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Breeding Test and Chick Survival of the Houbara Bustard "Chlamydotis Undulata Undulata Jacquin 1784" in Captivity, Ziban Region (Algeria)

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ABSTRACT

In the current study, breeding success and chick survival of a population of Houbara Bustard (Chlamydotis undulata undulata, JACQUIN 1784) during the season (2013-2014) in the Ziban region, province of Biskra (South-Est of Algeria) were scrutinized. This species is one of the protected species in Algeria by Described in 83-509 of 20/08/83, but the population of this bird is in decline because of excessive hunting and habitat destruction. Today, it has been postulated that the Algerian population of this species would have been split into subpopulations, and they would probably be isolated from each other. This study focused on the aspect of ex situ conservation and reproduction in breeding. The results of Breeding test, chick survival, biometric measurements and analysis of bustard's diet in the nature obtained on the basis of a trial of 10 Bustards captured in the Ziban region, would encourage the implementation of a program to strengthen natural populations.

Keywords: *Breeding, Houbara Bustard, Survival, Ziban.*

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1. INTRODUCTION

The Houbara bustard is a shy bird which can well adapt to desert environments. Two species have been recognized: *Chlamydotis macqueenii*, the Asian species which inhabits the arid plains from Sinaï to Mongolia and *Chlamydotis undulata*, and the African species, which is divided into two subspecies: *Chlamydotis undulata fuertaventurae*, only found in Canary Islands, and *Chlamydotis Undulata Undulata*, resident in North-African semi-desert steppes from Morocco to Sinaï. (Gaucher et al., 1996) The International Union for Conservation of Nature has classified the Houbara species as vulnerable (IUCN, 2011).

The Houbara bustard, *Chlamydotis Undulata Undulata*, is a Palearctic bird, inhabiting steppes and semi-desert areas with open and scattered vegetation (Johnsgard, 1991). The North African Houbara bustard is likely to represent only 10% (10 000 birds) of the entire world population of the former 'Houbara Bustard' group (BirdLife International, 2000).

In Algeria, it is one of the species protected by (Described 83-509 of 20/08/83). Its largest numbers have been concentrated from south of the Tellian Atlas mountains to Ghardaïa, El Golea and Aïn-Salah (Etchécopar and Hüe, 1964).

Few studies have been devoted to the biology and distribution of the species except the works of Mansori (1991), Gaucher et al. (1996), Belhamra and Abas (2004), and Belhamra et al. (2006).

The objective of this study was studying the aspect of ex-situ conservation and breeding in Captivity. The results obtained on the basis of a trial of 10 Bustards picked up in the region of Biskra would encourage the implementation of a program to strengthen the natural populations.

2. MATERIAL AND METHODS

Study area and data collection

The study area depended administratively on the region of Ouled Djellal in Biskra department (Southeastern Algeria), it included about 100 km at the Southwest of Biskra. And it covered 873,840 h, and a large portion of the territory was under the supervision of Besbes municipalities with an area of 363,360 h and Ras El Miaad which included 478,390 h. The vegetation in this area has been characterized by climactic and edaphic formations influenced by the geomorphology of the region (Merouani et al., 2018).

As a part of this work, the selected area has been located in the high and mild Saharan bioclimatic zone, and formed by the pre-Saharan steppe at Hamada scoparia (Fig.1).

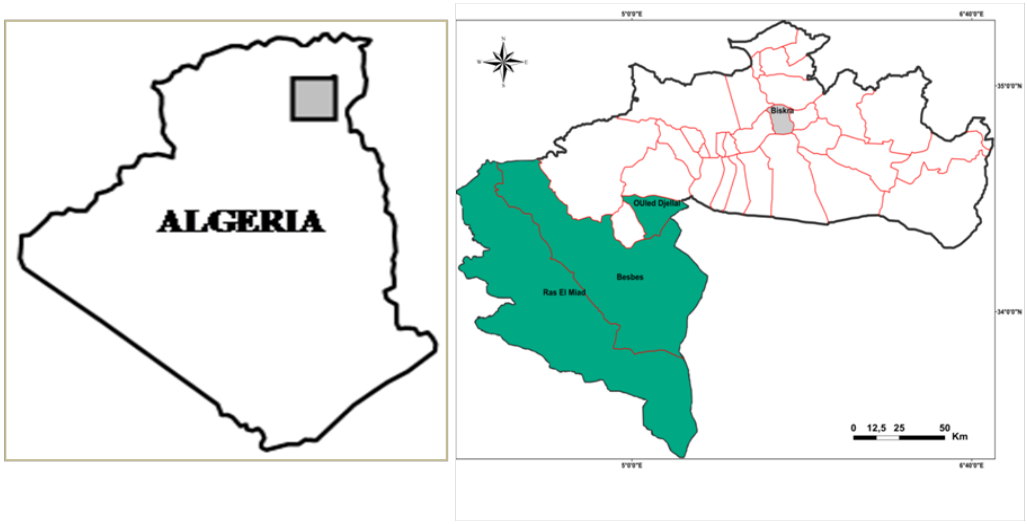

Figure 1. Study area location (Original).

Ten bustards were placed under a breeder, previously heated the day before at the temperature of 38 ° C, from the second week, the temperature was decreased at 2 °C per week. This technique allowed the chicks to ensure their own thermoregulation progressively. Each day, the bustards received fresh water combined with industrial food ad labium's rich in proteins and vitamins in addition to a supplement of fresh food given by tweezers; this food consisted of minced meat or larva and flour, chopped eggs and fruit.

Between the 5th and 6th weeks, the bustards terminated their growth on the unheated trays in the same room, and were then transferred to a natural photoperiod.

The breeding room was subjected to natural summer illumination (36 ° LN), and to auxiliary light of a set of fluorescent tubes controlled by a clock. The setting of the illumination time was carried out in such a way to preserve the twilight of the morning and its natural summer evolution, and a minimum phase photo of 14 hours of light was ensured. In this stage, the burgundies followed a fresh food ration consisting of minced meat alternatives to insects (locusts, small cracks ...), hard eggs cut or in pieces, tomatoes, salad and lentils.

- The first sub-adults were transferred to the terrarium in June, which ensured a normal transition of the photoperiod (about 16-8 LD). Then, the photoperiod naturally evolved in parallel in both structures (breeding room and terrarium) until transfer: photo phase still lasted 14 hours without dusk. The young were transferred to the terrarium from the second decade to a sudden decrease of the photo phase which was stronger as they were transferred.
- The morphological evolution of the bustards was followed by the biometric measurements including: Weight Length of the folded wing and Length of the tarsus.

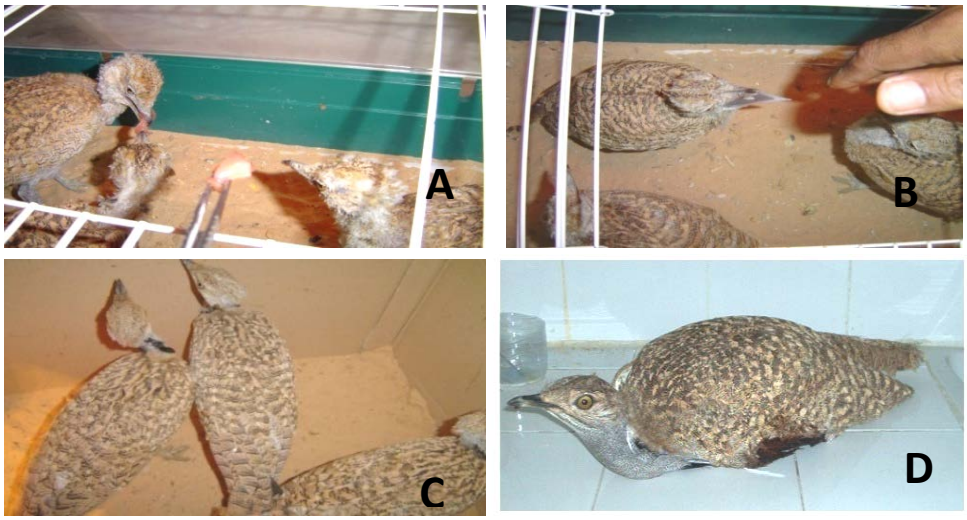

Figure 2. 2nd week chick fed with tweezers (A), (B). Chick of 5th and 6th week After Breeding in (C), (D) (Belhamra,2004).

Figure 3. Maintenance Phase and Biometric Measurements (Belhamra, 2004).

After lifting a simple analysis of digestive tract constituents of 5 specimens, a few droppings harvested from the field were made, then the abundance of the constituents was found in the diet of this species using the abundance index as presented in the following equation:

Abundance Index = Nx / Nt × 100.

Nx: Number of each specimen found.

Nt: Number of specimens found.

3. RESULTS

For the implementation of a program to strengthen natural populations, the consumed concentrated food was19.45 g for the bustard (♀n ° 1). On the other hand, the lowest amount was 1.64 g for the bustard (♀n ° 2). As for lentils, the average maximum value consumed was 7.12g recorded for the case of bustard (♂n ° 4). However, the average minimum quantity was 5.15g for the bustard (♀n ° 2). The highest value of fresh vegetables was noted for bustards (♀n ° 3 and ♂n ° 4) 7.6g, whereas the average minimum quantity was 3.77g in the bustard (♂n ° 5). In the case of minced meat, the mean maximum quantity was 3.7 g recorded for the bustard (♂n ° 5 and ♀n ° 3). On the other hand, the mean minimum value was 0.85 g recorded for the bustard (♂n ° 5). The bustards (♀n ° 3 and ♂n ° 4) showed a balanced average ration (Tab.1).

Table 1. The average consumption of the quantities of each food used in the food ration followed in breeding of the Houbara bustards in captivity.

Sex	Concentrated feed (g)	Fresh vegetables (g)	Dried vegetables (g)	Animal proteins (g)
♀n° 1	19.45	5.36	6.83	0.87
♀n° 2	1.64	4.43	5.15	3.24
♀n° 3	16.08	7.6	6.75	3.7
♂n° 4	8.52	7.6	7.12	3.7
♂n° 5	1.68	3.77	5.84	0.85

1. Weight evolution and biometric measurements of bustards in captivity

Table 2 shows the evolution of weight and biometric measurements of ten burgesses measured along two periods (09/06/2013 and 21/08/2013), in linen including the sexes of each bustard. As the second measure was practiced on five bustards, and the others were released.

For the evolution of the weight in the first phase (09/06/2013), the maximum and minimum recorded values were 893.8g, 288.2g in the bustards ♂n ° 1 and ♀ n ° 4 consecutively, and for the second phase (21/08/2013), the maximum value was: 1310.4g in the bustard # 4, and the minimum value was 692.8g in the bustard # 3.

For biometric measurements, the maximum value for the wing length folded in the first phase was 60cm in the bustard ♂n ° 1, and the minimum value was 21.4cm in the bustard n ° 4, and in the second phase, the maximum and minimum values were recorded successively in the bustards ♂ n ° 4 and ♀ n ° 3 (35.6cm, 33cm).

The maximum tarsus length in the first phase was 90.6mm in Bustard ♂n ° 1, and the minimum of 55mm was observed in Bustard ♂ n ° 5, and for other bustards, in the second phase, the maximum value was 94.1mm in Bustard # 2, and the minimum value was 70mm in Bustard # 4 (Tab.2).

Table 2. Weight evolution and biometric measurements of bustards in captivity.

Sex	**Weight (g) ± 0.01**		**Folded wing (Cm)**		**Tarsus (mm)**	
	09/06/2013	21/08/2013	09/06/2013	21/08/2013	09/06/2013	21/08/2013
♂n°1	893.8	Transferred (*)	60	Transferred (*)	90.6	Transferred (*)
♂ n°2	860.6	Transferred (*)	55	Transferred (*)	90	Transferred (*)
♀ n°1	678.3	Transferred (*)	36	Transferred (*)	85	Transferred (*)
♀ n°2	536	747.2	35	38	78.3	94.1

♀ **n°3**	692.8	692.8	33	33	86	86
♂ **n°3**	540.6	938.7	30	37	74.8	80.4
♀ **n°4**	298.88	715.8	21.4	30.4	61.1	70
♂ **n°4**	546.1	1310.4	21.6	35.6	69.9	75
♀ **n°5**	334.9	Transferred (*)	23	Transferred (*)	70.1	Transferred (*)
♂ **n°5**	288.2	Transferred (*)	22.5	Transferred (*)	55	Transferred (*)

(*): Transferred to Djelfa Reserve

2. Analysis of bustard's diet in the nature (gizzards and droppings).

To better define the diet of the Houbara, it was necessary to make the analysis of the stomach content of bustard Houbara, and the droppings of bustard Houbara recovered in the natural environment.

According to the analysis of droppings of the Houbara bustards in the Rass el Miaad area, ants were the most abundant (74.07%), followed by Orthoptera (18.52%), and Coleoptera (7.41%) (Tab.3).

Table 3. The average composition of the Houbara bustard droppings.

The order	The species	Abundance
Orthoptère	Orthopterasp1.ind	18.52%
Coléoptère	Coleopterasp1.ind	7.41%
Hyménoptère	Fourmicida.sp1.ind Fourmicida.sp2.ind Fourmicida.sp3.ind	74.07%

Concerning the results recorded on the analysis of the stomach contents of bustards, the Coleoptera were represented by an abundance of 64.29% and the Hymenoptera with an abundance of 35.71% (Tab.4).

Table 4. Results of the analysis of the bustards' stomach contents.

The order	The species	Abundance
Coléoptera	Coléoptera.sp1.ind Coléoptera.sp2.ind Coléoptera.sp3.ind	64.29%
Hymenoptera	Fourmicidae sp.ind	35.71%

Figure 4. Fiasco and containing gizzards (x25) (Original).

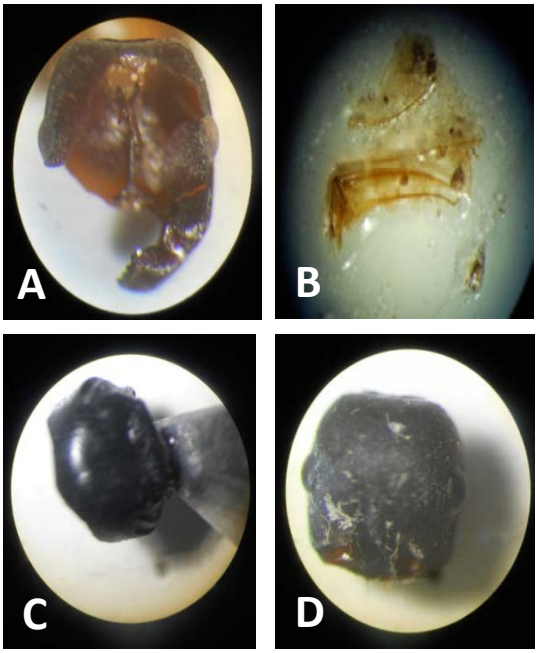

Figure 5. Different fragments of insects found in gizzards and analyzed dung (x25).(A) Head "Fourmicidae.sp, (B) " Wing "Coléopeterasp.ind" , (C) Head Coléopetera.sp and (D) " Head "Fourmicidae.sp. " (Original).

4. DISCUSSION

According to the results obtained, it appeared that during the growth period of the bustards, the weight increased in parallel with the wing length, the length of the tarsus and the age. These results were similar to those founded by Mansori, (1991) who found a relationship between weight, wing length and tarsal length with the age and nature of food and its protein richness.

According to the results obtained, it appeared that Houbara bustard diet was diversified, and included several vegetable foods; Stems, buds, and animal foods such as insects. Similar results were founded by Recher (19900 and Sherry (1990) in natural environments with the dominance of insects in the trophic menu of bustards. Hingrat et al. (2007) found that the arthropods were the most abundant, and Hingrat and Saint Jalme (2005) observed that the peak abundance in arthropods coincided with the peak of hatching in the Houbara Bustard.

But, Recher (1990) and Sherry (1990) have reported that Bustard's food was on the whole quite varied according to a generalist diet. The study of the diet composition of this bird by the analysis of droppings or by the analysis of the stomach containers revealed the dominance of the coleoptera and the hymenoptera: This confirmed all the studies and observations which were underlined by Combreau and Rambaud (1994),

Nadeem et al.,(2004), Tigar and Osborne (2000), and Gubin (2008), and showed the importance of coleoptera and ants in the houbara bustard diet. Different taxa have been reported in the diet of bustards in Saudi Arabia, the most common being Formicidae (Camponotus sp.) and coleoptera (Trachyderma, Zophosis, Mesostena, Scaurus) (Combreau and Rambaud,1994). Collins (1993) found Conorhynchus conicirostris (Coleoptera: Curculionidae), Zophosisplicata (Coleoptera: Tenebrionidae) and Messormaurus (Hymenoptera: Formicidae) as the most abundant insects with a passage from feeding ants to Zophosis whenever they were available.

5. CONCLUSION

The study of the food ration given to the bustards and the test of breeding of bustards indicated the variation in the quantity of daily food consumed by the bustards. The evolution of bustard weight during the growth phase was correlated with the consumption of animal proteins compared to dry and fresh vegetables, and a large variability was noted in food intake that might be due to stress, which was expressed by the lack of appetite of bustards, caused by their health status.

Finally, it can be concluded that the variation in quantity of food consumed by bustards was due to the age, sex, physiological and sanitary status of each bustard.

Therefore, the Houbara bustard had agro-ecological importance requiring protection by laws, national and international conventions as well as in-depth studies for the establishment of rearing centers and reintroduction trials in their natural environment.

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