

Contribution to the Study of the Spatial Distribution of *Gazella cuvieri* (Ogilby, 1841) in the Beni Chougrane Mountains (Mascara, Algeria)

ZAHAFI Bachir¹, HARIZIA Abdelkader², ANTEUR Djamel³ and BENABDELI Khéloufi²

¹Research Laboratory on biological systems and geomatics. ³University Mustapha Stambouli, Mascara, Algeria.

² Laboratory of Geo- Environment and development of spaces. ³University Mustapha Stambouli, Mascara, Algeria.

³ University Moulay Tahar Saida, Algeria

Received: June 25, 2016

Accepted: August 28, 2016

ABSTRACT

Faced to the threat of the disappearance of the Cuvier's gazelle, the study of its current distribution in the mountains of Beni Chougrane (Mascara, Algeria) will better understand their movements and thus its habitat. It will then be possible to set up a plan of follow-up and protection. The obtained results allow to arrest better the concept of protection of this species. The strong presence is localized in areas characterized by an absence of human activity, low slopes and the presence of herbaceous species.

KEYWORDS: Habitat- Movement- Cuvier's gazelle – Mountains of Beni Chougrane- Mascara- Algeria

1. INTRODUCTION

Cuvier's gazelle *Gazella cuvieri* (Ogilby, 1841) also known as the Atlas gazelle or gazelle of the mountain is endemic to North Africa [1] which endangered and is on the red list I.U.C.N. [2]. *G. Cuvieri* frequent bioclimates upper semiarid in the Sahara, in terms of habitat it prefers low as training arid steppes, wood matorrals and open woodlands. It avoids dense forest formations, the high plains with human presence and the most rugged terrain [3]. In environments that are favourable she lives in small herds of five to six individuals or alone [4]. Cuvier's gazelle is known in the wild in Morocco, Algeria and Tunisia [3,5], in Morocco it was observed at 60 m altitudes up to 2600 m [6]. *G. cuvieri* is present in Algeria from the Tell Atlas to the Sahara Atlas and localizes on the slopes of the Tell chains and most southern mountains formed by the Saharan Atlas [7], the species is essentially subservient to mountain areas and woodlands in search of food and shelter, gazelle endangered and the subject of protection measures since 1983 as it has disappeared from a part of the eastern Tellian Atlas [8]. Very little work has been done on *G. cuvieri* and the limited data available dealing with ethology of this species. The aim of this work is to study the distribution and to identify the habitat type or the territories occupied by *G. cuvieri* in the mountains of Beni Chougrane (Mascara and Relizane Regions).

2. MATERIALS AND METHODS

2.1. Characterization of the study area

The study area lies in the northwest region of Algeria as part of the mountains of Beni Chougrane, it is located between longitudes 0° 25'E and 0° 35' E and latitude 35° 10' N and 35° 40' N (Fig. 1). Its altitude varies between 150 and 600 m and above 25 % slopes. The terrain is very steep and heavily dissected, with a very dense drainage network of highly degraded vegetation, characterized by low densities of recovery and bad conditions of regeneration [9]. The region is characterised by a semi-arid Mediterranean climate with annual rainfall varying between 350 and 450 mm [10]. The average minimum temperatures of the coldest and hottest months are 8 months and 36 ° C respectively; the rainfall is kind of WSAS (Winter Spring Autumn Summer). Several studies agree in emphasizing the rich flora of the forest formations of the Beni Chougrane mountains where are distinguished the group of *Pinus halepensis*, *Tetraclinis articulata* and a group of Oleo-lentisk. This vegetation is characterized by a stage of degradation -inducing clear forests of Aleppo pine and Thuya Barbary, a scrub and calycotum and broom scrub and dwarf palm [9].

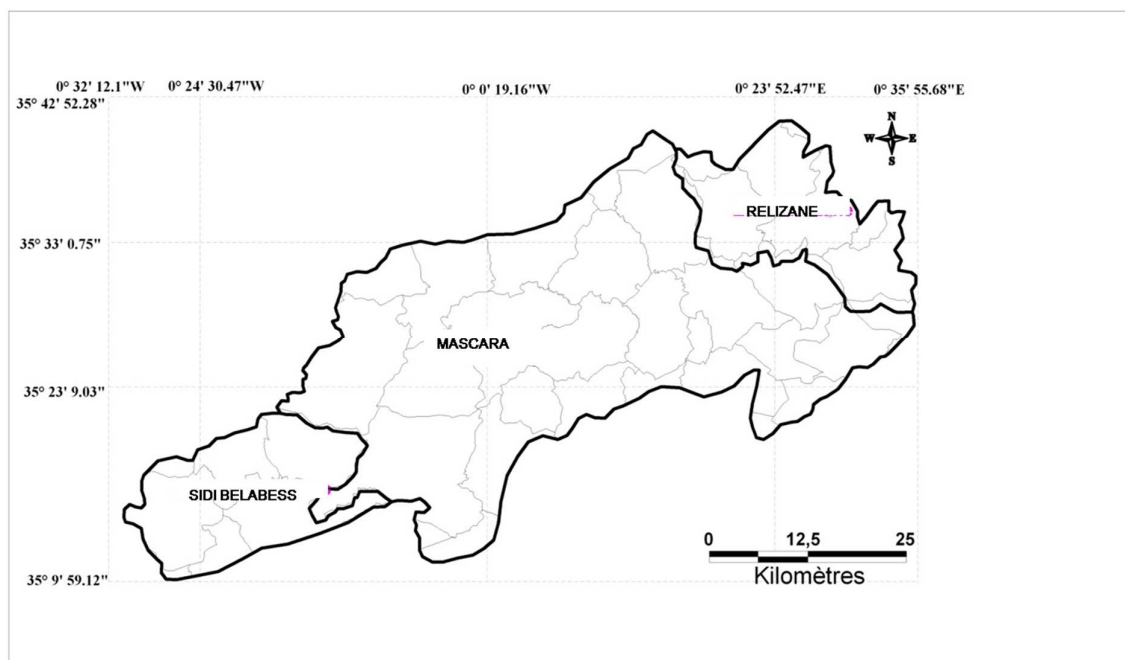


Figure 1. Location of the study area (original)

2.2. Selection of study sites

To study the habitat of gazelles in the mountains of Beni Chougrane, five areas were selected covering more than 143000 ha. Study areas represent all the geographic aspects of Beni Chougrane mountains since they constitute 43% of this group (Fig. 2). The plant cover rate ranges between 31.5 and 63.7 %, depending on the station and represents the totality of vegetation present.

2.3. Study areas typology

Each station is essentially distinguished by the nature of land use, the station 1 is covered by a low scrub consisting of two indicator species of degradation *Chamaerops humilis* and *Ampelodesma mauritanicum*. This is an area with high human presence since they include viticulture, arboriculture, cereals and legumes conduct extensive rainfall. In the Station 4 the natural vegetation is very degrading due to the marl nature of these soils. Agricultural activity is characterized by arboriculture and cereal diffuse. In terms of stations 2, 3, 5 vegetation is represented by dense forests belonging to the group of *Pinetum halepensis* and *Tetraclinum articulata* by the rainfall cereal and rustic arboriculture. The main features of the 5 stations of the study are summarized in the table 1. It allows a comparison of different parameters in relation to the distribution of the gazelle.

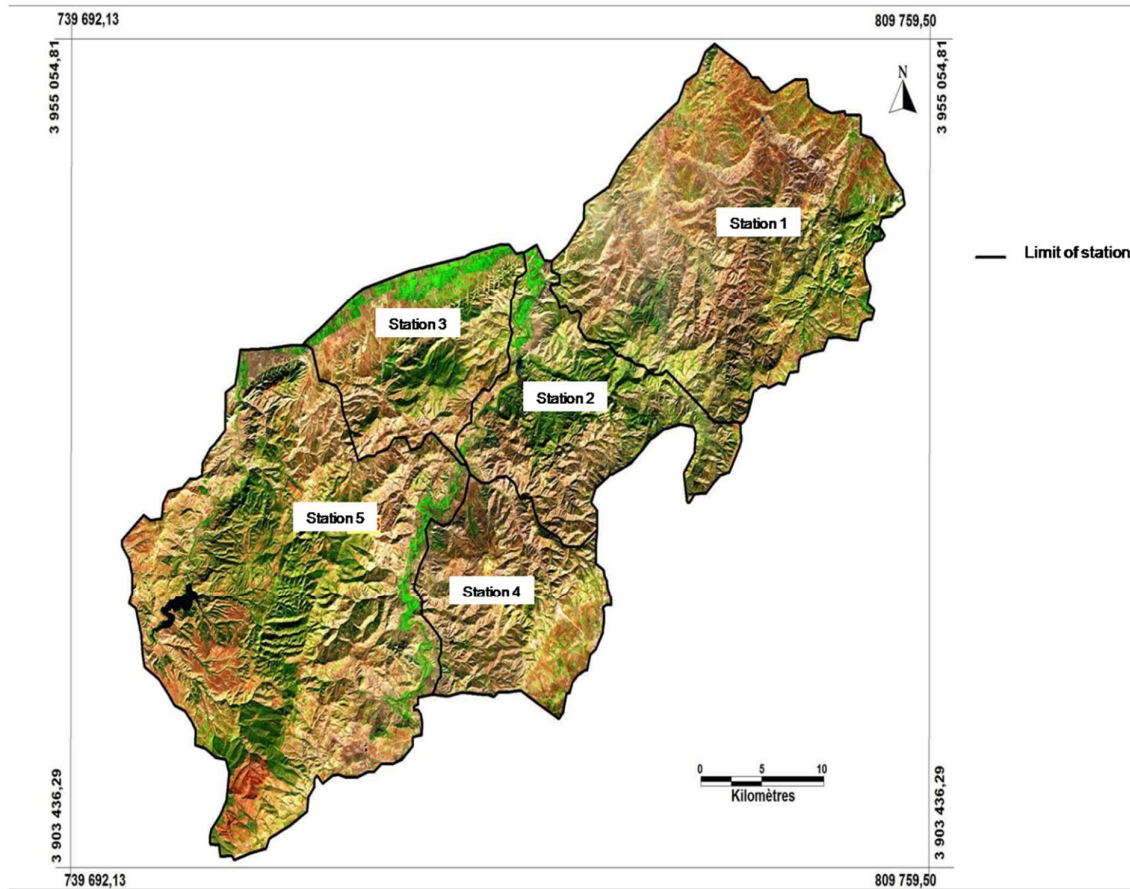


Figure 2. Area of *G. cuvieri* study and stations marked out in the mountains of Beni Chougrane(original) .

Table 1. Characterization and land use of the 5 stations of study

Station	1	2	3	4	5
Area (ha)	48580	18050	11450	15860	49210
Altitude (m)	70- 875	45 -870	25-680	140-700	35-820
Slope (%)	08-25	08-22	06-15	06-17	05-12
Végétation (ha)	15307	11491	4656	8693	29035
Plant cover rate (%)	31.5	63.7	40.7	54.8	59
Habitation (ha)	120	63	34	87	120
Agriculture	2349	5340	9117	7041	2280
Road network (km)	102	71	64	55	88

2.4. Enumeration method

To make the relationship between the gazelle and space presence, the technique of counting of *G. cuvieri* individuals through the different areas has been retained. The method of direct observation and indexes of presence, such as droppings , horns and traces [11] has refined the count. Surveys were conducted with forestry services and residents located in the study area. The spatial inventory method has been strengthened by the establishment of 18 long transects 8 to 10 km depending on the terrain and the area of each zone [12, 11] (Fig. 3). The itineraries were surveyed on foot accompanied by 3 people equipped with binoculars and long view and traces guide. The counts were made in two periods during the day one on sunrise and one on sunset. At each contact we take in consideration the number of individuals and place of the course. Counting gazelles took place from 2013 until 2015.

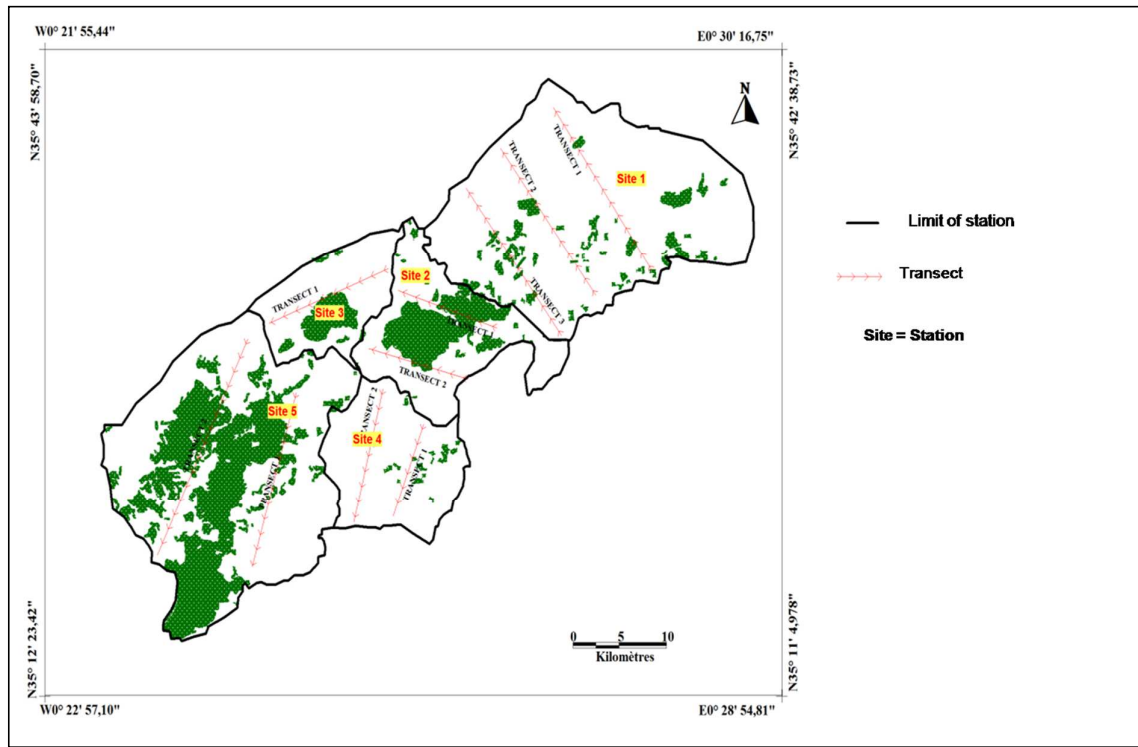


Figure 3. Transect and observation itinerary populations of *G. cuvieri* (original)

2.5. Use of remote sensig

For spatial distribution of the gazelle we have used remote sensing. Indeed we used a picture of the air to the study downloaded with Landsat TM satellite. The satellite image was processed to determine all of the geographical, physical and natural characteristics of areas frequented by gazelles. The GPS was also used to locate geographically the territories of the gazelles in each area study.

3. RESULTS AND DISCUSSION

3.1. Gazelle count's per station

The results of the gazelle count's per station and per year are shown in Table 2 below

Table 2. Average number of individual *G. cuvieri* per station per year of observation

Station	2013	2014	2015	Average±Standard deviation
1	25.2	21.00	19.25	21.82±1.26
2	19.75	20.75	22.25	20.92±2.66
3	25.60	26.25	30.50	27.45±8.74
4	21.75	36.50	21.00	26.42±3.88
5	26.75	23.25	19.00	23.00±1.58
Average±Standard deviation	23.81±2.94	25.55±6.51	22.45±4.72	23.92±1.78

The exploitation of the results obtained show an average number of 24 individuals *G. cuvieri* by area and per year. This is an interesting indicator of the species distribution in relation to the geographical conditions. Based on years of observation that number is 23.81, 25.55 and 22.45 respectively in 2013, 2014 and 2015. This fairly constant number every year shows that populations of gazelles are well-balanced especially due to favorable natural and climatic conditions. Several authors report that the density of the population depends on habitat resources (Corson, 2004) and ecological conditions [5,16,17]. In 2014, thanks to the localized rains, the average number of observed individual of gazelle was more important for the station 4. Rainfall favored the development of natural vegetation offering more food resources compared to other stations study. However, Cuvier's gazelles are very mobile and they could recolonize new areas. A largest number of gazelles live in small group in areas which are covered with forests of *Pinus halepensis*. These hills have been overgrazed for centuries and, as a result, the forests are mainly open. There are patches of regenerating forest, open areas with annual herbs, and some heavily eroded barren areas[4,14]. Weak meetings at the station 2 is related to its rugged terrain and

especially to human presence (sheep flocks with shepherds and dogs) who are fleeing gazelles usually frequented places. Indeed *G. cuvieri* avoid human presence and the rugged terrain but occurs in wheat fields, vineyards and hill-top grasslands [3,5]. In stations 3 and 4 human activity is weak, the slopes are low and the dominant cereal, the average amount of gazelle is the highest in the order of 26-27. Average observations of *G. cuvieri* made for stations 1 and 5 are respectively 21.82 and 23 individuals, gazelles gather in open cropland represented by cereal, vine and arboriculture, far from inhabited areas while fleeing wooded areas because of poaching within these two stations.

In the region of Mascara *G. cuvieri* is quite common in the hills between the regions of Mascara, Tiaret and Relizane where she lives in open country in the fields of wheat and vines [13], habitat of gazelles in the Mascara region also includes the forest composition of cork oak (*Quercus suber*) and holm oak (*Quercus rotundifolia*) [14,15].

3.2. Territories identification

In table 3 are reported the characteristics of the gazelle territories in the mountains of Beni Chougrane. Generally territories of the gazelle cover a total area of 23227 ha or 16.26 % of the total area of the study area. And seven (7) territories frequented by populations of *G. cuvieri* were identified (Fig. 4). Sizes vary from 1002 ha (station 2) to 7416 ha (station 1). from one station to another these territories represent a rate ranging from 0.76% (station 4) to 34.26 % (station 3) of the total area.

Table 3. Geographical characteristics of *G. cuvieri* territories in the Beni Chougrane mountains

Station	place called	Area of territory (ha)	% / Area of stations	Lambert coordinates
1	Ouled Bouzaida	7416	15.26	35°32'-35°36'N 0° 6'-0° 15 E
2	Kaf El Nsour	1002	05.55	35°29'-35°31' N 0°3'-0°7'E
3	Ouled Dahou	3900	34.06	35°30'-35°-33'N 0°5'W-0°1'E
4	Hamar Touares	1090	0.76	35°20'-35°22'N 0°0'W-0°1'E
	Ouled Bendeha	2223	1.58	35°21'-35°25'N 0°1'-0°5'E
5	Ouled Mahiedine	3361	06.83	35°23'-35°28'N 0°7'-0°1'W
	Ouled Said	4285	2.99	35°18'-35°22'N 0°9'-0°3'W
Total		23227	16.26	

3.3. Delimitation of territories *G. cuvieri* and protection plan

The delimitation of the range and displacement of Cuvier's gazelle provides insight monitoring and ensure a protection of its habitat.

The elaborate map is a first step towards the management of this protected species since 1983 : it is an indispensable tool for the establishment of a conservation program and land management to ensure the gazelle territory. Continued rigorous enforcement of legal protection for gazelle is vital to secure their future survival in Algeria. It is also important to complete the network of nature reserves, hunting reserves, and national parks in order to cover all habitats and geographical areas of the country [14].

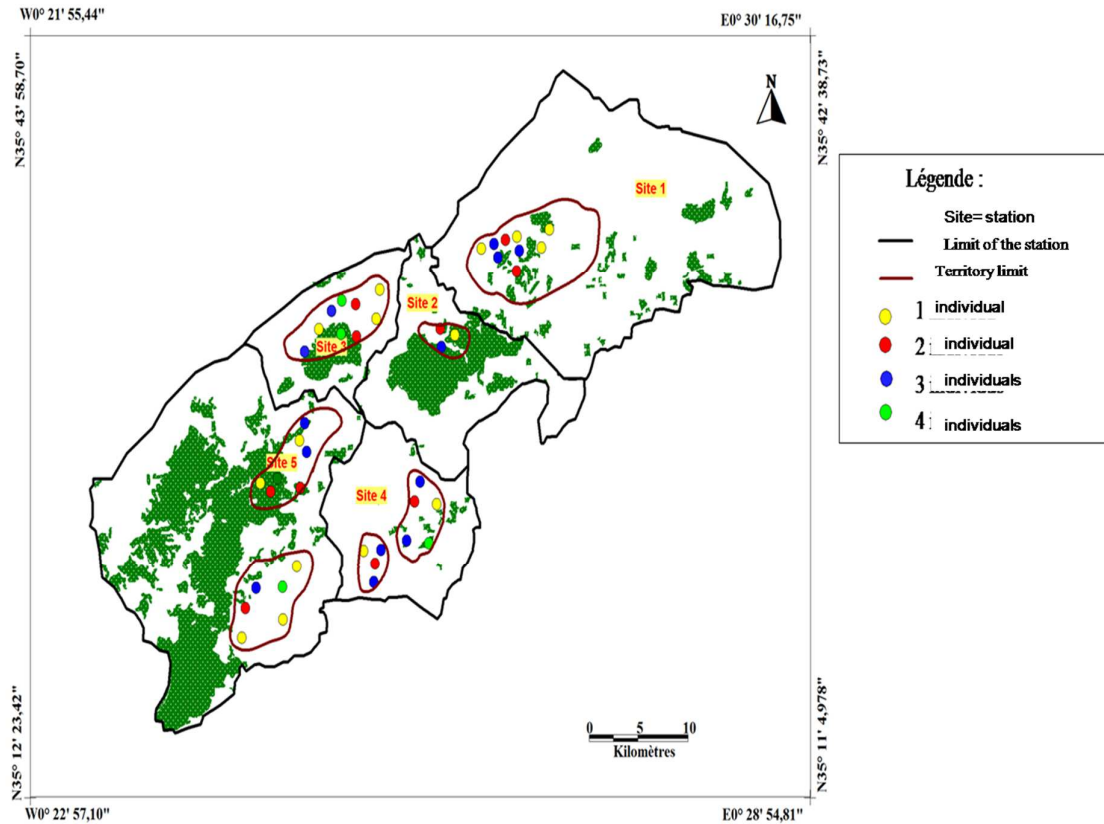


Figure 4. Geographical demarcation of territories frequented by *G. cuvieri* in the mountains of Beni Chougrane

4. Conclusion

The results are quite interesting since they allow to better understand the spaces types where Cuvier's gazelle develop in the mountains of Beni Chougrane (Mascara). The main indicators for the species to find its habitat are looking for quiet, low hilly areas and especially the presence of food in both open forest environment and agricultural. The gazelle distribution map is a tool and manage the future of this species since it allows the establishment of a territorial management strategy to ensure its spaces that are favorable to its preservation.

REFERENCES

1. Abaigar T. Y., Cano, 2005. Conservación y manejo de la Gacela de Cuvier (*Gazella cuvieri* Ogilby, 1841) en cautividad. Registro internacional. Instituto de Estudios Almerienses. Almería.
2. Mallon D. P., and F. Cuzin, 2008. *Gazella cuvieri*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.1. Downloaded on 14 March 2010.
3. Cuzin, F., 2003. Les grands mammifères du Maroc méridional (Haut Atlas, Anti Atlas et Sahara): Distribution, Ecologie et conservation. Ph.D. thesis. Université Montpellier II.
4. Kingdon, J., 1997. The Kingdon Field Guide to African Mammals. Academic Press, London and New York: NaturalWorld.
5. Beudels-Jamar R.C., P. Devillers, R.M., Lafontaine J, Devillers-Tershuren & M.O., Beudels, 2005. SaheloSaharan antelopes. Status and perspectives. Report on the conservation status of the six SaheloSaharan Antelopes. CMS Technical Series Publication n°. 11. UNEP/CMS, Bonn.
6. Cuzin, F., 1996. Répartition actuelle et statut des grands mammifères sauvages du Maroc (Primates, Carnivores, Artiodactyles). Mammalia., 60(1): 101-124.
7. Petrov, P., 1971. Répartition du gibier en Algérie et mesures à prendre en vue de la conservation et son développement. Unpublished report, Direction des Forêts.

8. Sellami, M., H. A., Bouredjli, and J. L., Chapuis. 1990. Répartition de la Gazelle de Cuvier (*Gazella cuvieri* Ogilby, 1841) en Algérie. *Vie et Milieu.*, 40(2/3): 234-237.
9. Belhadi, A. et Benabdeli, k. 2010. Impact des écosystèmes forestiers des Monts de Béni Chougrane (Mascara-Algérie) dans l'amélioration du potentiel mellifère. *Mediterranea.*, 21: 9-25.
10. Belhadi, A., K. Mederbal, K. Benabdeli, M. Ghali, 2008. Apport de l'apiculture dans le développement durable des Monts des Béni Chougrane (Algérie occidentale). *Mediterranea.*, 19 :9-37 .
11. Gaillard, J.M., Delorme D., Boutin J.M., Van Laere G., Boisaubert B. & R. Pradel, 1993. Roe deer survival patterns : a comparative analysis of contrasting populations. *J. Anim. Ecol.*, 62 : 778-791.
12. Gaillard, J.M., Delorme D., Boutin J.M., Van Laere G. & B. Boisaubert ,1996. Body mass of roe deer fawns during winter in two contrasting populations. *J. Wildl. Manage.*, 60 : 29-36.
13. Khirreddine, A., 1977. Etude écologique pour un aménagement cynégétique dans le massif Senalba Chergui à Djelfa. Thèse Ir.Agr. Institut National d'Agronomie, El Harrach.
14. De Smet K.M., Smith, and S.C. Kingswood, 2001. Antelopes. Part 4: North Africa, the Middle East, and Asia. Global Survey and Regional Action Plans. SSC Antelope Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. 260p.
15. De Smet, K., 1991. Cuvier's gazelle in Algeria. *Oryx.*, 25(2): 99-104.
16. Corson, P.J., 2004. Les antilopes d'Afriques : Biologie, Ethologie et Chasses. Ed. Gerfaut., 172 : 19-21.
17. Ramade, F., 2008. Dictionnaire encyclopédique des sciences de la nature et de la biodiversité. Dunod, Paris 2008. 737p.