

**Taxonomical comments on Sudan beaked worm snake,  
*Leptotyphlops macrorhynchus* (Jan&Sordelli, 1860) (Serpentes: Leptotyphlopidae)  
from Anatolia, Turkey**

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**Abstract:** In this study, 63 specimens of *Leptotyphlops macrorhynchus* collected from 14 localities were examined in terms of morphometric measurements and pholidosis characteristics. Eleven localities were found on the east side of the Euphrates River, an important dispersal barrier for animals in Anatolia and three localities on the west side of the river. According to Mann-Whitney U test dorsalia numbers showed differences between the east and west side population of the Euphrates River ( $p < 0.05$ ). The results of the student t test also showed two morphometric characters (diameter at midbody and diameter at tail) and two ratios different between the populations. This study also extends the known distribution area of the species by recording new localities.

**Key words:** *Leptotyphlops macrorhynchus*, The Euphrates River, distribution range, morphology, southeastern Anatolia.

## Introduction

*Leptotyphlops* (Fitzinger, 1843) genus has a hundred six species. *L. macrorhynchus* was first described as *Stenostoma macrorhynchum* from Sudan (Jan&Sordelli 1860). Sudan beaked worm snake, *L. macrorhynchus* (Jan&Sordelli, 1860) constitutes *L. longicaudus* species group with *L. nursii*, *L. erythraeus*, *L. burii*, *L. yemenicus*, *L. cairi*, *L. braccianii*, *L. ionidesi* and *L. tanae* (Broadley & Wallach 2007). *L. macrorhynchus* is distributed in East, through Sahel and Sudan savanna to the Horn of Africa, north to Turkey, south to Kenya and northern Tanzania (Baran & Atatür 1998, Sindaco 2000, Broadley & Wallach 2007). The occurrence of species in Anatolia was reported for the first time by Clark & Clark (1973) from east of the Euphrates River. Then, some researchers extended the distribution range of species (Baran 1978, 1982, Mulder 1995). Baran et al. 2004 recorded species on the west side of the Euphrates River which is an important dispersal barrier for animals in Anatolia (Yıldız et al. 2007) and Uğurtaş et al. (2006) confirmed this distribution with two new localities from west side of the River. More recently, Göçmen et al. (2009) determined the westernmost border of distribution range from Hatay province. Although in some studies on *L. macrorhynchus* reported localities, morphological and pholidot characters were not given or they are too limited (Mulder 1995, Sindaco et al. 2000, Baran et al. 2004, Uğurtaş et al. 2006). Uğurtaş et al. (2006) recorded

two new localities on the east side and two on the west side of the Euphrates River and compared populations. However, they evaluated only 11 specimens from all localities in terms of six morphometric and characteristics; and thus, the number of specimens and characters are not sufficient for accurate comparison.

The aims of this paper are to determine the morphological and pholidosis characteristics, to compare populations of the west and the east side of the Euphrates River, and to fill in the gaps in the distribution range of the species.

## Materials and Methods

We explored the East Mediterranean region and Southeastern Anatolia five times from May 2006 to May 2009. Color slides of the specimens were taken, and then all specimens were anesthetized with ether, fixed by 96% ethanol injection into their body and deposited in 96% ethanol. This method was selected for the possibility of using the specimens for DNA studies in the future (Göçmen et al. 2007). Later, they were numbered and deposited in the Zoology Department of Ege University (ZDEU). 63 specimens were collected at 14 localities. All localities are shown in Fig 1.

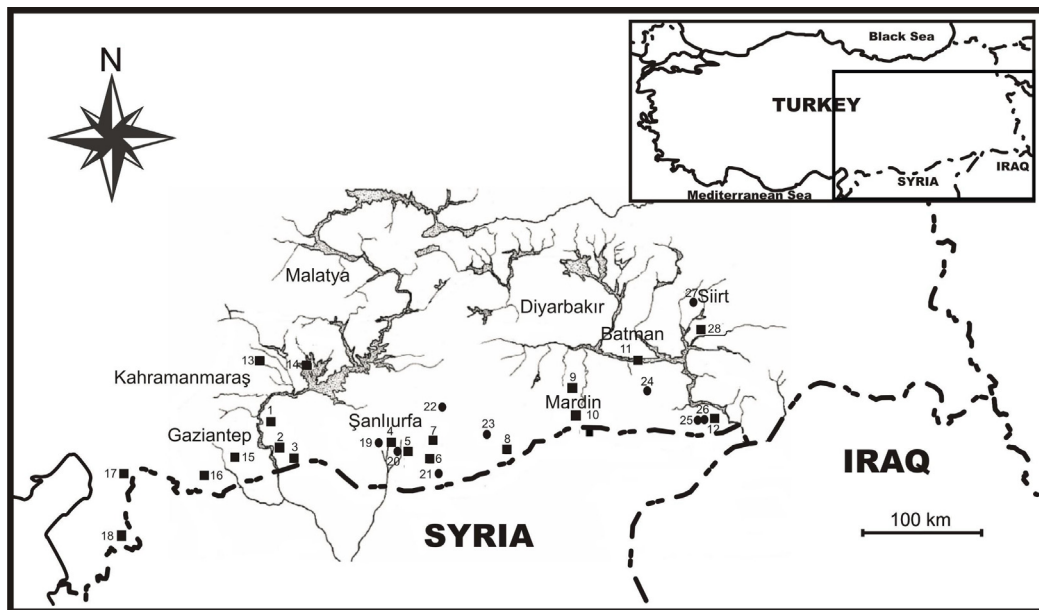
## Material list (n=63)

1. ZDEU 151/2006 (n=3), Karakeçi, Siverek, Şanlıurfa province, 762 m a.s.l. (37° 26' 41.49" N, 39° 26' 19.16 E), 10 May 2006, Leg. M. Z. Yıldız, E. A. Yağmur; ZDEU 155/2006 (n=1), Karakeçi, Siverek, Şanlıurfa province, 755 m a.s.l. (37° 26'

- 43.52° N, 39° 26' 41.43 E) 08 May 2006, Leg. M. Z. Yıldız, E. A. Yağmur
2. ZDEU 155/2006 (n=1) Üstüntaş village, Siverek, Şanlıurfa province, 737 m a.s.l. (37° 48' 31.66" N, 39° 13' 1.15 E), 10 May 2006 Leg. M. Z. Yıldız, E. A. Yağmur
  3. ZDEU 154/2006 (n=4), Tektek mountain, Şanlıurfa province, 707 m a.s.l. (37° 16' 38.01" N, 39° 21' 52.05 E), 08 May 2006, Leg. M. Z. Yıldız, E. A. Yağmur; ZDEU 96/2007 (n=3), Tektek mountain, Şanlıurfa province, 716 m a.s.l. (37° 08' 43.34" N, 39° 13' 49.22 E), 28 April 2007, Leg. B. Göçmen, M.Z. Yıldız, B. Akman, D. Yalçınkaya
  4. ZDEU 158/2006 (n=1), Dalbaşı village, Şanlıurfa province, 475 m a.s.l. (37° 06' 29.65" N, 39° 10' 21.23 E), 09 May 2006, Leg. M. Z. Yıldız, E. A. Yağmur
  5. ZDEU 176/2006 (n=1), Harran, Şanlıurfa province, 370 m a.s.l. (36° 51' 50.89" N, 39° 01' 46.50 E), 06 May 2006, Leg. M. Z. Yıldız, E. A. Yağmur
  6. ZDEU 157/2006 (n=2), Kocanizam village, Viranşehir, Mardin province, 593 m a.s.l. (37° 10' 23.89" N, 39° 31' 27.64 E), 09 May 2006, Leg. M. Z. Yıldız, E. A. Yağmur
  7. ZDEU 48/2007 (n=24) Küplüce village, Kilis province, 610 m a.s.l. (36° 44' 49.01" N, 37° 15' 04.05 E), 24 April 2007, Leg. B. Göçmen, M.Z. Yıldız, B. Akman, D. Yalçınkaya
  8. ZDEU 86/2007 (n=1) Ulubağ village, Şanlıurfa province, 594 m a.s.l. (37° 11' 27.59" N, 38° 53' 49.63 E), 28 April 2007, Leg. B. Göçmen, M.Z. Yıldız, B. Akman, D. Yalçınkaya
  9. ZDEU 139/2007 (n=6) Yörük village, İdil, Şırnak province, 645 m a.s.l. (37° 17' 0.49" N, 42° 1' 16.33 E), 12 May 2007, Leg. E. A. Yağmur
  10. ZDEU 141/2007 (n=6), Çataltepe village, Mardin province, 536 m a.s.l. (37° 16' 26.48" N, 40° 04' 11.86 E), 14 May 2007, Leg. E. A. Yağmur
  11. ZDEU 163/2007 (n=1) Aktepe village, Hatay province, 270 m a.s.l. (36° 41' 55.01" N, 36° 29' 43.05 E), 29 May 2007, Leg. B. Göçmen, M.Z. Yıldız, B. Akman, D. Yalçınkaya
  12. ZDEU 167/2007 (n=2) Reyhanlı, Hatay province, 320 m a.s.l. (36° 14' 21.01" N, 36° 33' 05.05 E), 29 May 2007, Leg. B. Göçmen, M.Z. Yıldız, B. Akman, D. Yalçınkaya
  13. ZDEU 178/2007 (n=1), Midyat, Mardin province, 945 m a.s.l. (37° 25' 9.45" N, 41° 23' 6.64 E), 31 May 2007 Leg. E. A. Yağmur
  14. ZDEU 71/2009 (n=3), 2 km E Meydandere village, Siirt province, 853 m a.s.l. (37° 55' 25.8" N, 42° 05' 14.5 E), 19 May 2009 Leg. E. A. Yağmur. ZDEU 72/2009 (n=2), 10 km E Meydandere village, Siirt province, 841 m a.s.l. (37° 55' 40.31" N, 42° 05' 42.34 E), 19 May 2009 Leg. E. A. Yağmur.

Mensural, meristic and qualitative data were recorded by following Broadley and Wallach (2007). All pholidotic features were examined using a stereo microscope. Morphological measurements, except snout-vent lengths, were recorded using a digital caliper (Mitutoyo 500-181 U) with an accuracy of 0.02 mm. SVL was measured to the nearest millimeter using a ruler. The exact locality of the specimens was detected by GPS receiver (Magellan XL). Data on color patterns (and photos) were recorded from living animals.

In order to compare the similarities and differences between populations, data were analyzed using SPSS 15.0 for



**Figure 1.** The localities of *L. macrorhynchus* from Anatolia. Square refer to old localities and circle refer to new localities.

1. Karaotlak Plateau-Halfeti-Şanlıurfa (BEV8183, Montpellier), 2. 5 km E Birecik-Şanlıurfa (Clark & Clark, 1973), 3. Arat Mountain-Birecik (Baran, 1982), 4. 30 km E Şanlıurfa (Clark & Clark, 1973), 5. Karahisar Pass-Tektek Mountain-Şanlıurfa, 6. Tektek Mountain (MVZ 128743), 7. 50 km E Şanlıurfa (Uğurtaş et al., 2006), 8. Hamzababa-Ceylanpınar (Baran, 1982), 9. Mardin (Baran, 1978), 10. 30 km W Kızıltepe-Mardin (Clark & Clark, 1973), 11. Suçeken-Hasankeyf-Batman (Uğurtaş et al., 2006), 12. Cizre (Baran, 1982), 13. Atmalı-Adıyaman (Uğurtaş et al., 2006), 14. Bağpınar-Adıyaman (Baran, et al., 2004), 15. 25 km E Gaziantep (Uğurtaş et al., 2006), 16. Küplüce-Kilis (Göçmen et al., 2009), 17. Aktepe-Hassa-Hatay (Göçmen et al., 2009), 18. Reyhanlı-Hatay (Göçmen et al., 2009), 19. Ulubağ-Şanlıurfa, 20. Dalbaşı-Şanlıurfa, 21. Harran-Şanlıurfa, 22. Karakeçi-Siverek-Şanlıurfa, 23. Kocanizam-Viranşehir-Şanlıurfa, 24. Çataltepe-Derik-Mardin, 25. Yörük-İdil-Şırnak, 26. Yalıntepe-Cizre-Şırnak, 27. Meydandere-Siirt, 28. Erüh-Siirt (Mulder, 1995).

windows. The Mann-Whitney U test was utilized for nonparametric data (Scale at midbody, Number of dark dorsals, Subcaudalia, Dorsalia, Scales of middle of tail) and Student t test were used for parametric data and indices (Head width, Rostral length, Rostral width, Diameter at midbody, Diameter at tail, Tail length, Snout-vent length, Total length, Rostral length/Rostral width, Total length/Midbody diameter, Total length/ Tail diameter, Total length/Tail length, Tail length/ Tail diameter) to compare two populations.

## Results

The specimens examined in this study were evaluated without sexual differentiation. Body cylindrical, thin, total length/midbody diameter: 77.87-170.59 covered with imbricate, small smooth scale of subequal size (Fig. 2c). Head and neck slightly broadened, the moderate tail terminating with a small conical spine-like scale (Fig. 2f). Snout hooked in lateral profile with distinct beak (Fig. 2a), rostral moderate (0.31-0.46 head width), much wider than nasals dorsally, reaching level of ocular shield but not to eyes. Behind rostral, upper lip bordered by infranasal, nostril midway between rostral and supralabial, small anterior supralabial with a width along lip equal to that of infranasal large ocular with small eyespot centrally placed in upper half, and moderate posterior supralabial. Frontal, supraocular and postfrontal are subequal. Body covered 14 transverse scale rows around the body, 10 around the tail, average 339 (315-375) dorsals between frontal and tail tip. All mensural and meristic data are shown in Table 1.

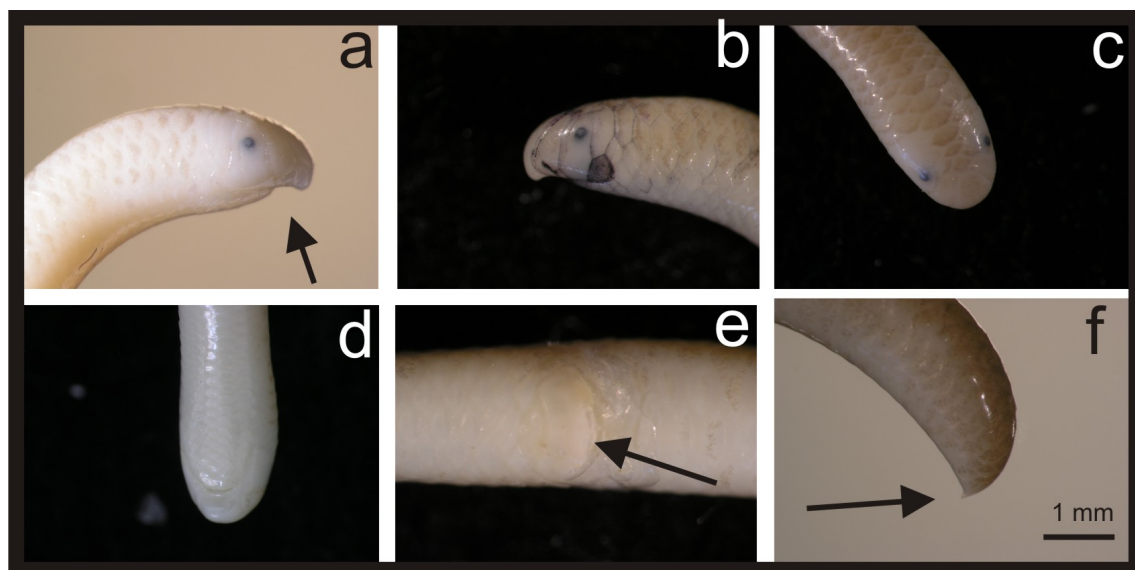
Dorsal coloration is pale reddish-brown or pink (in life) to beige or tan (in preservative) pigmented 5-9 scales, venter cream to white unpigmented.

All specimens were collected during day time under stones. Usually a few of them (once 9 specimens) were seen together. This subterranean species prefers humid loose soil on volcanic basalt and karstic.

We collected specimens from 14 different localities (Fig. 1). Some of them are near old localities. Additionally, Karakeçi village, Kocanizam village, and Çataltepe village localities were filled the gap in the distribution area and another new locality, Meydandere village, corresponds to the northernmost border of the distribution range in the South East Anatolia (Fig. 3).



**Figure 3.** General view of new locality for *L. macrorhynchus* in Meydandere village, Siirt. Date: 19.May.2009. (Foto by E. A. Yağmur).



**Figure 2.** Some detailed photographs of *L. macrorhynchus* specimen after fixation. **a.** Hooked Snout in lateral view **b.** painted with tile ink for show detail of shields **c.** Dorsal view, **d.** ventral of head, **e.** Anal **f.** conical spine-like scale ( ZDEU: 72/2009, Meydandere village, Siirt specimen).

**Table 1.** Some meristic and metric characters (mm) and derived ratio of investigated specimens. SD= standard deviation.

1. Head width, 2. Rostral length, 3. Rostral width, 4. Diameter at midbody, 5. Diameter at tail, 6. Tail length, 7. Snout-vent length, 8. Total length, 9. Scale at midbody, 10. Number of dark dorsals, 11. Subcaudalia, 12. Dorsalia, 13. Scales of middle of tail, 14. Rostral length/Rostral width, 15. Total length/Midbody diameter, 16. Total length/Tail diameter, 17. Total length/Tail length, 18. Tail length/Tail diameter.

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
N	36	36	36	36	36	36	36	36	36	36	36	34	36	36	36	36	36	36
Mean	1.71	0.98	0.75	1.92	1.56	17.25	179.31	196.56	14	6.31	40.36	345.44	10	1.34	104.89	128.76	11.45	11.30
SD	0.22	0.11	0.12	0.34	0.27	1.38	20.46	20.66	0	0.98	3.62	13.94	0	0.21	18.32	20.23	1.35	2.06
Min.	1.01	0.60	0.31	1.19	1.12	14.00	138.00	154.00	14	5	34	320	10	0.93	77.87	102.70	9.26	8.13
Max.	2.11	1.16	0.98	2.67	2.12	20.00	230.00	248.00	14	9	47	375	10	1.94	170.6	183.6	13.94	15.7
N	27	27	27	27	27	27	27	27	27	27	27	25	27	27	27	27	27	27
Mean	1.69	1.00	0.74	1.70	1.40	17.89	170.93	188.81	14	6.26	39.85	329.92	10	1.37	112.35	136.31	10.62	12.98
SD	0.16	0.09	0.10	0.25	0.19	1.72	16.30	16.91	0	0.76	2.66	12.19	0	0.22	12.26	12.60	1.18	1.87
Min.	1.47	0.78	0.57	1.22	1.12	13.00	141.00	158.00	14	5	35	315	10	1.06	85.53	113.02	9.29	9.77
Max.	2.04	1.13	0.94	2.35	1.92	21.00	201.00	220.00	14	7	45	352	10	1.77	147.54	164.29	13.54	16.07
p	0.702	0.581	0.752	0.005	0.008	0.119	0.075	0.107	1.000	0.965	0.780	0.000	1.000	0.589	0.058	0.074	0.012	0.001
N	63	63	63	63	63	63	63	63	63	63	63	59	63	63	63	63	63	63
Mean	1.70	0.99	0.75	1.83	1.49	17.52	175.71	193.24	14	6.29	40.14	338.86	10	1.35	108.09	131.99	11.09	12.02
SD	0.19	0.10	0.11	0.32	0.25	1.55	19.11	19.38	0	0.89	3.23	15.23	0	0.21	16.32	17.66	1.33	2.14
Min.	1.01	0.6	0.31	1.19	1.12	13	138	154	14	5	34	315	10	0.93	77.87	102.70	9.26	8.13
Max.	2.11	1.16	0.98	2.67	2.12	21	230	248	14	9	47	375	10	1.94	170.59	183.62	13.94	16.07

The results of the Man-Whitney U test have shown that dorsals are significantly different between the west and the east sides of the Euphrates populations ( $P=0.000$ ). Dorsals in the Eastern population were higher than western population (Mean: 345 and 329, respectively) but their range overlapped. According to the Student t test, diameter at midbody, diameter at tail, total length/tail length and tail length/tail diameter are significantly different between two populations ( $P<0.05$ ). The west of the Euphrates River population is thinner, tail shorter and thicker than the eastern population.

## Discussion

The occurrence of *L. macrorhynchus* in Anatolia was reported for the first time by Clark & Clark (1973) from the east side of the Euphrates River. Baran (1978, 1982) extended the distribution range of species from Şanlıurfa to Cizre. Then, Mulder (1995) recorded that Eruh, Siirt corresponds to the northernmost locality in the SE Anatolia. Baran et al. (2004) recorded species on the west side of the Euphrates River, an important dispersal barrier for animals in Anatolia (Yıldız et al., 2007) and Uğurtaş et al. (2006) confirmed this distribution with two new localities from the west side of the River. More recently, Göçmen et al. (2009) determined the westernmost border of distribution range from Hatay province.

According to Uğurtaş et al. (2006), no significant difference between west and east sides of the Euphrates River was found. However, we found out that dorsals, diameter at midbody, diameter at tail, total length/tail length and tail length/tail diameter are statistically different between two populations. These different characters were not measured and compared by Uğurtaş et al. (2006) and the specimen number was few so that they did not find any ordinary differences between west and east side of the Euphrates River. Dorsals in the Eastern population are higher than the western population (Mean: 345 and 329, respectively) but their range overlap. Dorsalia has wide range from other parts of the distribution area in the world. Broadley & Wallach (2007) reported that this value ranged from 315 to 414 for African population. Baha El Din (2006) reported that dorsalia ranged from 324 to 492 (Mean=399) for Egypt population.

Diameter at midbody, diameter at tail, total length/tail length and tail length/tail diameter are significantly different between west and east sides of the Euphrates River populations ( $P<0.05$ ). The west of the Euphrates River population is thinner, tail shorter and thicker than the eastern population. But these

characters' value is documented between the ranges given by Broadley & Wallach (2007)

Broadley & Wallach (2007) were stated that *L. macrorhynchus* differs from *L. cairi* in that it is unpigmented, has a beak and a longer thinner body. Göçmen et al. (2009) pointed out that Anatolia population has 5-7 scale pigmented dorsal scale rows. We found that 5-9 scale pigmented dorsal scale rows so that our finding on pigmentation is compatible with the one given by Göçmen et al. (2009). We think that more specimens should be examined from known distribution range of the *L. macrorhynchus* for molecular and morphological studies in order to clarify the taxonomic status of this species.

In conclusion, regarding pholidosis characteristics, morphometric measurements, and color-pattern features, specimens collected from 14 different localities from the west and east sides of the Euphrates River were found to have some differences but also some similarities as in previously given data for *L. macrorhynchus*, except for pigmented dorsal scale rows. Additionally, this study also fills in the gaps in the known distribution area and extends distribution range of the species by the new locality records and Siirt record corresponds to the northernmost border of the distribution range in SE Anatolia, Turkey.

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