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Taxonomic Status of Kuhl's Pipistrelle *Pipistrellus kuhlii* (Kuhl, 1817) in Turkey (Mammalia: Chiroptera)

¹Atilla Arslan and ²Irfan Albayrak

¹Department of Biology, Faculty of Science and Arts, Selcuk University, 42031 Selcuklu, Konya, Turkey

²Department of Biology, Faculty of Science and Arts, Kirikkale University, 71450 Yahsihan, Kirikkale, Turkey

Abstract: This study is a taxonomical evaluation of 160 specimens of *Pipistrellus kuhlii* (Kuhl, 1817) collected in Turkey between 1974 and 2004. The taxonomic properties of Turkish *P. kuhlii* were compared with records from the Palaearctic Region. In this study, the diagnostic characters, habitat, pelage colour, baculum, external and cranial measurements and distribution of *Pipistrellus kuhlii* were observed. It was determined *P. kuhlii ikhwanius* is distributed in Turkey.

Key words: *Pipistrellus kuhlii*, Turkey, taxonomy

INTRODUCTION

It has been recorded that 32 bat species exist in Turkey^[1-3]. Among these species, 31 feed on insects and one feeds on fruits. *Pipistrellus kuhlii* is very widely distributed bat (Kuhl, 1817) that extends from southern Europe to Pakistan and Africa^[4]. *P. kuhlii* is very important member of Turkish bat fauna. It occurs in all biogeographic regions of Turkey. In the Cilician coast and Mesopotamia, it is even the most common species at all^[5]. There are five valid records concerning subspecies of *P. kuhlii* in the Palaearctic Region: the range of *P. kuhlii* (Kuhl, 1817) is from Europe and North Africa and Iran; *P. k. marginatus* (Cretzschmar, 1830) is distributed in Arabia Petraea; *P. k. lepidus* Blyth, 1845 is distributed in Afghanistan; *P. k. ikhwanius* Cheesman et Hinton, 1924 is distributed in Central Arabia; *P. k. pallidus* Heim de Balsac, 1936 is distributed in Northern Sahara and Algeria^[6,6]. Kumerloev^[7] reported that Turkey is colonized by *P. k. ikhwanius*. Nader and Kock^[8] suggested that the Mediterranean populations are an intermediate forms between *P. k. kuhlii* and *P. k. ikhwanius*.

The purpose of this study was to determine the geographic variations of *P. kuhlii* and their distribution in Turkey.

MATERIALS AND METHODS

A total of 160 *P. kuhlii* specimens are deposited in the mammalian collection of the Biology Department in Kirikkale University and were collected regularly by Albayrak between 1974 and 2004. Only adults (n = 119)

were used for comparisons. Age determination was made according to the methodology described by Andersen^[9], Young^[10] and Baagoe^[11]. A test for significant differences between the means of both the males and females and geographical zones in Turkey was carried out on the basis of some morphometric data (t-test, > 0.05) and 5 external and 11 cranial measurements of each specimen were recorded together with weight. For this taxon, the diagnostic characters, habitat, pelage colour, measurements, collection localities and specimens examined were recorded. The nomenclature of colours given by Ridgway^[12] was also taken into consideration in defining the colour of the specimens. The bacula were prepared according to the method described by Topal^[13]. Diagnostic characters quoted by Caglar^[14] were used to distinguish the subspecies.

RESULTS

Pipistrellus kuhlii (Kuhl, 1817)

1819. *Vespertilio kuhlii* Kuhl Ann. Wetterau. Ges. Naturk., 4(2):199-292.

Type locality: Trieste, Italy

1900. *Pipistrellus kuhlii*, Mehely, Monogr. Chiropt. Hungariae, Budapest, 261.

Diagnostic characters: Wing membrane with white margin, especially between foot and 5th finger. Inner upper incisor unicuspid. Outer upper incisor, very small and not been sight sideways. Forearm, 30.1-35.1; greatest skull length 13.1-14.3; total skull length, 12.6-13.9; condylobasal length, 12.2-13.4; zygomatic

Table 1: External and cranial measurements and weight of adult males and females of *P. kuhlii* from Turkey; number of individuals (n), range, mean (x) and standard deviation (±SD)

Measurements	n	Range	x	±SD
Total length	115	83-100	92.90	3.31
Head and body length	113	47-64	57.15	3.01
Tail length	119	31-45	35.76	2.21
Hindfoot length	119	7.0-10.5	8.86	0.78
Ear length	118	8-17	11.89	1.20
Forearm length	86	30.1-35.1	32.77	1.04
Greatest skull length	112	13.1-14.3	13.70	0.23
Total skull length	118	12.6-13.9	13.27	0.24
Condylbasal length	118	12.2-13.4	12.76	0.24
Zygomatic breadth	82	8.2-9.1	8.68	0.18
Interorbital constriction	119	3.4-3.8	3.56	0.10
Braincase breadth	119	6.3-7.3	6.99	0.20
Mastoid breadth	117	7.3-8.1	7.69	0.17
Skull height	102	5.3-6.6	6.21	0.20
Maxillary tooththrow length	109	4.6-5.9	4.96	0.16
Mandibular tooththrow length	111	5-6	5.30	0.17
Mandible length	114	9.4-10.5	9.82	0.20
Weight	115	4-10	6.66	1.20

breadth, 8.2-9.1; interorbital constriction, 3.4-3.8; braincase breadth, 6.3-7.3; maxillary tooththrow length, 4.6-5.9; mandibular tooththrow length, 5.0-6.0; mandible length, 9.4-10.5 mm (Table 1).

Habitat: Individuals of *P. kuhlii* live under roofs of buildings, basement, molding, wall cracks and hollows (boat) and electric mast. They give birth to twins each year. They emerge at twilight. They may be encountered in summer when they prey on insects around street lights^[5].

Pelage colour: Its hair is bicoloured both dorsal and ventral surface, with the bases being a slaty black. Brown dorsal colour provided that the head and neck varies from paler brown to paler yellowish brown, ventral colour varies from dirty white provided that the throat and chest varies from yellowish dirty white. Its wing membrane with white margin (mean 2.3 mm), is especially between foot and 5th finger.

Measurements: External and cranial measurements of *P. kuhlii* are given in Table 1.

Collection localities and specimens examined (total, 160): East Anatolia region[Erzurum (1979), 3 (2 ♀♀, 1 ♂); Kars (1979), 44 (36 ♀♀, 8 ♂♂)], Southeast Anatolia region [Adiyaman (2002), 1 (♀); Gaziantep (1972, 2003), 1 (♂); Hatay (1977, 1979, 2002, 2003), 70 (60 ♀♀, 10 ♂♂); Kilis (2002), 2 (♀♀); Mardin (1970), 3 (♀♀); Sanliurfa (1970, 1972, 2004), 6 (3 ♀♀, 3 ♂♂)], Mediterranean region[Adana (1987), 10 (♀♀); Antalya (1985, 2004), 13 (♀♀); Mersin (2003, 2004), 4 (2 ♀♀, 2 ♂♂); Osmaniye (2002), 2 (♀♀)] and West Anatolia region[Mugla (1987), 1 (♂)].

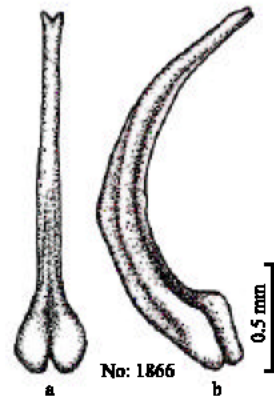


Fig. 1: Baculum of *P. kuhlii*, a. Dorsal, b. Lateral view

Baculum: Baculum length of *P. kuhlii* is 2 mm and its width is 0.37 mm. An elongate structure with a slender shaft and paired basal flanges, the ventral surface of the proximal part of the shaft is transversely concave, its distal part is cylindrical or nearly so; in profile the base in line with the shaft is more or less deflected downward at an angle to it, the tip is generally bifid or forked and may be directed ventrally to a greater or lesser extent (Fig. 1).

DISCUSSION

Lewis and Harrison^[6] recorded that in the Mediterranean region, the populations of *P. kuhlii* exhibit considerable cline variation in pelage colouration, those from the southern regions being much paler than those in the European part of the region. Kock *et al.*^[7], who evaluated the East-Anatolia *P. kuhlii* in details, found it is to be distinctly paler than those bats from the European Mediterranean but resigned to decide whether it is to be identified as *P. k. lepidus* or *P. k. ikhwanus*. According to Harrison and Bates^[4], specimens from Arabia and Iraq are referred to the pallid desert subspecies *P. k. ikhwanus* the wing membranes of which have an extensive ill-defined white margin and well marked with pallid vascular striae. In *P. k. kuhlii* of southern Europe, the white margin is very narrow and the wings are generally darker. Miller^[8] recorded nominative form from Europe, the white margin which is less than 1 mm. Kock *et al.*^[7] determined a range of 2.0-4.7 of white margin of Anatolian specimens. Since the white margin of specimens from Turkey is 2.3 mm, both our specimens and specimens of Kock *et al.*^[7] can be represented as *P. k. ikhwanus*.

Baculum morphology of Turkey specimens is similar to results of Hill and Harrison^[9] and Harrison and Bates^[4].

Miller^[8] from Europe (France, Greece, Switzerland, Italy, Sardinia and Spain), Ognev^[20] from Asia (Armenia

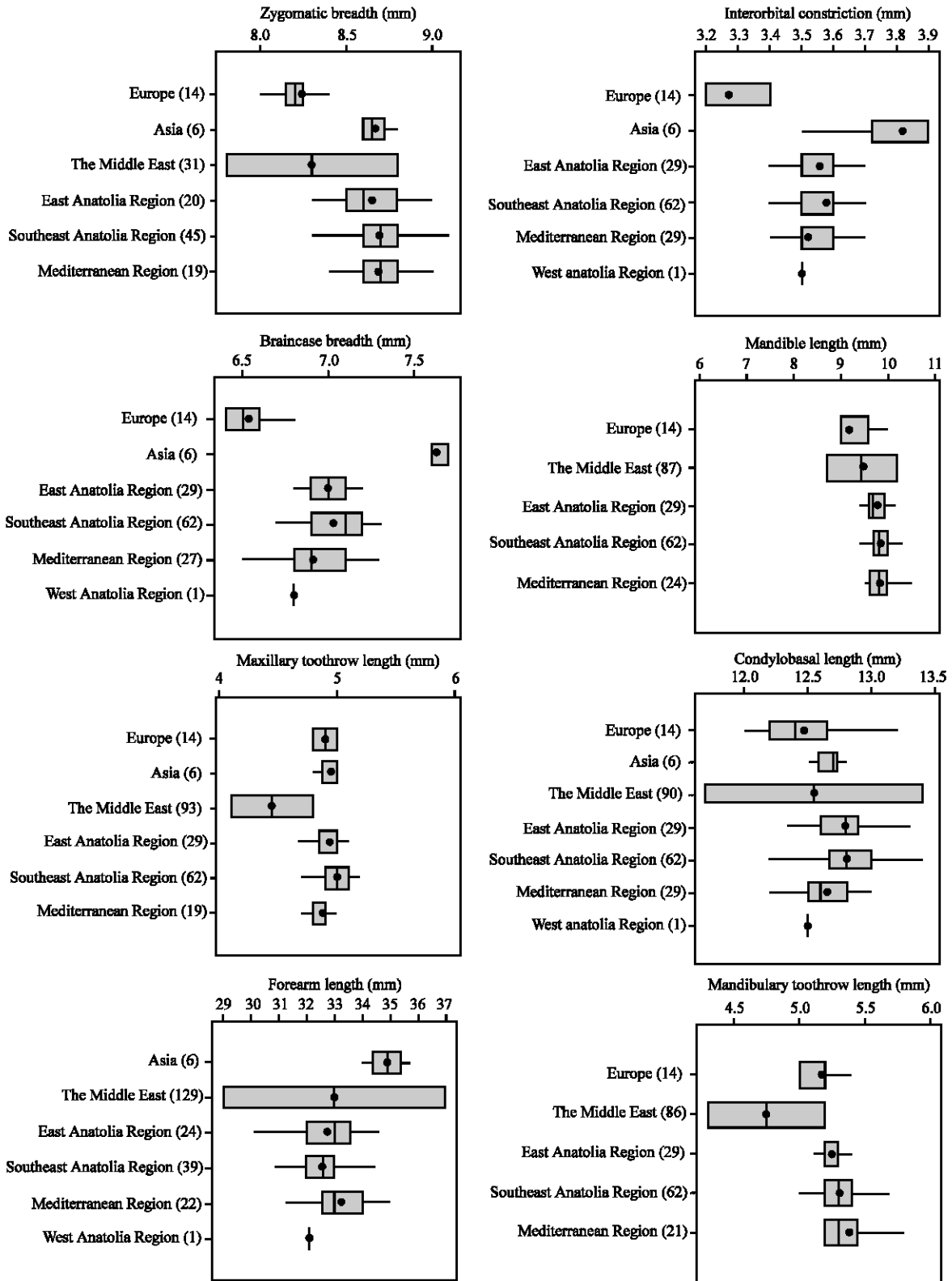


Fig. 2: Boxplot showing comparison of populations of *Pipistrellus kuhlii* from Europe (Miller^[18]), Asia (Ognev^[20]), the Middle East (Harrison and Bates^[4]) and Turkey (East Anatolia Region, Southeast Anatolia Region, Mediterranean Region and West Anatolia Region), (The numbers in parenthesis show the number of specimens)

and Iran) and Harrison and Bates^[4] from the Middle East (Lebanon, Israel, Syria, Jordan, Iraq, Kuwait, Saudi Arabia, UAE and Oman) recorded some external and cranial measurements of *P. kuhlii*. Measurements of specimens from Europe given by Miller^[13] were compared with measurements which we obtained for the specimens from Turkey. Zygomatic breadth, interorbital constriction, braincase breadth, mandible length and condylobasal length of European specimens were smaller than all specimens from Turkey, whereas from the point of maxillary and mandibular tooththrow length, there wasn't a statistical difference between Europe and Turkey specimens. It was determined that greatest skull length given by Ognev^[20] for *P. kuhlii* in Asia are statistically smaller than Turkish ones, whereas interorbital constriction, braincase breadth and forearm length for Asian samples are bigger than Turkish bats. Also condylobasal length, zygomatic breadth and maxillary tooththrow length belonging to samples from Turkey were found to be not different statistically from Asian ones. When Harrison and Bates^[4] compared condylobasal length, zygomatic breadth, mandible length and forearm length measurements of samples in the Middle East with the ones in Turkey, a specific difference was not seen statistically, where it was determined that maxillary tooththrow length, mandibular tooththrow length and greatest skull length of samples in the Middle East were found to be smaller as shown in Fig. 2.

Statistical evaluations of morphometrical measurements revealed that specimens of Turkey were different from specimens of Europe and Asia but they were similar to specimens of the Middle East. Therefore our specimens can be represented as *P. k. ikhwanius*.

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