomas, 1907. Ann. Mag. N. M., 20:197.

Type locality: Southern Shore of Caspian Sea, Northern Persia.

Diagnostic characters: Some specimens have a pale yellowish and gray-brownish dorsal colour, whereas some others have distinct dorsal colours of smoky gray brown, light-brown-tinged blackish brown, grayish brown and brownish gray. The ventral colour of some specimens varies from gray-brown tinged yellow to yellowish-brown-tinged gray whereas the ventral colour of other specimens is dark ash gray or brownish ash gray. The ears, wings and flight membranes are pale light brown.

Habitat: It lives in big colonies and is sympatric with *Myotis myotis* and *Myotis blythi*. It stays in hibernation until April and produces one infant a year, in May-June.

Measurements: External and cranial measurements, and the weight of *M.s.pallidus* are given in Table 2.

Collection localities and specimens examined (total, 250): Ankara, Çubuk, Ballık, Miyriköy, Miyrendağı (13), Kalecik, Çandır (62), Kızılcahamam, Otacıköy, Karacinkayalığı (26); Antalya, Kaş, Limanağzı, Hıdırellez Mağarası (1); Balıkesir; Havran, İnönü Köyü Mağarası (3); Burdur, İnsuyu Mağarası (3); Bursa, İnkaya, Kuşini Mağarası (1); Diyarbakır, Çermik, Kalecik Köyü Mağarası (4); Erzincan, Tercan, Mamahatun Kervansarayı (11); Erzurum, İspir, Elmalı Köy, Çamlıca Mağarası (24); Siirt, Sağlarca (Billursu) Köyü (8); Gümüşhane, Mescitli Köyü (7); Hatay, Narlıca Köyü, Karanlık Mağara (3), Harbiye Mağarası (2); Isparta, Aksu (Anamas), Zindan Mağarası, (8); İzmir, Gümüldür, İncirli Maden Ocağı (1); Kars, Aralık, Küçük Ağı Dağı, Serdarbulak Yaylası (15); Konya, Sızma Köyü, Kuzey Mağara (3); Niğde, Gümüşler, Epçik Mağarası, (2); Ordu, Yaraşlı Köyü (40); Tokat, Turhal, Pazar, Abayel Köyü, İnderesi Mevkii (5); Trabzon, Maçka, Bağışlı Köyü (8) (Fig. 1).

The comparison of *M.s.schreibersi* with *M.s.pallidus*

Kuhl (35) first described *Vespertilio schreibersi* as having a dorsal colour of ash-gray-tinged yellowish white with an ear length of 9.1 mm. Blasius (36), then evaluated this species as a valid species: *Miniopterus schreibersi*.

Miller (37) recorded the colour of the upper parts of 37 *M.s.schreibersi* specimens from Spain, France, Switzerland, Italy, Hungary, Greece, Sardinia, and Sicily as "drab faintly lighter and more nearly hair brown anteriorly; underparts ecru-drab". Ognev (38) described the back colour of 9 specimens of *M.s.schreibersi* from the Crimea as "brownish gray" and the abdominal region as "light smoky-gray".

The specimens of *Miniopterus schreibersi* from Turkey were compared with the original description of

Table 1. Statistical data consisting of weight, and external and cranial measurements of adult *Minipoterus schreibersi schreibersi* (♂♂ + ♀♀): number of individuals (n), range (r), mean (m) and standard deviation (± Sd).

Measurements	n	r	m	Sd
Total length	7	117-124	120.7	2.69
Head and body length	7	67-68	67.4	0.53
Tail length	7	49-56	53.1	2.60
Hindfoot length	7	12-13	12.1	0.37
Ear length	7	10-11.5	10.9	0.44
Tragus length	6	3.9-5.2	4.6	0.45
Forearm length	7	40.0-43.5	42.8	1.30
Tibia length	6	16.4-18.5	18.0	0.79
2 nd metacarpal length	6	32-41.5	38.4	3.29
3 rd metacarpal length	6	40.0-42.2	40.9	0.92
Length of 1 st phalange of 3 rd digit	6	10.5-11.3	10.8	0.26
Length of 2 nd phalange of 3 rd digit	6	28.7-29.7	29.2	0.37
4 th metacarpal length	6	38.3-40.3	39.2	0.84
Length of 1 st phalange of 4 th digit	6	8.3-8.7	8.5	0.13
Length of 2 nd phalange of 4 th digit	5	15.2-17.5	16.0	0.93
5 th metacarpal length	6	34.5-35.6	35.0	0.40
Length of 1 st phalange of 5 th digit	6	9.3-9.7	9.5	0.13
Length of 2 nd phalange of 5 th digit	6	5.9-6.8	6.2	0.33
Greatest skull length	7	15.3-15.8	15.5	0.16
Total skull length	6	15.0-15.3	15.1	0.11
Condylbasal length	6	14.4-14.7	14.5	0.11
Palatal length	7	1.0-1.2	1.1	0.04
Zygomatic breadth	7	8.5-8.8	8.6	0.11
Interorbital constriction	7	3.6-3.8	3.7	0.88
Braincase breadth	6	7.8-8.1	7.9	0.12
Mastoid breadth	6	8.5-9.0	8.7	0.18
Skull height	5	8.2-8.6	8.3	0.19
Maxillary tooththrow length	5	5.9-6.1	6.0	0.05
Mandibular tooththrow length	6	6.4-6.5	6.4	0.05
Mandible length	5	10.9-11.2	11.0	0.13
Weight	7	9.5-13.0	10.5	1.15

Kuhl (35) and redescription of Miller (37) and Ognev (38) in terms of coloration. There seems only to be similarity in the coloration of some specimens from Kırklareli Province in Turkish Thrace. The dorsal and ventral colour of only the subadult specimens fit well with the original description. There was a slight difference in the adults when the colour on the head and nape, was compared.

Morphometric data from our specimens were also compared with the original description and other descriptions. Our data are in agreement with Miller's (37) and Ognev's (38) data in terms of condylbasal length, zygomatic breadth, interorbital constriction and maxillary

tooththrow length (Fig. 2). When compared to Miller's (37) data, our specimens have similar values for braincase breadth; however, the mandibular tooththrow and mandible length are greater than in Miller's data. When compared with the skull heights measured by Ognev (38), our data show similarity, but the forearm and total skull lengths are shorter than those recorded in his data. Thus, we included only European Turkey (Turkish Thrace) within the distributional area of the nominate form.

Thomas (39) described the general colour of the *pallidus* holotype from the southern shore of the Caspian Sea as "wood brown" and the ventral colour as "smoky-gray" while the margin of the interfemoral membrane

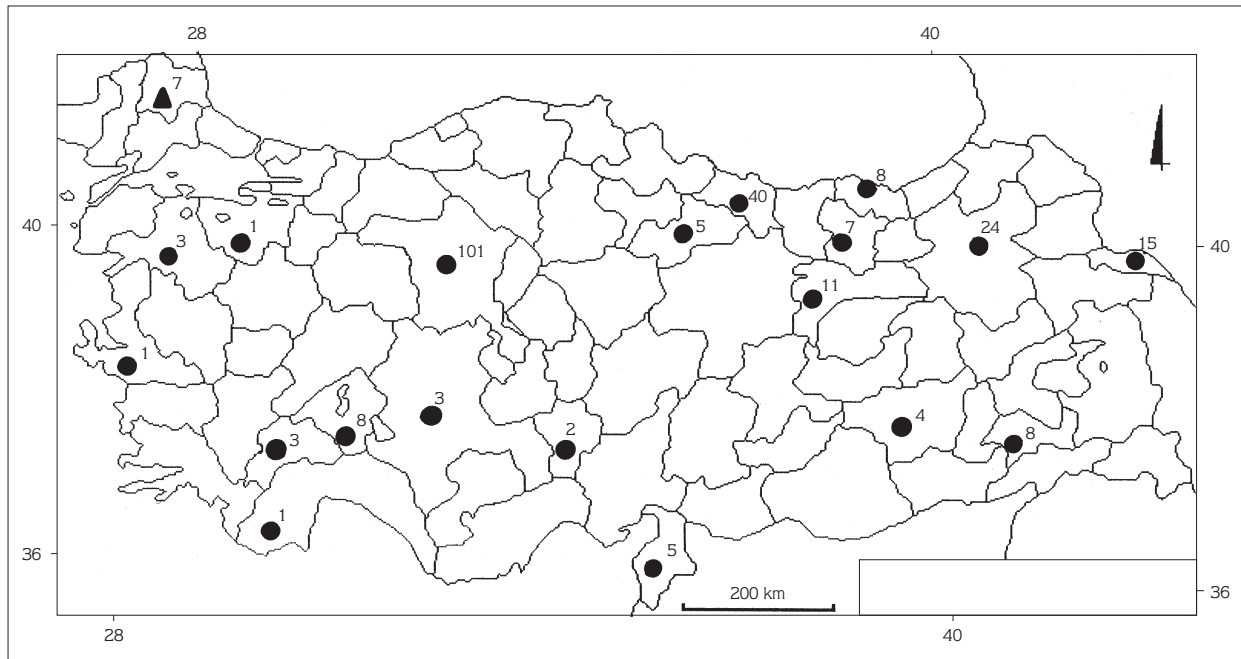


Figure 1. Distribution of subspecies of *M.schreibersi* in Turkey; *M.s.schreibersi* (▲), *M.s.pallidus* (●).

and inqual region was described as “buffy”. He also recorded that the head and body, tail, ear, condylobasal length and mastoid breadth were 55, 57, 12, 15, and 9 mm respectively.

Ognev (38) recorded that the dorsal colour of 5 *pallidus* specimens from Transcaucasus was “drab (pale straw gray)” and that the ventral colour was “drab gray (pale gray whitish)”. Harrison (40) recorded that dorsal colour of 9 specimens from Jordan, Israel, Lebanon, and Iraq was “pale grayish brown” and that the ventral colour was “grayish white”. He identified his specimens as *M.s.pallidus*.

Of the Turkish specimens, only the colours of those from Diyarbakır and Siirt Provinces in Anatolia fit well with the original description of *pallidus*, because the gray-brown dorsal colour of some of our specimens is similar to that of Ognev’s (38) *pallidus* specimens. However, the ventral colour varies from grayish-brown-tinged yellow to yellowish-brown-tinged gray. Therefore, all the materials differ from those of Ognev (38). The dorsal colour of our material is similar to that given in Harrison’s data (40), but it differs in terms of the ventral colour.

For *pallidus*, our morphometric data were compared with the original description, and Ognev’s (38) and Harrison’s (40) data. Only interorbital constriction exhibited smaller values, but the forearm length, greatest

skull length, condylobasal length and braincase breadth fall within the ranges determined in our specimens. The zygomatic breadth of our material is in agreement with Ognev’s(38) and greater than Harrison’s(40). The total skull length in our material is almost the same as in Ognev’s (38) data. The skull height of the Turkish specimens is somewhat greater than in Ognev’s (38) data, whereas the interorbital constriction is smaller. The maxillary tooththrow length in Ognev’s (38) data falls within the range of our specimens. The maxillary tooththrow length and mandibular tooththrow length values of our specimens are conspicuously higher than those recorded by Harrison (40) but the mandible length is similar (Fig. 3).

As a result, only 7 out of the 257 specimens from Turkish Thrace are *M.s. schreibersi* and the remaining 250 specimens from Anatolia are *pallidus*, showing wide colour variations.

Discussion and Conclusion

According to Lay (41), Kuzyakin and Bobrinsky et al., reported that there is seasonal variation in the fur colour of *M.schreibersi* exhibited basically by fading, and Dwyer and Constantine also stated that this fading in colour is the results of molting.

Table 2. Statistical data consisting of weight, and external and cranial measurements of adult *Miniopterus schreibersi pallidus* (♂♂ + ♀♀): number of individuals (n), range (r), mean (m) and standard deviation (\pm Sd).

Measurements	n	r	m	Sd
Total length	176	100-134	119.3	4.84
Head and body length	176	50-81	68.2	5.09
Tail length	176	43-56	51.0	2.69
Hindfoot length	175	9-14	11.8	0.92
Ear length	176	8-14	11.0	0.95
Tragus length	87	4.6-7.0	5.4	0.46
Forearm Length	144	41.8-47.0	46.3	0.38
Tibia length	105	17.0-20.2	18.7	0.73
2 nd metacarpal length	95	38.0-43.3	40.7	1.14
3 rd metacarpal length	95	39.7-43.4	41.8	0.80
Length of 1 st phalange of 3 rd digit	95	10.2-12.7	12.3	0.96
length of 2 nd phalange of 3 rd digit	95	28.0-31.8	30.2	2.18
4 th metacarpal length	95	37.7-42.0	40.1	0.92
Length of 1 st phalange of 4 th digit	95	8.2-9.9	8.8	0.40
Length of 2 nd phalange of 4 th digit	92	13.6-17.0	15.1	0.77
5 th metacarpal length	95	33.7-38.6	36.3	0.84
Length of 1 st phalange of 5 th digit	95	8.4-11.0	9.7	0.45
Length of 2 nd phalange of 5 th digit	93	5.9-7.4	6.6	0.33
Greatest skull length	170	14.7-16.0	15.6	0.24
Total skull length	174	15.3-15.9	15.3	0.23
Condylbasal length	173	14.1-15.5	14.9	0.26
Palatal length	129	0.8-1.4	1.1	0.10
Zygomatic breadth	145	8.4-9.1	8.6	0.16
Interorbital constriction	178	3.3-3.8	3.6	0.11
Braincase breadth	176	7.5-8.3	7.9	0.16
Mastoid breadth	168	8.3-9.2	8.7	0.21
Skull height	156	7.8-9.2	8.2	0.62
Maxillary tooththrow length	166	5.8-6.6	5.9	0.11
Mandibular tooththrow length	177	6.1-6.8	6.3	0.12
Mandible length	176	10.8-11.5	11.1	0.15
Weight	167	8.0-20.0	12.3	2.20

The dorsal colour and ventral colour of six adult specimens collected from Ordu (N) on 19th July and 6th August are smoky gray brown and dark ash gray respectively. However, 13 specimens from the same province and locality collected on 23rd and 24th June and on 19th July have a dorsal colour of light-brown-tinged yellow and a ventral colour of slightly grayish-brown-tinged yellow with ash gray or ash gray with slightly brownish gray spots on the chin and chest.

Four specimens collected from Trabzon (N) on 11th and 12th August, have a dorsal colour of light brown tinged gray, whereas eight specimens collected from

Trabzon on 11th and 12th August and 2nd November, have a dorsal colour of blackish brown. The ventral colour of these specimens is slightly grayish-brown-tinged yellow with ash gray or ash gray with slightly brownish gray spots on the chin and chest. One specimen collected from İzmir (W) on 11th June, three specimens collected from Balıkesir (W) on 14th July, one specimen collected from Bursa (W) on 15th September, three specimens collected from Burdur (SW) on 30th September, four specimens collected from Isparta (SW) on 29th September, 31 specimens collected from Ankara (C) on 19th-21st July and on 16th September, three specimens

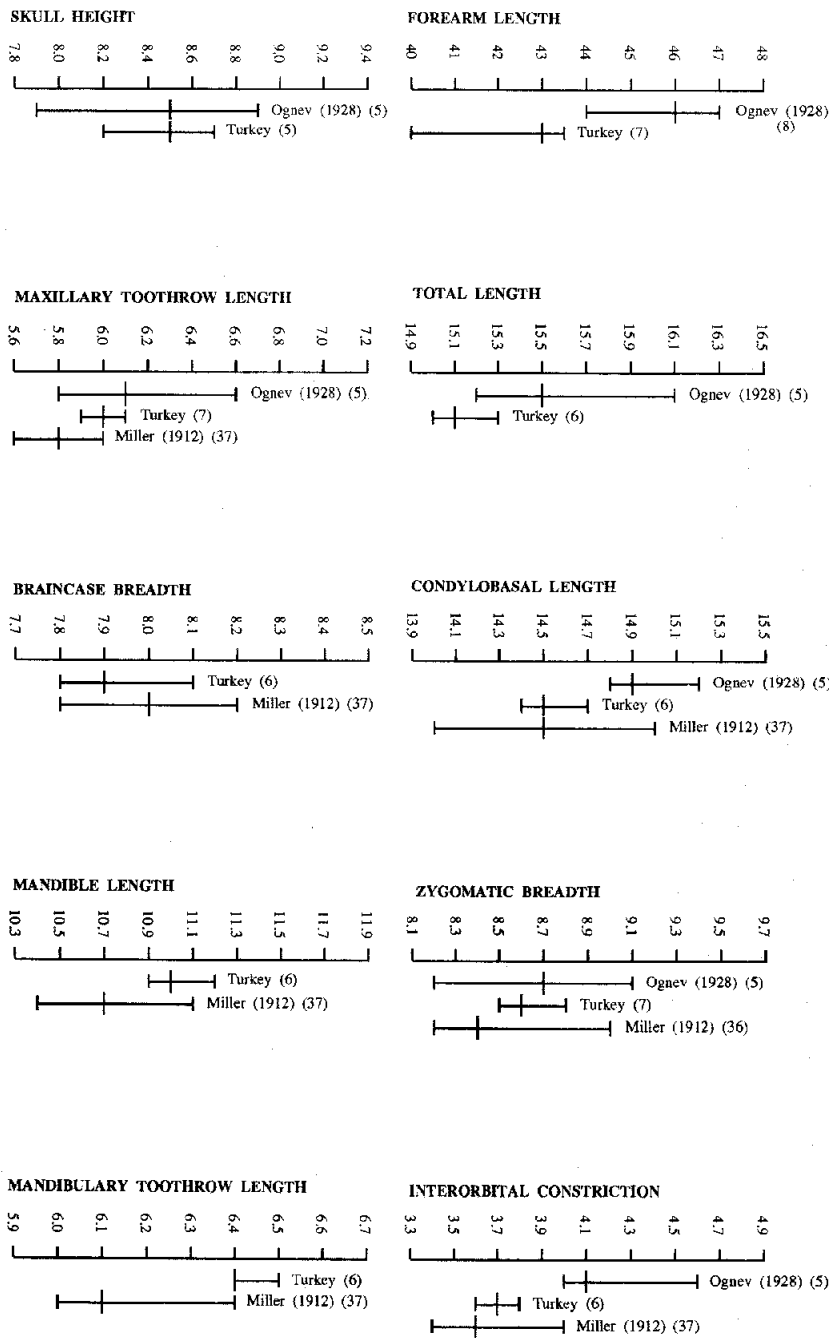


Figure 2. Comparison of external and cranial measurements of *Miniopterus schreibersi* from Europe (Miller, 1912), Crimea (Ognev, 1928) and Turkey.

collected from Konya (C) on 20th September, two specimens collected from Niğde (C) on 26th May, 13 specimens collected from Ordu (N) on 23rd and 24th June, four specimens collected from Trabzon (N) on 19th July and 12th August, three specimens collected from Erzincan (E) on 28th September, 17 specimens collected from Erzurum (E) on 24th August and 15 specimens

collected from Kars (NE) on 7th August all have the same coloration characteristics such as spotted fur coloration under the chin.

Strinati (6) considered *M.scheribersi* specimens from Bursa to be the nominate form. The dorsal colour of one specimen from Bursa is identical to that of Strinati's specimens but ventral the colour differs. Steiner and

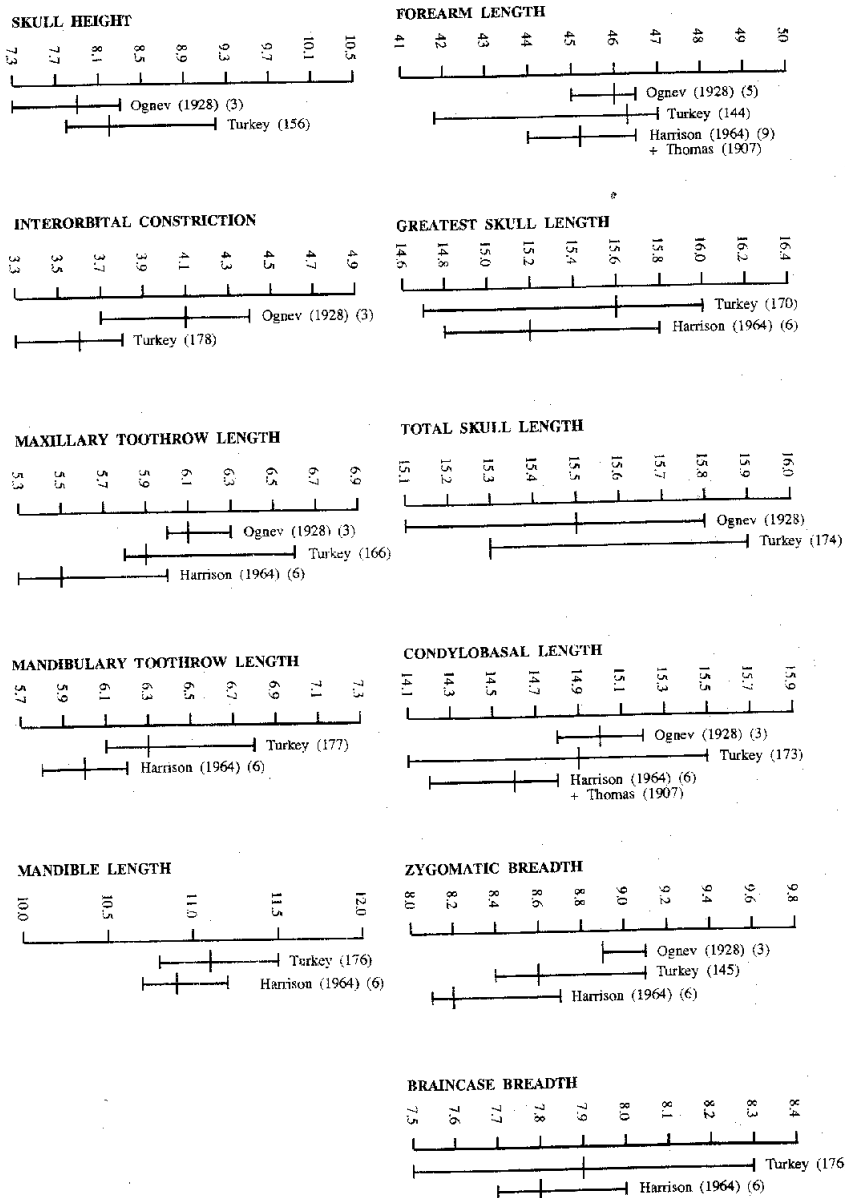


Figure 3. Comparison of external and cranial measurements of *Miniopterus schreibersi* from Iraq (Thomas, 1907), Crimea (Ognev, 1928), Middle East (Harrison, 1964) and Turkey.

Gaisler (27) obtained 10 specimens from Balıkesir and 21 specimens from Erzurum and Trabzon. They identified the specimens from Balıkesir as the nominate form. They identified 21 specimens from Erzurum and Trabzon as *pallidus* because of their darker coloration. Our three specimens from Balıkesir differ from the nominate form in terms of dorsal colour.

Our 17 specimens from Erzurum and 12 specimens

from Trabzon differ from the nominate form in terms of dorsal colour.

This species could not be investigated in respect of the baculum because of the absence of the baculum in this species. Karyological studies of this species are still being conducted. Consequently, according to our data, the range of *M.schreibersi pallidus* must be amended to include the whole of Anatolia.

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