

Timing of migration and breeding phenology of European Turtle dove (*Streptopelia turtur*) in Bulgaria

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Abstract

Between 2014–2022 we monitored the arrival and departure date of European Turtle doves (*Streptopelia turtur*) in Bulgaria. We collected data on first arrival date through observations in different part of the country between April 1 and May 1. In September, we collected data about the end of the species autumn migration. Data on breeding behaviour were collected between 2017–2022 from 41 nests. The correlation between the height of the position of nests and the height of the trees on which they were located was examined by Spearman rank moment test. Two peaks of fledging were established, i.e. at the end of June and the end of July. The mean height of the nests was 4.6 m. There is a significant positive correlation between tree height and nest height ($r = 0.82$, $p < 0.0001$). The mean clutch size was 1.84 and the mean brood size was 1.6 young/successful pair. Breeding success for all period was 82.76 %.

Key words: breeding success, brood size, clutch size, migration timing.

Introduction

European Turtle dove (*Streptopelia turtur* L., 1758) is a game bird of great importance for many hunters in Europe. Its breeding population is declining, and it falls in the category of vulnerable species (Birdlife International 2019). Mediterranean countries hold one of the largest breeding populations in Europe (Fisher et al. 2018). Bulgaria falls in the eastern migration route of

the species (Marx et al. 2016) and at present, it is one of the primary game species. Hunting season spreads from the second Saturday of August until 30 November. But to guarantee the sustainable management of the species, since 2021 the number of hunting days and hunting bags have been reduced.

The purpose of this study is to present data on the arrival and departure dates of the European Turtle dove, as well as data

on the reproduction of the species in the last decade.

Materials and Methods

Between 2014–2022 we collected data on first arrival date of Turtle doves in Bulgaria through observations in different parts of the country between April 1 and May 1. In September, we collected data about the end of the species autumn migration. In the period 2014–2018, observations were conducted mainly in Southern Bulgaria, and between 2019–2022 in the rest of the country (Fig. 1).



Fig. 1. Study area of European Turtle dove in Bulgaria.

Note: triangles indicate the areas where data were collected.

Data were collected through observations carried at different times of the day. Dawn and dusk observations were conducted on the same days. Thus, the morning and evening observations were distributed relatively evenly in time. The dates of the first and last Turtle doves seen were recorded, as well as the dates of the first and last breeding song heard. In addition, the periods in which fledglings were observed were also recorded. Turtle

dove breeding data were collected from 41 nests monitored throughout the period 2017–2022. For each nest we determined its height, the height of tree, tree species, number of eggs, also clutch and brood sizes when possible. The correlation between the nests' height and the trees' height on which they were located was examined by Spearman rank moment test. We used this test to check whether the birds choose a specific part of the tree crown or whether the nests are randomly located in different cases. Breeding success was calculated by the proportion of successful nests/nesting attempts. Under nesting attempt we accept the cases in which a pair was found with a built nest, also for successful nesting we accept the cases with fledglings. The brood size was defined as the number of fledged juveniles per successful breeding pair.

Results

The first arriving birds were observed between April 15 and 26. The first singing Turtle doves were recorded in the period April 22 – May 1. The last recorded songs were between August 09 to August 21 for the entire period for which we have information (Fig. 2, Table 1). Autumn migration was between September 15 and September 23 (Table 1). After that, only single individuals were observed in Sakar Mountain Southern Bulgaria.

The first fledglings were observed at the end of June (2017–2020), but in 2021–2022 were recorded in the first half of June. The second peak of fledging was observed in the second half of July (Table 2).

During the study period, information was collected from 41 Turtle dove nests,

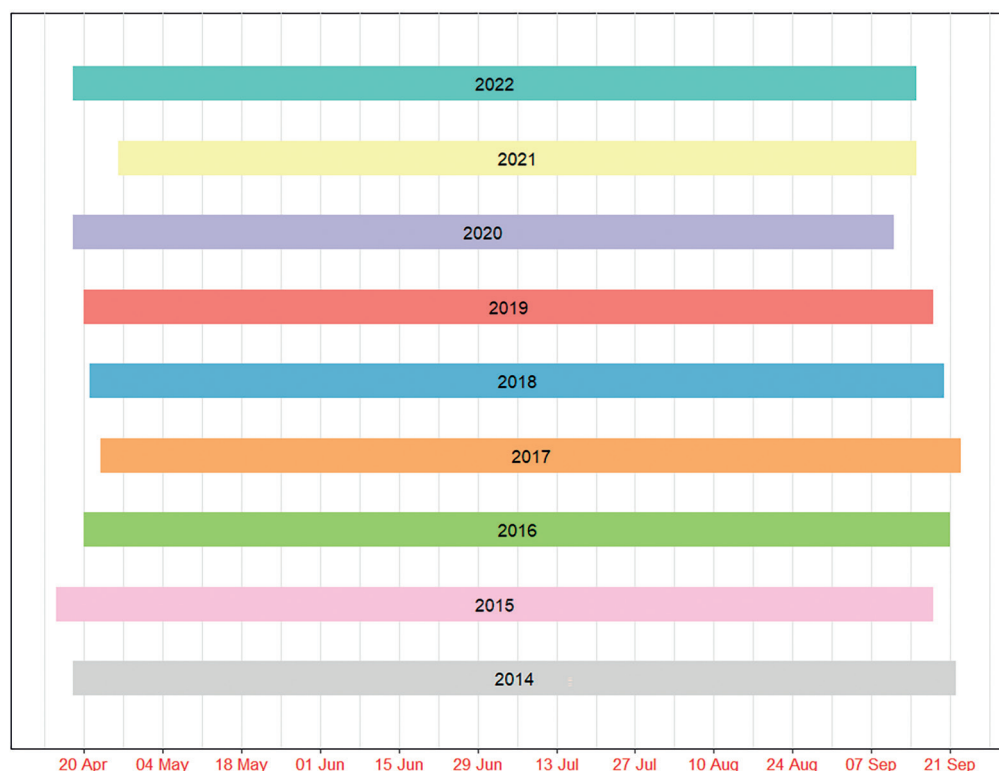


Fig. 2. Dates of arrivals and departures of European Turtle doves in the period 2014–2022.

Table 1. Migration time of European Turtle dove between 2014–2022.

Year	Date of arrival	First song	Last song	Departure
2014	18 – 23.04	28.04	21.08	15 – 25.09
2015	15 – 21.04	26.04	17.08	18 – 30.09
2016	20 – 24.04	23.04	20.08	21 – 30.09
2017	23 – 27.04	01.05	13.08	23 – 30.09
2018	21 – 26.04	01.05	01.08	20 – 30.09
2019	20 – 26.04	01.05	10.08	18 – 30.09
2020	18 – 24.04	22.04	09.08	11 – 20.09
2021	26 – 30.04	30.04	21.08	15 – 25.09
2022	18 – 23.04	23.04	21.08	15 – 25.09

mostly from Southern Bulgaria. The nests were located on 11 tree species from 10 genera (Table 3). The average height at which the nests were located was 4.6 ± 1.4 (2.5–8 m), (mean $\pm$ SD (min-max)),

and the average height of the trees on which they were located was 6.6 ± 1.9 (3.5–11.5 m). There is a significant positive correlation between nest height and tree height $r = 0.82$, $p < 0.0001$. As the

Table 2. Periods of observations of fledglings.

Year	Dates	
	June	July
2017	27 – 29	n/a
2018	22 – 23	n/a
2019	20 – 22	18 – 21
2020	21 – 23	19 – 21
2021	09 – 13	10 – 12
2022	11 – 13	20 – 24

height of trees increases, so does that of the nests. The average clutch size of successful breeding pairs was 1.84 (1–2) eggs and the average brood size was 1.6 (1–2) (mean (min-max)) juveniles. Out of 41 observed nests, five (12.2 %, $n = 41$) were unsuccessful, in 24 cases we observed successful breeding ($n = 41$) and we didn't have information about 12 nests ($n = 41$). Breeding success for all periods was 82.76 % ($n = 29$).

Table 3. Data for breeding of European Turtle dove between 2017–2022, nest height distribution, height of used trees and clutch, brood sizes and nesting success.

No	Species tree/shrub	Nest height, m	Plant species height, m	Data	Clutch size	Brood size	Nesting success
1	<i>Quercus pubescens</i> Willd.	3.4	4.1	06.05.2017	n/a	n/a	n/a
2	<i>Robinia pseudoacacia</i> L.	4	5.5	27.06.2017	1	n/a	0
3	<i>Pinus nigra</i> Arn.	6.5	9	28.06.2017	0	n/a	n/a
4	<i>Quercus pubescens</i> Willd.	3	5	28.06.2017	n/a	n/a	n/a
5	<i>Pinus nigra</i> Arn.	8	9.3	28.06.2017	2	n/a	1
6	<i>Robinia pseudoacacia</i> L.	4.3	5.5	17.05.2018	2	2	1
7	<i>Fraxinus ornus</i> L.	4.8	6	02.06.2018	n/a	n/a	n/a
8	<i>Pinus nigra</i> Arn.	5	7.5	22.06.2018	n/a	1	1
9	<i>Populus</i> sp.	6	11.5	22.06.2018	n/a	2	1
10	<i>Robinia pseudoacacia</i> L.	5.1	7.1	22.06.2018	n/a	1	1
11	<i>Quercus pubescens</i> Willd.	3.8	6.4	23.06.2018	n/a	2	1
12	<i>Pinus nigra</i> Arn.	4.6	8.5	23.06.2018	n/a	2	1
13	<i>Pinus nigra</i> Arn.	5.1	8.6	04.05.2019	0	n/a	n/a
14	<i>Robinia pseudoacacia</i> L.	3.5	6	23.05.2019	n/a	n/a	n/a
15	<i>Quercus pubescens</i> Willd.	5.5	6.4	24.05.2019	2	n/a	1
16	<i>Pinus nigra</i> Arn.	6.5	8.6	24.05.2019	2	n/a	1
17	<i>Acer negundo</i> L.	6.5	8	24.05.2019	2	n/a	1
18	<i>Pinus nigra</i> Arn.	8	9	24.05.2019	n/a	n/a	n/a
19	<i>Quercus cerris</i> L.	4.5	6.5	24.05.2019	2	n/a	0
20	<i>Ulmus minor</i> Mill.	3.1	4.3	24.05.2019	n/a	1	1
21	<i>Prunus cerasifera</i> Ehrh.	3.5	5.2	25.05.2019	n/a	2	1
22	<i>Carpinus orientalis</i> Mill.	2.5	3.5	25.05.2019	2	n/a	1
23	<i>Quercus pubescens</i> Willd.	3.5	5	25.05.2019	2	n/a	1
24	<i>Pyrus</i> sp.	3	4.2	08.06.2019	0	n/a	n/a
25	<i>Quercus pubescens</i> Willd.	4.5	6	19.07.2019	2	1	1
26	<i>Quercus pubescens</i> Willd.	4	6	19.07.2019	2	n/a	1
27	<i>Ulmus minor</i> Mill.	3.2	4.3	19.07.2019	2	2	1

No	Species tree/shrub	Nest height, m	Plant species height, m	Data	Clutch size	Brood size	Nesting success
28	<i>Quercus cerris</i> L.	4.1	6	20.07.2019	2	n/a	0
29	<i>Pinus nigra</i> Arn.	4	8.8	30.05.2020	n/a	n/a	n/a
30	<i>Quercus cerris</i> L.	6.1	8.2	20.07.2020	1	n/a	0
31	<i>Pinus nigra</i> Arn.	4	8.4	22.05.2021	2	n/a	1
32	<i>Quercus pubescens</i> Willd.	3.5	5.3	25.05.2021	2	n/a	1
33	<i>Pinus nigra</i> Arn.	6.5	8	10.06.2021	2	2	1
34	<i>Populus</i> sp.	6.3	8	13.05.2022	2	n/a	0
35	<i>Quercus pubescens</i> Willd.	3.2	4.5	15.05.2022	1	n/a	n/a
36	<i>Pinus nigra</i> Arn.	6.2	9	10.06.2022	0	n/a	n/a
37	<i>Ulmus</i> sp.	4.3	5	11.06.2022	0	n/a	n/a
38	<i>Robinia pseudoacacia</i> L.	3.5	4.5	20.07.2022	n/a	2	1
39	<i>Quercus pubescens</i> Willd.	3	5	20.07.2022	n/a	1	1
40	<i>Quercus pubescens</i> Willd.	4	5	21.07.2022	n/a	1	1
41	<i>Quercus cerris</i> L.	6	8.5	21.07.2022	n/a	2	1

Discussion

The results of our study on arrival times confirm those of the most recent studies in Bulgaria and other parts of Europe (Baptista et al. 2015, Gruychev 2017, Gruychev and Mihaylov 2019). However, we do not have registered early arrivals – at the beginning of April as reported in studies at the end of the last century (Simeonov et al. 1990). The period of data collection shows that in the spring Turtle doves arrive in large numbers in the second half of April (Table 1). The autumn migration of the species is occurring in the second half of September. During the monitored period we have no individual recorded in October. Our study shows a shortening of the stay time of Turtle doves in Bulgaria, compared to the data from the end of the last century (Simeonov et al. 1990).

Here we reported two peaks of fledglings – end of June and second half of July, which indicates likely 2 clutches of the species. Although there are sightings of late-breeding single Turtle doves in August, we still have no evidence of a

definite third nesting in Bulgaria. Our results are in agreement with the already known data from earlier research (Simeonov et al. 1990, Nankinov 1994, Browne and Aebischer 2004, Baptista et al. 2015, Gruychev 2017, Gruychev and Mihaylov 2019).

The average height at which the nests were located was 4.6 m, about 1 m lower than those found in Sakar (Gruychev 2017). The average height of the trees is also lower – 6.6 m. However, the values of these heights fall within those reported in other studies for Europe (Patev 1950, Nankinov 1994, Browne and Aebischer 2004, Browne et al. 2005, Gruychev 2017, Squalli et al. 2022). The height of the nests is positively related to the height of the trees on which they are located. This strategy is related to protecting the nests from terrestrial predators (Guan et al. 2018, Carboneras et al. 2022, Squalli et al. 2022), and in some parts of the range also from reptiles (Mansouri et al. 2020b, Mansouri et al. 2021). A similar correlation between nest and tree height has been reported in other parts of the species range

(Aitouakli and Bensaci 2021).

Breeding success in our study was 82.76 %. Breeding success of Turtle doves in different parts of Morocco was reported to be between 73.8 % and 86.1 % (Hanane and Baamal 2011, Mansouri et al. 2020a). In Algeria mean breeding success was 74.68 % (Aitouakli and Bansaci 2021), in Extremadura, Spain it was 53 %, in Madrid – between 36–58 % (Rocha and Hidalgo 2002). According to recent research in Spain, it was reported as 57 % (Arroyo et al. 2019). The breeding success of Turtle dove in Bulgaria was high, compared to other parts of the species' range for which information is available. Mean clutch size reported in our study was 1.84 eggs/successful breeding pair. This result is higher than the one found for Sakar Mountain between 2014–2016 years (Gruychev 2017). It falls within those reported for the species, being close to that of Morocco (Hanane and Baamal 2011) and higher than for some parts of Algeria, Spain and UK (Browne et al. 2005, Arroyo et al. 2019, Aitouakli and Bensaci 2021). The average brood size for the entire period of the present study was 1.6, with 60 percent of cases having two fledglings and the rest one ($n = 15$, Table 3). This result is in agreement with reports from the UK (Browne et al. 2005).

The higher breeding success in Bulgarian Turtle dove population compared to other populations in Europe shows its importance for the conservation of the species in Europe.

Conclusion

This study reports a shift in the arrival dates of Turtle doves compared to those at the end of the last century. We experience a delay of up to two weeks in some

years in arrival times. The reasons are probably due to factors in the species' wintering grounds. Similar to the known data from previous research, the majority of birds make two broods. According to the collected data, breeding success and clutch size are relatively high. This determines the relatively high reproductive potential of the breeding population of the species in Bulgaria. Likely the limiting factors on the population should be sought in the breeding habitats or along the migration route of the species.

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Authors' statement

The present study was conducted in accordance with the national legislation. Data were collected with a permit issued by the Minister of the Ministry of Agriculture, Food and Forestry of Bulgaria.

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