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BREEDING BIOLOGY OF *STREPTOPELIA TURTUR* IN IRAN

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ABSTRACT

The European turtle dove is a migratory bird inhabiting Khuzestan province, especially in Karkheh National Parkin spring for breeding. Regarding the threats that species faces globally, understanding the breeding biology of species is a prerequisite for its effective conservation in the study area. Therefore, we surveyed 200 nests from egg laying to fledging to record the breeding characteristics of European turtle dove inside and outside Karkheh National Parkto investigate the impact of conservation on breeding success of the species. Our results indicated that nesting began on late April and ended on early August inside the park. Outside the park breeding started on early May and the last nestling left the nest on mid August. During these periods the turtle dove bred in three subsequent period. The overall nest success was 75.5% inside the National Park and 62.8% outside the Park. One of the most effective factors in the success of juvenile's flight inside the park was the height of the nests above the ground which was on average 3.78±0.77 m inside in comparison with the height of the nests outside the park (2.38±0.5).

Keywords: European turtle dove, breeding biology, nest, nest success.

Introduction

The European turtle dove (*Streptopleia turtur*) is a small member of the Columbidae family originating from the western Palearctic low altitude regions (Lormee *et al*., 2016). The species is a widespread migrant breeder across much of central and southern Europe, Central Asia, the Middle East and North Africa (Bakaloudis *et al*., 2009), wintering mainly in the Sahel zone of Africa (Baptista *et al*. 2015). It has undergone large range declines in north-west Europe, including the Netherlands and the U.K. (e.g. Balmer *et al*. 2013), and the population continues to decrease throughout Europe which has led to its categorization as vulnerable by IUCN (Birdlife International, 2019).The main reason for its decline is reduction of its breeding habitats (Mansouri *et al*., 2019). However, it is a common and locally abundant breeding bird throughout Iran and it inhabits areas wherever trees or scrub available for nesting, Occurs widely all over Iran on migration (Kaboli *et al*., 2012).

This species migrates to Khuzistan province in springs and uses the area as a breeding ground. Considering the high threats species faces in terms of its breeding, it is important to study the breeding biology of the species in the study area to reach a better decision for its conservation.

There are several studies on various aspects of turtle dove behavious such as migration routes (Lormee *et al*., 2016), population trends in Europe (Browne and Aebischer, 2005) and breeding biology (e.g. Browne *et al*., 2005; Hanane, 2016). In recent years, extensive research has been conducted in Iran on birds (e.g. Hemami & Zaeri, 2011; Hosseini, 2015), but there is little research on doves, and especially turtle dove, due to specific habitat conditions and the birds' nesting on tall branches of tamarisk and *Populus euphratica*. In this study we investigate the breeding biology of the species inside and outside the Karkheh National Park (hereafter KNP) to have a better understanding of the species breeding biology and the effectiveness of conservation on its reproduction and survival.

Material and Methods

Study area

Karkheh National Park is located between 31 36 to 32 57 N and 48 10 to 48 32 E (Figure 1).

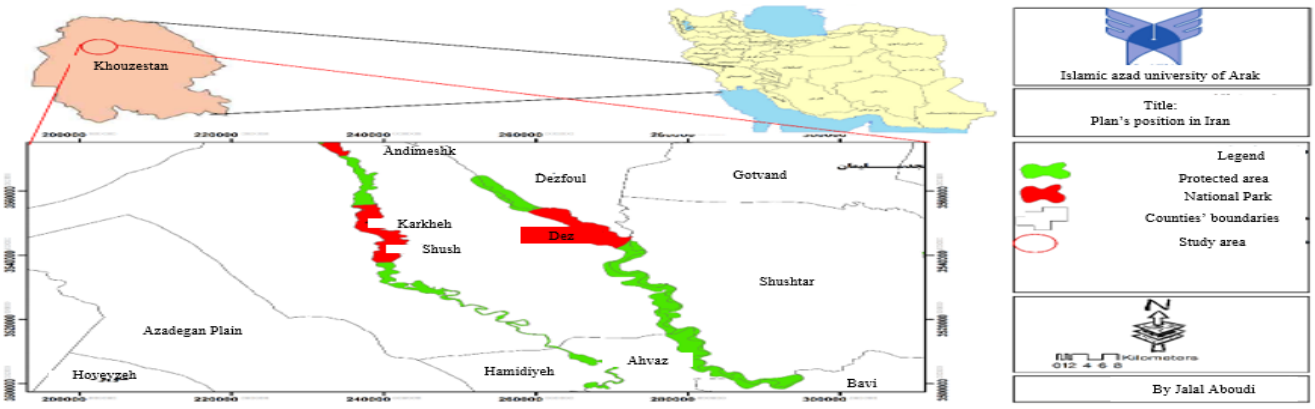

Fig. 1 : Study Area of Karkheh National Park

This place has a good habitat in terms of lush and dense forests and is a home to a variety of wildlife. Characteristics of this area are dense forests of tamarisk, *Populus euphratica*, *Lyciumshawii*, which are harmoniously dense. Due to its easy access to water and food sources and the availability of trees, it is well-suited for nesting of European turtle dove.

Field sampling:

In order to become familiar with the area and to investigate the nesting and breeding sites, the area was precisely surveyed prior to the migration of the bird to the area. Turtle doves entered the region on 2019/04/16.

The beginning of hatching began with the discovery of the first egg on 2019/04/30 in Karkheh National Park. The turtle dove's hatching and breeding was divided into three periods in this region, The first period began on 2019/04/30 and ended on 2019/05/30.The second and the third periods started on 2019/06/1, 2019/07/03 and ended on 2019/07/02 and 2019/08/04, respectively. Each hatching and breeding period of turtle dove usually takes one month. For accuracy, for the first, second and third periods inside and outside KNP34, 33 and 33 nests were selected, respectively. Overall, 200 nests during breeding season outside and inside KNP were studied.

Measurement and sampling time began after first hatching on 2019/04/16and continued until the last nestling left the nest on 2019/08/19 in the study areas.

Fate of 100 nests inside the conserved area and 100 nests outside the conserved area were closely monitored approximately every day to check and record dates of egg laying, hatching and fledging.

The nest height above the ground was recorded for all the nests included in the study (both inside and outside the KNP). Moreover, other nest characteristics such as nest length, nest bredth and nest cup depth were measured. For each active nest, the clutch size, egg length, egg breadth (down to 0.01 cm accuracy using a vernier callipers), egg weight (down to 0.01 g using a digital scale) and number of nestlings were recorded (Figure 2). The potential cause of nest failure was also recorded, wherever possible. All nestlings of each nest were weighed on two-day intervals to investigate the trend of the nestling growth (Figure 3). Finally, to estimate the nesting success, the fate of all nests was followed from the egg laying stage to fledging.

Fig. 2 : Measuring the weight and length and breadth of the eggs.

Fig. 3 : Measuring weight of nestlings at different development stage

Statistical analyses

Prior to choosing statistical analyses we tested for normality of data to choose proper parametric or nonparametric tests. All the statistical analyses were performed by using SPSS (ver.21).

Results

Nest measurements

Height of the nests above the ground was on average 3.87± 0.77 m (mean± SD) inside KNP and 2.38±0.50 m (mean±SD) outside KNP. This difference was highly significant (t-test, $p<0.0005$)

Nests were heavier inside KNP with average weight of 24.44±2.16g (mean±SD) in comparison with weight of nests outside KNP with average of 23.98±1.5g (mean±SD). This difference was statistically significant (t-test, $p<0.05$). Moreover, nests had more height, more depth and less length inside KNP which these differences were statistically significant. However, the nest width did not differ between inside and outside KNP (table 1).

Table 1 : Descriptive statistics of nest measures (mean±SD) with the result of test for difference between inside and outside KNP

Nest measures (cm)	Inside the KNP (mean±SD)	Outside the KNP (mean±SD)	P value for Mann-Whitney U test
Nest height	5.24±0.64	4.76±0.48	<0.0005
Nest depth	1.53±0.31	1.34±0.25	<0.0005
Nest length	25.10±2.14	26.1±1.27	<0.0005
Nest width	19.22±1.83	19.39±2.04	0.874

Egg measurement:
The eggs were semi oval in shape and did not differ significantly in weight and length between two areas (Table 2).

Table 2 : Descriptive statistics of egg measures (mean±SD) with the result of test for difference between inside and outside KNP

Egg measures	Inside the KNP	Outside the KNP	P value for Mann-Whitney U test
Egg weight	8.89±0.19	8.83±0.25	0.127
Egg length	2.78±0.10	2.80±0.9	0.231
Egg breadth	2.05±0.11	1.93±0.13	<0.0005

Nestling weights:
Table 3 : Weight of nestlings (mean±SD) in two-day intervals from beginning of the hatching to fledging

Nestling weight (g)	Inside the KNP	Outside the KNP	P value for difference (t-test)
Stage 1	7.59±0.43	7.73±0.32	0.012
Stage 2	22.09±-.94	23.24±0.87	<0.0005
Stage 3	34.54±0.96	34.95±1.00	0.011
Stage 4	44.89±0.56	45.87±1.67	<0.0005
Stage 5	62.90±1.71	63.91±0.71	<0.0005
Stage 6	73.68±1.76	74.72±0.68	<0.0005
Stage 7	83.98±0.82	84.41±0.41	0.004
Stage 8	81.57±0.53	81.64±0.36	0.612

The fledging period took 16 days. During first seven stages neslings gained weight, however, in the last stage nestlings lose weight. This was because of the fact that parents had to stop feeding the nestlings for the last two days, so the nestlings would have to leave the nest and fly (Table 3).

Nestling mortality
All of the eggs were hatched and all of the recorded mortality happened during the fledging period. As it is depicted in figure 4, the number of nestling mortality except for two early stages was higher outside KNP.

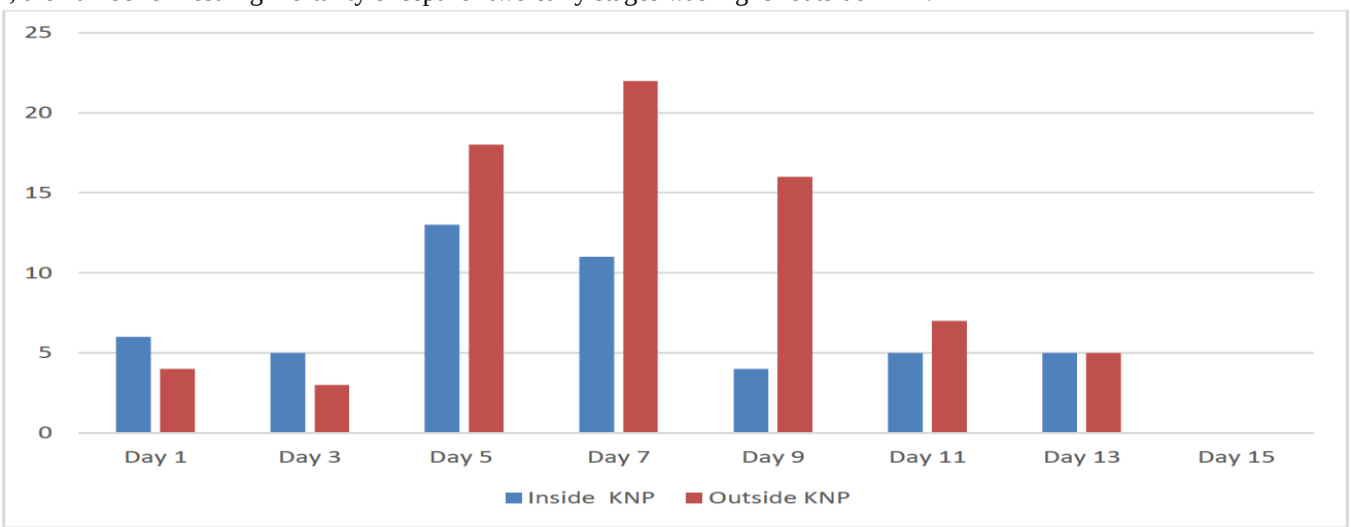

Fig. 4 : Percentage of nestlings mortality in eight stages of investigation inside and outside KNP

Nesting success:
In all the nests the clutch size was two eggs. Fledging success was 51% inside the conserved area and 25.5 percent outside the conserved area (Table 4).

Table 4 : Nest success for the turtle dove

Breeding location	No. of eggs	No. of hatched eggs (hatching success)	No. of fledging young (fledging success)	Nest success
Inside KNP	200	200 (100)	102(51)	75.5
Outside KNP	200	200(100)	51(25.5)	62.75
Total	400	400(100)	153(38.2)	69.1

Discussion

The height of the nests above ground depends on the area's vegetation, for example inside KNP due to conservation and consequently intact tree vegetation, average height of nests above ground was 3.87 m. However, outside KNP the average height of the nests was 2.38 m due to the cutting of the trees to use as timber. In other research in Bulgaria (Gruchev, 2017) where the dominant tree plants in turtle dove habitat were *Querqus spp* and *Pinus nigra*, the average height of the nests above the ground was estimated 5.3±1.8 m. However, in our study area the dominant tree for nesting was tamarix.

We observed three distinct breeding period in our study as Gruchev (2017) suggested there were three breeding period in their study area, too. Turtle dove had a clutch size of two, an incubation period of 16 days which approves prior findings (Kaboli *et al*., 2012). However, we found out that the fledging period in the study area (16 days) was shorter than what was stated for throughout the country (19-21 days, Kaboli *et al*., 2012).

The fledging success was higher inside KNP. The reason for this success include: higher level of conservation, no change in land-use and prohibition of poaching inside KNP. However, outside KNP over-cutting of trees, changing land use, especially conversion of forests to agricultural land, and forest fires, lower the habitat security and decrease habitat quality for nesting and breeding. Turtle dove is of great economic importance in Khuzestan province and many other parts of Iran as a game bird (Kaboli *et al*., 2012). Because of this, with the arrival of this migratory bird, poachers hunt large numbers of this bird. In another study in 2015, Hosseini and colleague showed that the most important threatening factor for breeding birds in Dez protected area (near KNP) was habitat destruction caused by land use change and overuse of resources such as over hunting.

The turtle dove is known to be dependent to the farmland during its breeding both in Europe and in North Africa (Dias *et al*., 2013; Yahiaoui *et al*. 2014). In this study we observed the same behavior by breeders outside KNP. However, a more specific study focusing on bird's diet is needed before reaching a conclusion.

Spatial distribution of doves throughout a habitat depends on trees for nesting and cereal crops for feeding and drinking (Hanane, 2017). With all aforementioned difficulties, areas outside KNP could be an important habitat for breeding turtle doves because of accessibility to water resources and cereal farms around and remaining tamarix vegetation. Therefore, substantial changes to management of these areas could add to total breeding success of turtle dove in this area.

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