

ISSN 0260-5805

**THE BRITISH
HERPETOLOGICAL SOCIETY
BULLETIN**



**No. 36
Summer 1991**

ADDITION OF *COLUBER SINAI* TO THE HERPETOFAUNAL LIST OF ISRAEL WITH COMMENTS ON *C. ELEGANTISSIMUS*¹

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INTRODUCTION

On 28 July 1953 the late Professor Georg Haas at the Hebrew University in Jerusalem (Adler, 1989: 101-102) received a message by telephone from members of Qibbuz 'Ein Ghadian (now Yotvata) near Elat: they found a dead little snake, "greenish with black cross bands", hanging on the wire fence. Haas, delighted, promptly declared that herewith a rare snake, previously known only from two specimens, was added to Israel's herpetofauna: *Coluber elegantissimus*. He requested and received the cadaver (HUI-R 3666).

Coluber elegantissimus, aptly named for its vivid colouration (Plates 1-2), was described by Günther (1878), then keeper of Zoology at the British Museum (Natural History), London (Adler, 1989: 45-46). Günther had one specimen, collected about 1875 by Sir Richard Burton in the mountains east of El Muwaylah, Midian (NW Arabia). The type (front cover) is in the museum (BM(NH) 1946.1.15.7). Another specimen, collected at Akabah (now in Jordan) in 1883 (Hart, 1891), is in the same museum (BM(NH) 84.6.18.1).

In fact, at least one more specimen preceded the Israeli discovery, unknown to Haas: BM(NH) 1964.152 from Rumaihiya, central Arabia, collected in 1946 but catalogued in 1964 and published only by Marx (1968).

Neither the original 'Ein Ghadian specimen, nor the several which have since been found in or near the 'Arava Valley, have ever been reported in detail. The species publicly entered Israel's herpetofaunal list through Barash and Hoofien's (1956) Hebrew guide and key to the local reptiles. Although even the few earliest specimens varied greatly in the width and number of the black cross bands, as well as in the presence or absence of a mid-dorsal reddish stripe, the species was simply regarded as variable or polymorphic (Werner, 1966). This attitude was unaffected by Schmidt and Marx' (1956) description of the similarly coloured *Lytorhynchus sinai* from Sinai (Plates 3-4), nor by its later transfer to the genus *Coluber* (Marx, 1968).

Marx (1968:30) and Leviton (1986:444) give useful comparisons of *Coluber elegantissimus* and *C. sinai*. Among other differences, the latter has narrower and more numerous black cross bands than the former, and lacks the mid-dorsal "light" (reddish in life) stripe characterizing the former. Marx had at his disposal seven *C. elegantissimus* and the data from the type, and all three then known specimens of *C. sinai*: one without locality, and the two types from the southern Sinai mountains. Another specimen from the same area, which the Hebrew University received in 1978 (HUI-R 8780; Werner, 1988) accords with the latter. Actually, Marx's table contains for *C. sinai* an erroneous number of black cross bands on the body, 21-26, whereas the two types (Schmidt and Marx, 1956: Fig. 4 and p. 32) had 50-51. Our specimen has 49.

Marx (1968) explained his including *C. elegantissimus* in a work concerning Egypt: "This species has not been recorded from Egypt. The specimen from Akaba and additional material from southern Israel makes this species occurrence in Sinai almost certain" (sic). In this attitude he had been preceded by Flower (1933) who had given the species' distribution as "Arabia, Palestine, and probably Sinai".

Recently Dr. Yoram Ayal of the Jacob Blaustein Institute for Desert Research, Sede Boqer, photographed in Sinai what evidently was a *Coluber sinai* with a conspicuous red mid-dorsal stripe. Because this stripe had previously been known in *C. elegantissimus* but not in *C. sinai*, these photographs, which Dr. Ayal kindly presented to us, prompted us to examine variation

¹ Dedicated to the memory of Professor Georg Haas, 19.1.1905-13.IX.1981.

in the local material of *C. elegantissimus* and *C. sinai*. We wished to establish their status in Israel and suspected that they might be synonymus. But we found that they are distinct, and that both occur in Israel.

MATERIALS AND METHODS

Coluber elegantissimus (16), localities from north to south (all in Israel): Lotan, TAU-R 13,347; Yotvata (= Ein Ghandian, Ein Radian), HUI-R 3,666, TAU-R 2,631, 13,230, 13,240, 13,482, 13,749; Samar, HUI-R 16,202; Biq'at Timna', TAU-R 11,489, Beer Ora, HUI-R 16,356, TAU-R 4,621, 5,774; Nahal Roded, HUI-R 8,419; Qibbuz Elot and its sewage, HUI-R 16,213, TAU-R 8,676; TAU-R 8,676; Elat, TAU-R 9,288.

Coluber sinai (7), localities from north to south (all but the last in Israel): Nahal 'Arugot (at 'En Gedi), HUI-R 8,653, 16,230;; Mezada, TAU-R 1,904; Nahal Holit (IG 154 005), HUI-R 8,947; Nahal Zenifim, TAU-R 2,654; Wadi Redadi (Nahal Roded), TAU-R 2,662; Zuqe Dawid Field School, Sinai (near Saint Catherine's Monastery) HUI-R 8,780.

These specimens were examined by conventional methods for size and proportions (Goren and Werner, 1987), pholidosis and colour pattern but only selected pertinent results are presented here.

In addition, for several of these and some additional specimens colour photographs, taken from the living (or freshly dead) animals, were available. Most photographs were diapositives on Kodachrome (25 or 64) film; some included beyond a mm ruler, also a scale for colours, comprising a series of pieces of original standard Ostwald colour papers. The snake which stimulated this study was found on the footpath at the entrance to St. Catherine's Monastery on 4.V. 1990 by Y. Ayal and Rina Rosenman.

OBSERVATIONS AND COMMENTS

Distinguishing the species

The two species differed consistently by most of the characters presented by Marx (1968: Table 3) and some others. To facilitate identification, Table 1 compares selected characters among three samples: *C. elegantissimus* from Israel examined by us, *C. sinai* from Israel examined by us, and *C. sinai* from Sinai examined by Schmidt and Marx (1956), Marx (1968) or ourselves. The snake photographed by Dr. Ayal conformed to the latter in all characters that could be analyzed on the prints but is excluded from Table 1.

We may say at this point, that the photographs of "*Coluber elegantissimus*" in Barash and Hoofien (1956: 154 bottom) and Gruber (1989:77) happen to present *C. sinai*. The photograph of "*C. elegantissimus*" in Dor (1987: 204) is altogether of a *Telescopus fallax*, although the colour photograph on the end paper of the same book correctly presents a *C. elegantissimus*.

The data in Table 1 are not segregated by sex, because of sample size and because in the field most users would not know the sex of their individual. However, each of the three samples contained individuals of both sexes; the differences presented are not sexual differences erroneously regarded as interspecific.

Additional differences between the two species may serve to identify incomplete sloughs. The eye is larger in *C. elegantissimus* (17.3-19.4% of head length, n=5) than in *C. sinai* (13.0-15.2%, n=4). In *C. elegantissimus* the upper preocular is in contact with the frontal, whereas in *C. sinai* it is not. In *C. elegantissimus* the 5th upper labial "enters" the eye, whereas in *C. sinai* both the 4th and the 5th do so. In *C. elegantissimus* the posterior chin shields are completely separated by two series of scales, whereas in *C. sinai* they meet or almost meet at their anterior angles, and are properly separated only posteriorly (Fig. 1).

The dorsal scales of *C. elegantissimus* are somewhat slanted sideways, so that the mid-dorsal row stands out straight, whereas in *C. sinai* the dorsals are straight as is usual in *Coluber* (Fig. 2). The dorsals of *C. elegantissimus* are not drawn as oblique in Gasparetti (1988: 224) but this trait is visible in his photograph (Gasparetti 1988: 223).

The tail is usually shorter in *C. elegantissimus* (27.4-34.5 perca², n=15) than in *C. sinai* (33.2-38.6 perca, n=7).

² Percents of rostrum-anus length (Werner, 1971).

The black bands on the tail of *C. elegantissimus* extend feebly but clearly to the ventral side, whereas the *C. sinai* tail is unmarked ventrally.

In both species the reddish vertebral stripe may be either present or absent. But in *C. elegantissimus* when absent in life or faded in alcohol its location is nevertheless indicated by a stripe lacking melanophores, lighter than the general yellow ground colour. In *C. sinai* the location of the absent reddish stripe is not thus indicated.

Convergence of coloration

Some of the differences between the two species, especially in eye size and in dorsal scutellation, indicate that these species are not closely related. Their being similar in pattern, down to the variable presence of the red stripe, offers no contradiction. Although the ecological significance of this phenomenon is unknown, it is paralleled in other snakes elsewhere. In southwestern North America, both *Chionactis occipitalis annulata* and *Chilomeniscus cinctus*, yellow, black-cross-banded little snakes, show inter- and intra-population variation in the occurrence of red "secondary saddles". In the latter species these are small, i.e. mid-dorsal, increasing the overall resemblance to the *Coluber* spp. discussed here (Mattison, 1989, presents colour plates). Somewhat similarly, in the polymorphic *Homoroselaps lacteus* (southernmost Africa), some of the morphs are basically coloured black and yellow in broken cross bands, often but not always with a reddish vertebral stripe (Branch, 1988). The pattern of black and yellow crossbands or rings and a mid-dorsal red stripe or band recurs in other snakes, though we lack data on intraspecific variation of the red band: *Dipsas bicolor* (Costa Rica), *Oxyrohopus leucomelas* (Colombia) and *Scolecophis atrocinctus* (El Salvador) (Campbell and Lamar, 1989).

Geographical distribution

The report by Negumi (1949) of a *C. elegantissimus* collected in June 1939 in central Sinai and deposited in "Z.G.M." (presumably the Giza Zoological Museum), predates the description of *C. sinai*. Moreover, this is very probably the same *C. sinai* specimen in the "Giza Museum", without locality data, on which Marx (1968) reported.

The map of locality records (Fig. 3) shows that *C. elegantissimus* is (so far) known only from the southern 'Arava Valley and some intimately connected subsidiaries. This is the northwestern extreme of its general distribution in the Arabian Peninsula (Gasparetti, 1988: 222-234, 367, 408-409, 446), in common with a widespread zoogeographical pattern, of mainly arenicolous reptiles (Werner, 1987). *C. sinai* is (so far) known mainly from wadies, and especially oases in wadies, among the mountains of the extreme desert in southern Sinai and in the southeastern Negev of Israel.

Thus, the two species appear to be parapatric (with contiguous distribution ranges) rather than sympatric (with overlapping ranges). The prediction of both Flower (1933) and Marx (1968), that *C. elegantissimus* would also occur in Sinai, is not supported by the data so far.

Geographical variation

Although sample sizes are inadequate for an analysis of geographical variation, certain phenomena appear indicated (Table 1): In *C. sinai* the number of dark cross bands on the body (not on the tail) is smaller in Israeli than in Sinai specimens. A comparison of Table 1 with Table 3 in Marx (1968) will raise the possibility that in *C. elegantissimus* the number of bands varies similarly between Israel and Arabia. Unfortunately comparisons involving the data in Marx (1968) are weakened by his sample having comprised material from both Arabia and Israel. (The data in Gasparetti (1988) appear to have been derived from Marx (1968)).

On the other hand, in *C. sinai* the average width of the dark cross bands (measured in scale-lengths) is smaller in Israel than in Sinai and the opposite is true of the light interspaces. In this case, data in Marx (1968) indicates that band width in *C. elegantissimus* varies in the opposite direction: the bands are on the average wider in Israel than in Arabia.

It is interesting that the variations in the relative widths of dark and light bands indicated in *C. sinai* and suspected in *C. elegantissimus* would, if validated, be in opposite directions, as if to increase the visual difference where the distribution ranges are in contact.

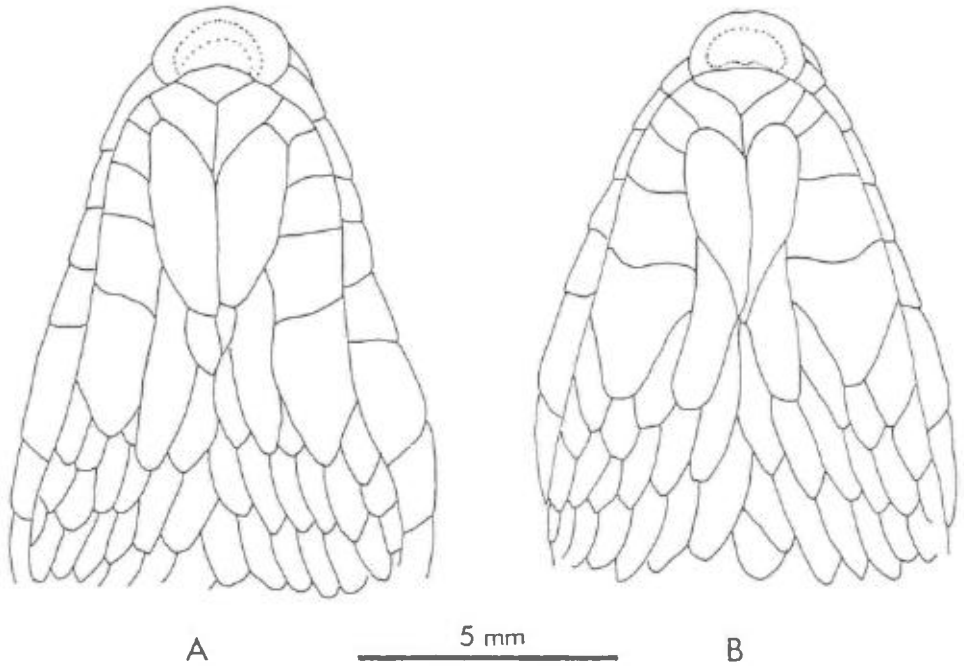


Figure 1. Throat of (A) *Coluber elegantissimus* (HUI-R 8419), (B) *C. sinai* (HUI-R 8653).

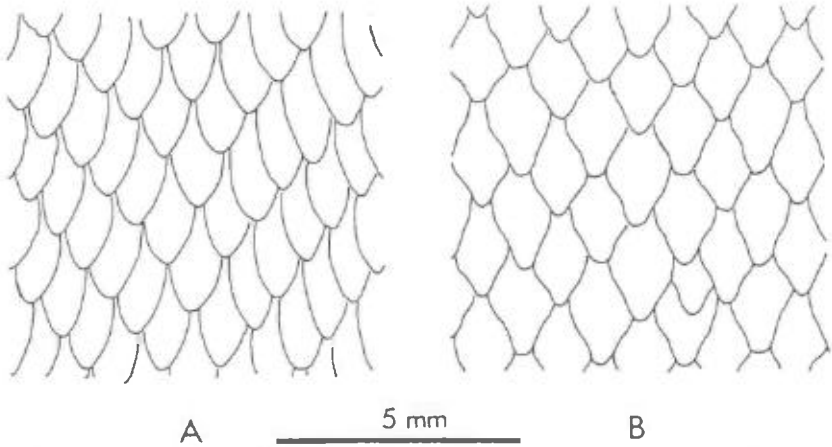


Figure 2. Dorsal scales of (A) *Coluber elegantissimus* (HUI-R 16356), (B) *C. sinai* (HUI-R 8653).

CONCLUSIONS

1. In the desert of Israel there occur both of the similar species, *Coluber elegantissimus* which is endemic to the Arabian Peninsula (sensu lato), and *C. sinai* which is endemic to Sinai and southeasternmost Israel.
2. The two species may best be distinguished by *C. elegantissimus* having 19 scale rows at midbody and fewer than 40 dark crossbands in total, whereas *C. sinai* has 17 scale rows at midbody and over 60 dark crossbands in total.

3. Faunistic research requires specimens preserved in a museum and accompanied with accurate collection data. These cannot be replaced by field notes because one cannot always foresee what details would later become necessary; but the deficiency can be partly bridged by photography.

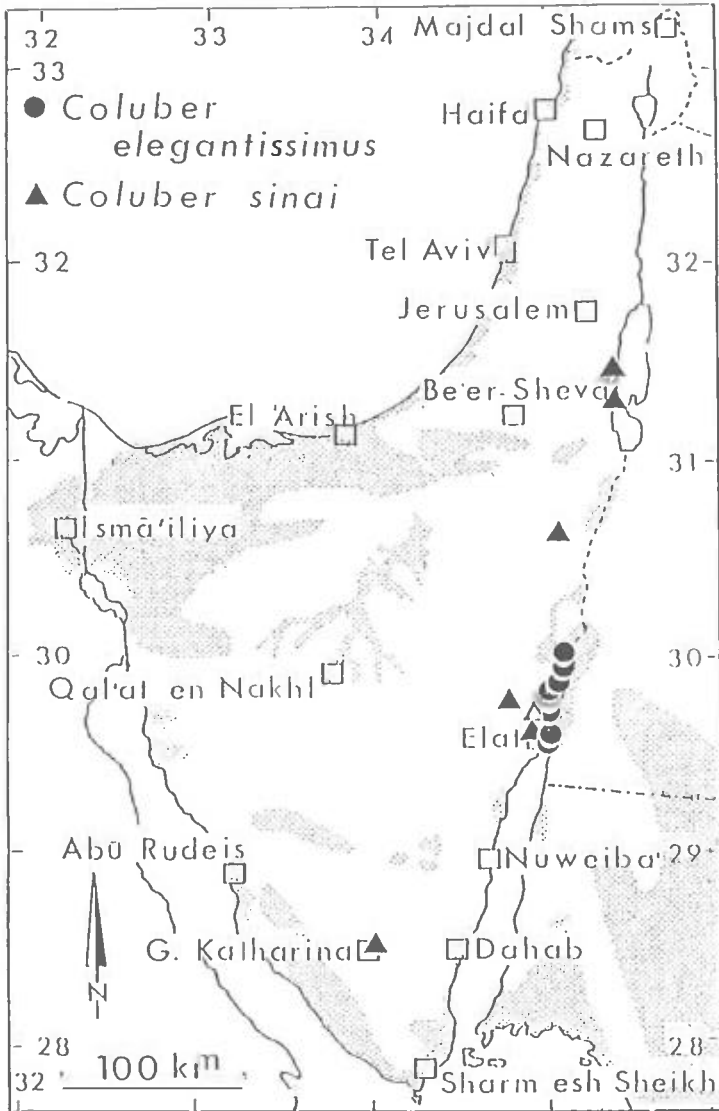


Figure 3. Locality records in the survey area (Werner, 1987, 1988) of Israel and Sinai: circles, *Coluber elegantissimus*; triangles, *C. sinai*; solid symbols, specimens examined; open symbols, other records (some symbols represent more than one individual); stippling, sands.

ACKNOWLEDGEMENTS

This report could not have been written without the endeavours of successive curators and curatorial assistants of collections of the Hebrew University of Jerusalem and Tel Aviv University, of collectors who donated specimens to these collections, and of librarians in the Department of Zoology, Hebrew University. We thank the Israel Herpetological Information Center and the Nature Reserves Authority for manifold cooperation; Dr. A. Leviton, California Academy

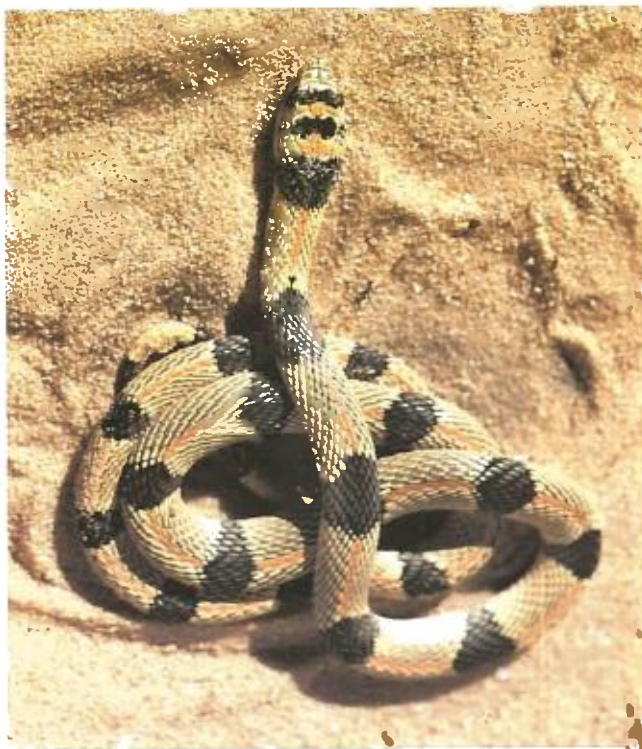


Plate 1. *Coluber elegantissimus* with red vertebral stripe (Courtesy H. Mendelsohn).



Plate 2. *Coluber elegantissimus* juvenile without red vertebral stripe, from Yotvata (photo A. Shuv, Courtesy H. Mendelsohn).



Plate 3. *Coluber sinai* with red vertebral stripe, from Nahal 'Arugot, En Gedi (photo Y.L. Werner).



Plate 4. *Coluber sinai* without red vertebral stripe, from Bir Hindis (= Be'er Ora; courtesy H. Mendelssohn).

of Sciences, for continual helpful correspondence; Mr. G. Perry for free use of the Tel Aviv University material; Dr. Y. Ayal and R. Rosenman for photographs of *C. sinai*; Prof H. Mendelsohn, Tel Aviv University, for permission to publish photographs and Mr. J.H. Hoofien for advice on the manuscript (only some of which we followed).

**Table 1. Distinguishing meristic characters of
Coluber elegantissimus and *Coluber sinai* (n = number of snakes)**

Definition of character	<i>C. elegantissimus</i> (Israel)		<i>C. sinai</i> (Israel)		<i>C. sinai</i> (Sinai)	
	n	range	n	range	n	range
Dorsal scale rows at mid-body	15	19	6	17	4	17
Subcaudals (pairs)	5	65-86	3	91-97	2	94-98
Dark dorsal crossbands, number						
Total	15	29-35	6	69-75	3	74-81
on head and body	15	20-24	6	45-49	3	49-51
on tail	15	7-11	6	22-28	3	24-13
Width of crossbands, in scale lengths						
Dark band, mid-body	15	3-5.5	6	1-2	4	1.5-2
Light interspace, mid body	15	4-7.5	6	2.5-3.5	4	2.3-3
Dark band on nape (3rd)	15	5-8	6	2.5-3.5	4	3-4

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