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## New Locality Records for *Eirenis occidentalis* (Rajabizadeh, Nagy, Adriaens, Avci, Masroor, Schmidtler, Nazarov, Esmaeili & Christiaens, 2015) and *Eirenis punctatolineatus* (Boettger, 1892) (Squamata: Colubridae) from eastern Anatolia (Turkey)

Kamil CANDAN<sup>1,\*</sup>, Serkan GÜL<sup>2</sup> and Yusuf KUMLUTAŞ<sup>1,3</sup>

1. Dokuz Eylül University, Faculty of Science, Department of Biology, Buca-İzmir, Turkey.

2. Recep Tayyip Erdoğan University, Faculty of Science and Arts, Department of Biology, Rize, Turkey.

3. Dokuz Eylül University, Research and Application Center for Fauna Flora, Buca-İzmir, Turkey.

\*Corresponding author, K. Candan, E-mail: kamil.candan@deu.edu.tr

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**Abstract.** Here, we report new localities for *Eirenis occidentalis* and *Eirenis punctatolineatus* from the eastern Anatolia during a field survey in 2017, and present a summary of a morphological comparison between our specimens and published literature. Our findings largely extend the known distributions of both species: Çöpler village (İliç, Erzincan) is the northernmost record for *E. occidentalis*, whereas Karanlık Canyon (Kemaliye, Erzincan) is the north westernmost record for *E. punctatolineatus* in Turkey.

**Key words:** biodiversity, *Eirenis occidentalis*, *Eirenis punctatolineatus*, distribution, Anatolia.

### Introduction

Turkey constitutes an interesting area for reptilian biogeography due to its climate, vegetation, heterogeneous topography and geological history; together these unique factors produce a biodiversity hotspot (Bilgin 2011). Moreover, Turkey, consisting of both the European and Asian parts, is a zoogeographical land bridge among Africa, Asia and Europe, and currently hosts more than 165 reptile species (Baran et al. 2012).

The genus *Eirenis* is known from the Middle East, south-eastern Europe, the Caucasus Mountains, Pakistan, and northeastern Africa (Mahlow et al. 2013, Uetz & Hosek 2017). The number of distinct species included in the genus *Eirenis* has reached 20 with the addition of many new taxa identified based on both morphological and molecular studies (Eiselt 1970, Schmidtler & Schmidtler 1978, Schmidtler & Lanza 1990, Schmidtler & Eiselt 1991, Schmidtler 1993, 1997, Nagy et al. 2003, 2004, Rajabizadeh et al. 2015). The dwarf snake genus *Eirenis* is composed of four subgenera, *Eirenis* Jan 1863; *Pseudocyclophis* Boettger 1888; *Eoseirenis* Nagy et al. 2003, and *Pediophis* Fitzinger 1843 (Nagy et al. 2003). It has been suggested that the genus *Eirenis* might have originated from Anatolia (Schmidtler 1993, Nagy et al. 2003, Mahlow et al. 2013), with a total of thirteen *Eirenis* species known from Turkey (Baran et al. 2012). Studies on eastern Anatolian *Eirenis* are limited in comparison to other regions of Anatolia where genus *Eirenis* are distributed (Mertens 1952, Schmidtler & Schmidtler 1978, Baran 1982, Teynie 1987, Franzen & Sigg 1989, Schmidtler & Lanza 1990, Schmidtler & Eiselt 1991, Mulder 1995, Baran et al. 2004a, Tayhan et al. 2011, Göçmen et al. 2013, 2014, Tuniyev et al. 2014, İğci et al. 2015).

In the current study, we aim to (1) describe the morphological characters of the snake specimens collected from the localities outside the known distribution of the genus in Turkey, and to (2) expand the distribution range of both snake samples with two new locality records.

### Materials and Methods

The snake specimens were collected from eastern Anatolia between 20 and 31 May 2017 during a herpetological field survey. The exact

localities of the collected specimens were determined using a Garmin eTrex® 30 Handheld GPS, and were shown in Fig. 1. Sampling was conducted between 07.00 and 19.00 hours in the daytime. Colour and pattern characteristics were recorded while the animals were alive. The specimens were euthanized using tricaine methanesulfonate (MS222) and stored in 95% ethanol in the Zoology Lab of the Department of Biology at Science Faculty, Dokuz Eylül University. The metric measurements were taken using a digital caliper with sensitivity of 0.01 mm, and pholidosis characters were counted under a stereo microscope. The ventral plates were counted according to Dowling (1951) and all scale counts are indicated as "left/right (L/R)". Thus, the new specimens are presented along with comparative information mentioned in the literature in Tab. 1 and Tab. 2.

### Results

#### First species

*Eirenis occidentalis* (Rajabizadeh, Nagy, Adriaens, Avci, Masroor, Schmidtler, Nazarov, Esmaeili, Christiaens 2015). Adult female, Çöpler village, İliç, Erzincan province, eastern Anatolia, Turkey, 39° 27' 19.11" N - 38° 32' 21.42" E, 948 m elevation, 26.05.2017, S. Gül and K. Candan.

Body is cylindrical, head is small and not distinct from the neck, head and body scales are not keeled. Rostrum does not quite intrude between the internasals and is bordered by two upper labials, two nasals, and two internasals. Nostrils are situated on the nasal scales at either side. Single preocular, postocular and loreal are present on each side of the head. The third and fourth of supralabials are in contact with the eyes on each side. Three pairs of infralabials are in contact with the anterior chin shields on each side of the head. The straight collar band can be seen over the lower part of the head and is not connected ventrally, its length and weight of the collar band is 20 and 6 scales respectively. The posterior chin shields are not in contact to each other at the middle of the lower part of the head. The number of gular scales between the eighth infralabials in a transverse row is 12. The number of gular scales between the posterior chin shield and first preventral is 9. Other morphological characteristics of our specimen are given in Tab. 1 with a comparison to the data given in previous studies related to *E. occidentalis*.

The background colouration of the head is reddish

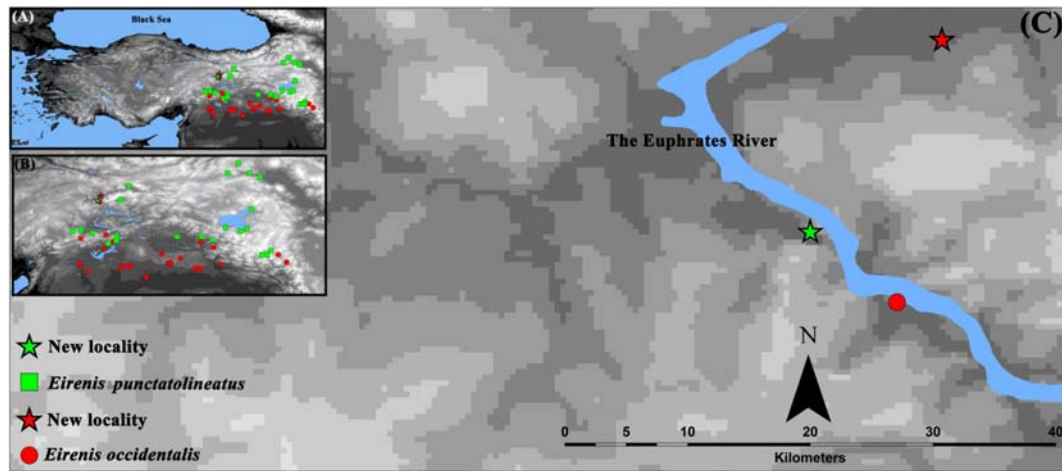


Figure 1. The distribution map for *E. occidentalis* (red) and *E. punctatolineatus* (green) considering records from the literature. New localities are shown as stars.

Table 1. A comparison of the current findings to literature data for *Eirenis occidentalis*. A: Clark & Clark (1973); B: Eiselt (1976); C: Baran (1978); D: Baran (1982); E: Baran et al. (2004a); F: Rajabizadeh et al. (2015); G: İğci et al. (2015), H: This study.

	A (n=2)	B (n=9)	C (n=3)	D (n=2)	E (n=4)	F (n=15)	G (n=1)	H (n=1)
1.	254.00 ± 66.00 (188-320)	278.56 ± 28.20 (159-400)	281.67 ± 27.69 (238-333)	298.50 ± 3.50 (295-302)			165	334.37
2.	209.50 ± 52.50 (157-262)	237.33 ± 24.61 (138-357)	237 ± 24.98 (201-285)	249.50 ± 3.50 (246-253)			136	271
3.	44.50 ± 13.50 (31-58)	41.22 ± 4.58 (21-62)	44.67 ± 3.84 (37-49)	49.00 ± 7.00 (42-56)			29	63.37
4.								7.49
5.								5.20
6.							1.2	1.65
7.							0.7	0.30
8.							1.8	2.43
9.							0.8	1.72
10.							1.3	1.28
11.	25.37 ± 7.24 (18.13-32.61)		15.94 ± 1.02 (14.41-17.88)	16.9 ± 2.16 (14.23-18.54)		15.65 ± 0.52 (13.05-18.99)	17.58	18.95
12.						2.45 ± 0.06 (2.19-2.80)		2.24
13.						68.07 ± 1.68 (61.11-83.77)		69.43
14.							1	1
15.						14.04 ± 0.04 (14-15)	14	14
16.						14.7 ± 0.17 (14-16)		12
17.					0.00 ± 0.00 (0-1)	0.22 ± 0.09 (0-1)		1
18.						9.91 ± 0.19 (8-11)		9
19.	15.00 ± 0.00 (15-15)	15.00 ± 0.00 (15-15)		15.00 ± 0.00 (15-15)	15.00 ± 0.00 (15-15)	14.96 ± 0.10 (13-16)	15	15
20.						10.78 ± 0.18 (9-12)		11
21.						0.96 ± 0.04 (0-1)		1
22.						1.96 ± 0.18 (0-3)		1
23.	197.50 ± 4.50 (193-202)	210.56 ± 2.69 (195-218)	207.33 ± 2.19 (203-210)	204.50 ± 3.50 (201-208)	204.50 ± 5.38 (192-218)	211.29 ± 1.68 (204-224)	203	200
24.	53.00 ± 1.00 (52-54)	50.56 ± 2.70 (35-60)	52.67 ± 2.73 (49-58)	52.50 ± 5.50 (47-58)	50.25 ± 0.75 (49-52)	51.23 ± 1.36 (42-58)	64	65

1. Total length, 2. Snout-vent length, 3. Tail length, 4. Head length, 5. Head width, 6. Rostral width, 7. Rostral length, 8. Distance between the nostrils, 9. Anterior inframaxillary length, 10. Posterior inframaxillary length, 11. TL/TOL x 100, 12. HL/TOL x 100, 13. HW/HL x 100, 14. Number of preoculars, 15. Number of supralabial scales, 16. Number of infralabial scales, 17. Number of loreal scales, 18. Number of scales bordering parietals, 19. Number of dorsal scales at one head-length before cloaca, 20. Number of scales between the last infralabials, 21. Number of scales between posterior chin shields, 22. Number of preventral scales, 23. Number of ventral scales, 24. Number of subcaudal scale.

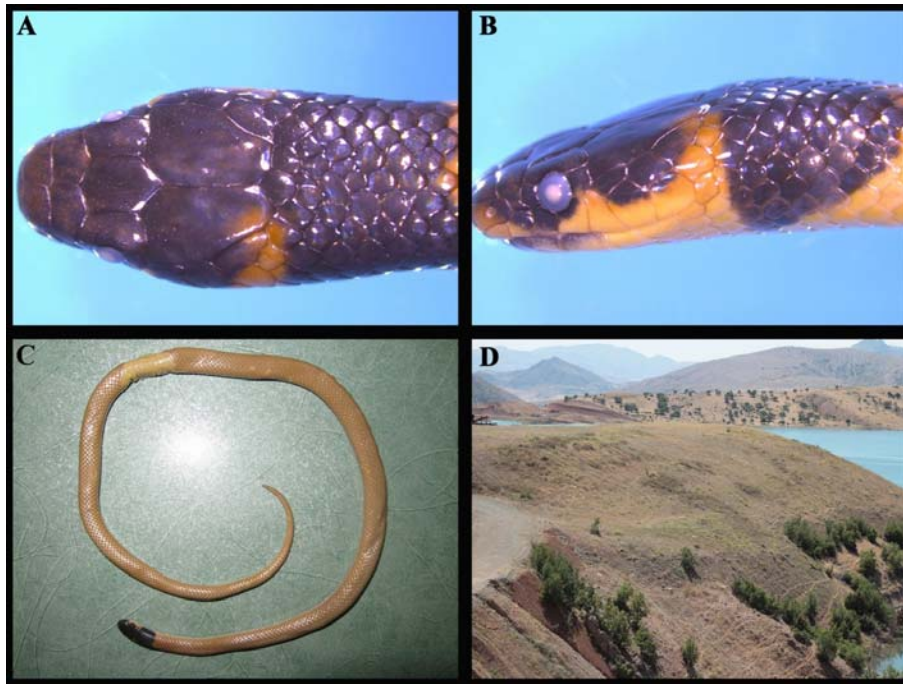


Figure 2. Dorsal head (A), lateral head (B), and total view (C) of the *Eirenis occidentalis* specimen. (D) the habitat of the captured sample.

brown and blackish. The black colouration on the top of the head is in contact with a 6-7-scale-wide blackish band on the nape (Fig. 2A-B). The background coloration of the dorsum is reddish brown without a pattern. The venter and the lower part of the tail are uniformly cream, without maculation (Fig. 2C).

The snake was found in the late afternoon around 16.30 (air temperature 22°C) being active in a grassy open field. We also observed another sympatric reptile species, *Platyceps najadum* (Eichwald 1831), living in syntopy in the same habitat in Çöpler village (Fig. 2D).

#### Second species

*Eirenis punctatolineatus* (Boettger 1892). Adult female, Karanlık Canyon, Kemaliye, Erzincan province, eastern Anatolia, Turkey, 39° 18' 51.7" N - 38° 26' 32.5" E, 919 m elevation, 27.05.2017, S. Gül and K. Candan.

The rounded head is distinct from the neck, head and body scales are not keeled. Two preoculars and postoculars present on each side of the head (Fig. 3A-B). The single loreal is in contact with the second and third supralabials. The third and fourth supralabials are in contact with the orbit. The first and fourth of the infralabials are in contact with the anterior inframaxillars. The collar band is not connected ventrally, its length and width is 13 and 4 scales respectively. The number of scales between the last infralabials in a transverse row is 11. The number of gular scales between the posterior chin shields is 1. The number of scales bordering the parietals is 18. Other morphological characteristics of our specimen are given in Tab. 2 with a comparison on the data given in previous studies related to *E. punctatolineatus*.

The basic color of the individual is light brown. The dorsum is light brown with anterior dorsal dark crossbars four scales long and one to one and a half scale wide, separated by one and a half to two-scales distance from the next cross-

bar without interruption to the dorsal midline. The dorsal dark crossbars reduce posteriorly to dark spots and then progressively change to longitudinal continuous or interrupted dorsal parallel lines at 2/3 of the total length (Fig. 3C).

The specimen was found in the late afternoon around 16.00 (air temperature 18°C) under a stone. Other sympatric reptiles living in the same habitat (Fig. 3D) were *Eirenis modestus* (Martin 1838) and *Zamenis hohenackeri* (Strauch 1873).

#### Discussion

*Eirenis persicus* was first described as *Cyclophis persicus* by Anderson (1872) [type locality: Bushire, Persia" (Bushehr, South Iran)]. The taxonomic situation of the involved taxa was very complicated and the authors stated that it needs a revision because it includes several taxonomic units regarded as synonyms (Frynta et al. 1997, Mahlow et al. 2013). According to Nagy et al. (2003), *Pseudocyclophis* is a monotypic subgenus including only the species *E. (Pseudocyclophis) persicus*. In the study of Rajabizadeh et al. (2015), a total of 60 snake specimens from all known localities of *Eirenis (Pseudocyclophis) persicus* were analyzed based on morphometric characters, geometric morphometrics, ecological niche modelling and molecular characters. They described a new species, *Eirenis occidentalis*, spreading from southeastern Turkey to western Iran which represents the western lineage of the *E. (P.) persicus* group.

*E. occidentalis* is distinguished from *E. (P.) persicus* by having a higher average number of ventrals, a lower average number of subcaudals and a lower average ratio of the tail length over the total length, usually seven -rarely eight- infralabials, higher number of anterior dorsals, no loreal and typical color-pattern characteristics (unicoloured dorsum,

Table 2. A comparison of the current findings to literature data for *Eirenis punctatolineatus*. A: Clark&Clark (1973); B: Eiselt (1976); C: Baran (1982); D: Franzen&Sigg (1992); E: Baran et al. (2004a); F: Baran et al. (2004b); G: Rajabizadeh et al. (2012); H: İgci et al. (2015), I: This study.

	A (n=1)	B (n=4)	C (n=3)	D (n=13)	E (n=1)	F (n=1)	G		H (n=1)	I (n=1)
							Male (n= 12)	Female (n=9)		
1.	286	417.00 ± 52.25 (262-483)	413.00 ± 43.50 (370-457)		310	417			52	183.65
2.	210	311.50 ± 38.54 (196-355)				305			158	139.37
3.	76	105.50 ± 14.73 (66-128)	89.00 ± 6.00 (85-93)	63.0 ± 1.33 (45.0-89.0)		112			210	44.28
4.										8.35
5.										5.33
6.									8.68	
7.									4.50	
8.										3.61
9.										2.57
10.									1.6	1.44
11.									1.1	0.54
12.									2.3	2.10
13.									2	2.40
14.									1.9	1.74
15.							24.66 ± 0.40 (21.86-26.40)	21.79±0.31 (20.77-23.17)		24.11
16.							4.13 ± 0.17 (3.36-5.43)	3.79 ± 0.09 (3.44-4.26)		4.54
17.							60.06 ± 1.01 (54.48-66.28)	59.04±1.23 (54.00-64.89)		63.83
18.							1.70 ± 0.10 (1.43-2.47)	1.45 ± 0.10 (0.94-2.07)		1.40
19.							3.26 ± 0.12 (2.80-4.22)	2.89 ± 0.10 (2.36-3.51)		3.82
20.							2.12 ± 0.10 (1.73-2.92)	1.87 ± 0.05 (1.63-2.11)		1.84
21.			1			1			1	2
22.					2	2				2
23.					1	1				1
24.		8.50 ± 0.29 (8-9)		7.00 ± 0.00 (7-7)	7	7			7	7
25.			9			8	9.17 ± 0.11 (9-10)	9.00 ± 0.00 (9-9)	9	8
26.										12
27.										1
28.										11
29.							1.42 ± 0.15 (1-2)	1.13 ± 0.13 (1-2)		1
30.	17	17.00 ± 0.00 (17-17)	17	17.00 ± 0.00 (17-17)	17	17			17	17
31.	75	75.50 ± 2.33 (69-80)	69.50 ± 6.50 (63-76)	71.50 ± 1.36 (66-79)	68	76.00 ± 2.00 (74-78)	72.09 ± 1.14 (63-77)	64.67±0.78 (61-68)	78	78
32.	163	160.75 ± 2.75 (158-169)	175.50 ± 0.75 (175-176)	163.38 ± 1.74 (154-171)	169	159.50 ± 1.50 (158-161)	159.00 ± 0.63 (155-162)	167.78±2.49 (155-178)	161	164
33.									13	13
34.									13	
35.									4	
36.										
37.							9.58 ± 0.26 (8-11)	10.00 ± 0.46 (8-11)		
38.							4.83 ± 0.21 (4-6)	4.11 ± 0.20 (3-5)		
39.							12.75 ± 0.54 (10-16)	12.89 ± 0.45 (11-15)		12

1. Total length (TOL), 2. Snout-vent length (SVL), 3. Tail length (TL), 4. Head length (HL), 5. Head width (HW), 6. Pileus length, 7. Pileus width, 8. Snout width (SW), 9. Snout length (SL), 10. Rostral width, 11. Rostral length, 12. Distance between the nostrils, 13. Anterior inframaxillary length, 14. Posterior inframaxillary length, 15. TL/TOL × 100, 16. HL/TOL × 100, 17. HW/HL × 100, 18. SL/SVL, 19. HW/SVL × 100, 20. SW/SVL × 100, 21. Number of preoculars, 22. Number of postoculars, 23. Number of loreal scales, 24. Number of supralabial scales, 25. Number of infralabial scales, 26. Number of scales bordering parietals, 27. Number of scales between posterior chin shields, 28. Number of scales between the last infralabials, 29. Number of preventral scales, 30. Number of dorsal scales at one head-length before cloaca, 31. Number of subcaudal scales, 32. Number of ventral scales, 33. Temporals+dorsals around/touching the parietals, 34. Collar band length (dorsal scales), 35. Collar band width (dorsal scales), 36. Ratio of length of posterior chin shield to anterior one, 37. Number of gular scales between 8th infralabials in a transverse row, 38. Number of gular scales between posterior chin shield and first preventral, 39. Number of scales bordering hind parietals.

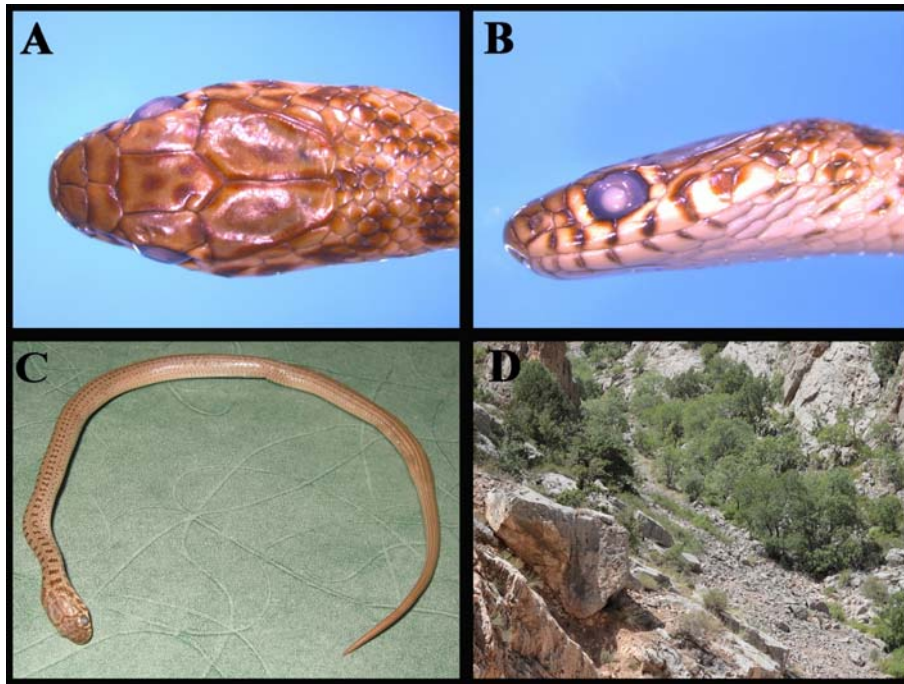


Figure 3. Dorsal head (A), lateral head (B), and total view (C) of the *Eirenis punctatolineatus* specimen. (D) the habitat of captured sample.

anterior dorsal scales without dark base) (Mahlow et al. 2013, Rajabizadeh et al. 2015).

Regarding the meristic pholidosis characters, metric measurements and color-pattern characters, our specimen from Çöpler village is within the variation limits mentioned for the taxon in the literature (Clark & Clark 1973, Eiselt 1976, Baran 1978, 1982, Baran et al. 2004a, İğci et al. 2015, Rajabizadeh et al. 2015 – Tab. 1).

The occurrence of the taxon in Kemaliye, Erzincan was reported by İğci et al. (2015) based on two museum specimens deposited in the local natural history museum in Kemaliye. Although a two-day excursion was conducted by those researchers, they did not find any new specimens from the Kemaliye and its surrounding, and therefore the occurrence of the taxon in Kemaliye should be confirmed with additional specimens. In the present study, the occurrence of the taxon is confirmed with the individual captured in Çöpler Village. The new locality record represents the northernmost locality record of the species and extends its distribution approximately 20 km to the north suggesting this snake may have a larger distribution in eastern Anatolia. It seems that the occurrence of the species continues along Euphrates River.

*Eirenis punctatolineatus* was first described as *Cyclophis modestus* var. *punctatolineata* based on the color-pattern characteristics from only one specimen in “Russisch Armenien” (Boettger 1892). It is known from Turkey, central and southern Armenia, southeastern Azerbaijan, Nakhichevan, north-eastern Iraq and northern and western Iran in the northern Zagros and Azerbaijan mountains and through the Alborz Mountains up to northern Khorasan and adjacent mountains of central Iran (Baran et al. 2012, Rajabizadeh et al. 2012, Mahlow et al. 2013). This taxon was considered a distinct species with the name *Contia punctatolineata* by Chernov (1939). The studies based on the morphological characters of

this species, which has a wide geographic range, were made until recently on samples obtained from its limited occurrence sites (Wall 1908, Werner 1917, Eiselt 1970, Schmidtler & Schmidtler 1978, Baran 1982, Franzen & Sigg 1989, Latifi 1991, Schmidtler & Eiselt 1991, Baran et al. 2004b, İğci et al. 2015).

The occurrence of the *E. punctatolineatus* in Turkey was first reported from Hakkari, in eastern Anatolia by Eiselt (1970). The same author also described a new subspecies (*E. punctatolineatus kumerlovi*) from Akdamar Island in Van Lake, eastern Anatolia, Turkey based on a single specimen (having a black dorsal coloration with scattered light spots). This new taxon was synonymized as *Eirenis punctatolineatus* by Franzen & Sigg (1989) based on the specimens from terra typica that have 50% percent black dorsal coloration. Rajabizadeh et al. (2012) described the morphological and geographical variation based on 44 specimens obtained from the whole distribution range of the species and elevated the southern populations of the species (known from the southern Zagros mountains and the adjacent area of the western Zagros foothills, in the south to low elevated mountain sides adjacent to the Persian Gulf, and eastwards to around Kerman and Bam cities in Kerman province, Iran) to a new taxon, *Eirenis punctatolineatus condoni* (Boulenger 1920). Now, *E. punctatolineatus* is known from many localities from the Hakkari (easternmost) province to the Malatya (westernmost) province in eastern Anatolia (Eiselt 1970, Clark & Clark 1973, Baran 1976, Baran 1982, Teynie 1991, Mulder 1995, Schmidtler 1998, Sindaco et al. 2000, Baran et al. 2004b, Mahlow et al. 2013, İğci et al. 2015).

Morphological comparisons revealed that the specimen captured in the Karanlık Canyon is in agreement with the values given in previous studies (Rajabizadeh et al. 2012, Clark & Clark 1973, Eiselt 1976, Baran 1982, Franzen & Sigg 1992, Baran et al. 2004a, 2004b, İğci et al. 2015 – Table 2).

The Karanlık Canyon is the northwesternmost record for *E. punctatolineatus* in Turkey. In the paper of Sindaco (2000), Erzincan was included in the distribution area of the taxon without giving any information. Our locality record from the Karanlık Canyon confirms the occurrence of *E. punctatolineatus* in Erzincan. The Karanlık Canyon is approximately 60 km from Munzur Valley which is the most recent locality for the species in eastern Anatolia. With the newly found locality, it is verified that the distribution range of the snake species in eastern Anatolia is larger than the known one.

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