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Short Communication

On the Occurrence of Arabian Red Fox *Vulpes vulpes arabica* (Thomas, 1902) in Sakaka, Northern Saudi Arabia

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ABSTRACT

The Arabian red fox *Vulpes vulpes arabica* is found in all regions of Saudi Arabia with some exceptions of the large sand deserts and the central areas of Kingdom of Saudi Arabia. It was recorded from the north of Saudi Arabia only in the Harret al-Harrah protected area in 1983. The aim of the research was to determine the status and to study morphological and cranial features of the Arabian red fox inside Sakaka city located in Al Jouf area in the northern part of Saudi Arabia to add new information about existence of Arabian Red Fox in the northern Saudi Arabia.

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The carnivores of Saudi Arabia have been intensively studied in the last decades (Harrison, 1968, 1972; Gasperetti *et al.*, 1985; Nader, 1990a, b; Harrison and Bates, 1991). Some works summarized the status of carnivores in Arabian Peninsula at a national level such as Al-Khalili (1990) in Bahrain Qumsiyeh *et al.* (1993) in Jordan Al-Jumaily (1998) in Yemen and Grobler and Al-Ojali (2002) in Oman. Besides that some workers provided information about carnivores outside the Arabian Peninsula such as Hatt (1959) in Iraq, Kumerloeve (1975) in Lebanon, Massetti (2009) in Syria and Osborn and Helmy (1980) and Basuony *et al*. (2010) in Egypt including Sinai.

The Arabian red fox, *Vulpes vulpes arabica*, is a subspecies of the red fox *Vulpes vulpes* (Carnivora: Canidae) native to Arabia and it is probably the most common medium-sized carnivore in the Arabian Peninsula (Henry, 1996; Kurten, 2007; Likius *et al*., 2007). The Arabian red fox is almost distributed over all habitats and may be strongly attracted to scavenge around camps and human settlements (Kingdon, 1991). It is more adapted to deserts according to other carnivores whereas ears are much larger and body is much smaller than that of the red fox (Wilson and Reeder, 2005; Feldhamer *et al*., 2007).

Little information is available about the status and ecology of the Arabian red fox in arid and semi-desert areas such as the Arabian Peninsula (Gasperetti *et al*., 1985; Ginsberg and MacDonald, 1990). Green (1986) and Seddon *et al.* (1997) recorded it from all sections of Harrat al-Harrah protected area in northern Saudi Arabia, and also was seen frequently in the protected area during 1989-1990 (Goriup *et al*., 1989; Harrison and Bates, 1991). Specimens collected from the Arabian Peninsula are usually referred to *V. v. arabica*, characterized by small size and pale colour (Harrison and Bates, 1991; MacDonald *et al.*, 1999) but the validity of this and other subspecies has not been confirmed by using genetic analysis (Zimen, 1980; Voelker, 1986; Zrzavy and Ricankova, 1999; Rais *et al*., 2011).

This work presents new intensive details on the occurrence of the Arabian red fox in Sakaka, Al Jouf region, northern Saudi Arabia and includes new additions on its existence in the region.

Materials and methods

Sakaka city is located in the northern part of Saudi Arabia. Sakaka is represented by covers an area of about 100 km^2. It is situated at 29° 97° N and 40° 21° E and about 560 meters elevation above the sea level (Fig. 1). It is the biggest town and the administrative capital of Al Jouf governorate. Al Jouf governorate has a notable abundance of irrigation water that enables dwellers to cultivate dates and olives as well as other agricultural products. The average maximum temperature in Sakaka is in July and August 39.4°C; the temperature in winter drops below freezing (Al Zawad, 2008). Average annual rainfall varies from 40 mm in the west to 60 mm in the east and north, with about 50 mm at Sakaka. Rains are usually expected in winter and may be in spring (Al Zawad, 2008). Vegetation is sparse in the region and consists mainly of perennial shrubs and grasses, legumes and herbs (Green, 1986).

A number of specimens (n=5) were hunted from

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different localities of Sakaka by aid of a native dweller from Sakaka using a powerful leg trap during May to November 2015. Specimens were immediately killed in the field by breaking their necks to stop all the actions of metabolism and vital activities (Stuart and Stuart, 2003). External measurements were taken precisely in centimeters as follows: total body length (TBL) from the tip of the snout to the tip of tail, tail length (TL) from the root of the tail to its tip, ear length (EL), hind foot length (HFL), shoulder height (SH) and the body mass (BM) was taken in grams. All collected material including skins, skulls, lower jaws, bones, stomachs and bacula of male specimens were deposited at the College of Science, Aljouf University Zoological Collection in Sakaka, Al Jouf, Saudi Arabia. Materials examined are listed according to collection locality and museum numbers given to the specimens. Skulls, lower jaws and bacula were bleached by using hydrogen peroxide H_2O_2 (40 %) and measured precisely by using a sensitive caliper of 0.1 mm accuracy. 15 cranial measurements were taken of the skulls and lower jaws as follow: greatest length of the skull (GLS), condylobasal length (CBL), basal length (BL), viscerocranial length (VCL), facial length (FL), nasal length (NL), snout length (SL), greatest length of auditory bulla (ABL), zygomatic width (ZB), minimum interorbital width (MnIW), prosthion (IF) which is taken from the interorbital foramen to the anterior extremity of the skull, maximum width of braincase (MxWb), width of bulla (WB), mandibular toothrow (MT) and mandible length (M).

Results

Table I shows external measurements and weights in grams of collected animals from different localities. Figure 1 represents a comparison between external measurements of recent specimens collected from Sakaka and the ones collected by Saleh and Basuony (1998) collected from southern Sinai.

Figure 2 represents a comparison of some cranial measurements in the two foxes collected from Sakaka and southern Sinai.

Discussion

It is known that the red fox *Vulpes vulpes* is Eurasian in origin, the earliest fossil remains of the modern species back to the Pleistocene. Its ancestor was smaller than the current one. It started to disperse from Asia to Africa by the mid of Pleistocene (Likius *et al*., 2007; Statham *et al*., 2011, 2014).

The Arabian Peninsula was split from Africa by movement of the Red Sea Rift. Splitting started in the Eocene forming Gulf of Aqaba and Gulf of Suez. The connection between Arabia and Sinai however continued that served as a migration route for animals to disperse from Arabia to Sinai and vice versa (East, 1967; Biton and Gildor, 2011).

Similarities found between Arabian red foxes of Sinai and northern Arabia are due to the fact that Sinai is considered to be a land bridge between the two continents of Asia and Africa. Arabian red foxes colonized Sinai after the formation of Gulf of Aqaba that separated the two continents and served as a partial natural biogeographical barrier. The colonizing foxes developed the special characteristics while living on rich vegetation found there. The Arabian red foxes in Arabian Peninsula evolved into a distinct form adapted to living in this semiarid desert.

The specimens from southern Sinai were much bigger than those of Sakaka especially in total body length, ear length and hind foot length whereas the specimen from Sakaka had longer tail (Fig. 2). Foxes of southern Sinai live in widespread vegetated wadis and frequent around human habitations where food remains are dumped everywhere, whereas foxes of Sakaka live in a semiarid region lacking rich vegetations.

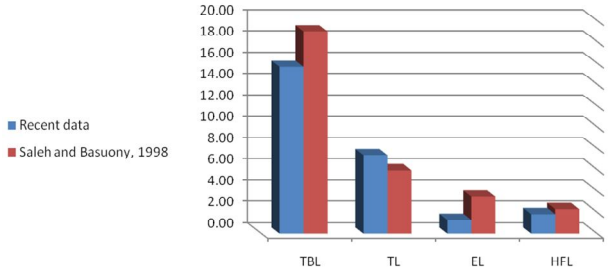

Fig. 1. A comparison between values of the external measurements of recent data and data reported in Saleh and Basuony (1998). For abbreviations see Table I.

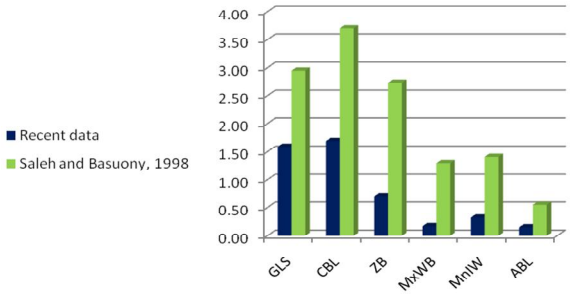

Fig. 2. A comparison between values of the standard deviations of cranial measurements of recent data and data mentioned in Saleh and Basuony (1998).
GSL = GTL; ABL – TBL; Mn1W = IC; and MxWb=BB of Saleh and Basuony (1998). For other abbreviations see Table II.

Table I.- External measurements (cm) and body masses (g) of the collected specimens of Arabian red fox from different localities of Sakaka. BM, body mass; EL, ear length; HFL, hind foot length; SH, shoulder height; TBL, total body length; TL, tail length.

Locality	Museum No.	Sex	TBL	TL	EL	HFL	SH	BM
Mehereeth	m001	M	64.5	29	7	10.5	24.5	1300
Al Nufud 1	m002	F	59	23	6	9.5	20	600
Al Nufud 2	m003	M	88.5	39	9	13	33	2900
Al Nufud 3	m004	F	80	32	8	12	29	1900
Om Adam	m005	M	96	41	9	14	32	2100
	St. Dev.		15.658	7.362	1.304	1.823	5.427	864.870

Table II.- Cranial and lower jaw measurements (cm) of the collected specimens of Arabian red fox from the different localities of Sakaka.

	m001	m002	m003	m005	St. Dev.
GLS	9.74	8.59	12.12	11.34	1.586
CBL	9.19	8.04	11.76	10.97	1.687
BL	8.69	7.56	11.16	10.33	1.617
VCL	4.24	3.46	5.26	5.22	0.864
FL	5.74	4.83	7.20	6.91	1.094
NL	2.93	2.22	3.65	3.78	0.721
SL	3.79	3.07	4.85	4.71	0.835
ABL	1.81	1.82	2.09	2.07	0.153
ZB	5.61	5.17	6.81	5.96	0.695
MnIW	1.81	1.65	2.37	2.09	0.317
IF	3.16	2.54	4.06	3.76	0.673
MxWB	4.21	4.22	4.23	4.56	0.170
WB	1.31	1.24	1.60	1.44	0.158
MT	4.13	3.79	6.34	5.93	1.274
M	7.06	6.20	8.84	8.27	1.189

Note: Skull of Specimen m004 was broken

Cranial measurements were taken precisely in centimeters.

ABL, greatest length of auditory bulla; BL, basal length; CBL, condylobasal length; FL, facial length; GLS, greatest length of the skull; IF, prosthion which is taken from the interorbital foramen to the anterior extremity of the skull, M, mandible length; MnIW, minimum interorbital width; MT, mandibular toothrow; MxWb, maximum width of braincase; NL, nasal length; SL, snout length; VCL, viscerocranial length; WB, width of bulla; ZB, zygomatic width.

Similarly cranial measurements in the two foxes collected from Sakaka and southern Sinai (Fig. 3) show that specimens from Sinai are much larger than the crania of specimens from Sakaka. This is due to the larger size of specimens from southern Sinai which reflected on the cranial measurements.

From the previous findings it is concluded that the Arabian red fox lived first in Arabia from a long time ago and started to migrate to Africa continent through the corridors between Asia and Africa moving to Sinai. There in Sinai they found much food and water and so they became large in size and heavy in weight while those lived in Arabia had less food and water so they became smaller in size and lighter in weight.

Saleh and Basuony (1998) mentioned that the *V. v. arabica* hunted from Siani was the first record there and also this work recorded *V. v. arabica* from Sakaka city in the northern Arabia for the first time and introduced new detailed morphological and cranial measurements data about this subspecies status in Sakaka city. There is no conflict between findings of Saleh and Basuony (1998) and findings of this recent work due to the differences between the external and cranial measurements of the two subspecies which are found in Sinai and Sakaka city. One may predict that the two subspecies formed two different colonies and may they became different in their genetic characters. This will make a good chance to do more comparison genetic studies between the two subspecies in Sinai and Sakaka.

Conclusions

The Arabian red fox *Vulpes vulpes arabica* has been recorded Sakaka city in the northern part of the Kingdom of Saudi Arabia. It has remarkable differences in external and cranial features from the other same subspecies living in Sinai peninsula

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Statement of conflict of interest

Author has declared that there is no conflict of interest.

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