

## Habitat and Nest Site Selection of the European Rollers in the Northern Anatolia

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### ABSTRACT

In this study, habitat preferences of the European Rollers (*Coracias garrulus*) in the Northern Anatolia was investigated, in 2014 breeding season. Total of 31 breeding pairs in 4 certain roller sites were located. The average distance between the breeding territories was 1.2 km in one of the roller sites with 17 pairs. Both solitary and colonial breeding pairs were recorded. Overall, 8, 2 and 2 nests (total of 12 nests) were located on sand quarries, concrete buildings and abandoned magpie nests on electrical poles, respectively. The habitat preferences were determined within a radius of 300 m and 1000 m around the nest site for the breeding and foraging habitats, respectively. We conducted the spatial analysis in ArcGIS 10.5 using Corine Land Cover 2012 database. Agricultural areas were the major land cover types where the European Rollers breed in our study. Use of unfavorable habitats and other nest sites including magpie nests necessitated a conservation program for the European Rollers in the study area.

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## Gökkuzgunların Kuzey Anadolu'daki Habitat ve Yuva Yeri Seçimi

### ÖZET

Bu çalışmada, gökkuzgunların 2014 yılı üreme döneminde Kuzey Anadolu'daki habitat tercihleri değerlendirilmiştir. 4 ayrı üreme bölgesinde toplam 31 adet çift tespit edilmiştir. 17 çiftin bulunduğu üreme alanında yuvalar arasındaki ortalama mesafenin 1.2 km olduğu belirlenmiştir. Çalışma alanı içinde hem soliter çiftler hem de kolonyal halde üreyen çiftler kaydedilmiştir. 8 tanesi toprak yarlarda, 2 tanesi beton binalardaki oyuklarda, 2 tanesi de elektrik direklerinde bulunan saksığan yuvalarında olmak üzere toplam 12 adet aktif yuva yeri tespit edilmiştir. Gökkuzgunların üreme ve beslenme habitatı tercihleri sırasıyla 300 ve 1000 m yarıçaplı alanlarda değerlendirilmiş ve alansal analizler ArcGIS 10.5 programında Corine Land Cover 2012 veri tabanı kullanılarak gerçekleştirilmiştir. Tarım arazilerinin, çalışma alanı içindeki gökkuzgunların ürettiği alanlarda en önemli arazi örtüsü tiplerini oluşturduğu belirlenmiştir. Gökkuzgunların saksığan yuvaları gibi uygun olmayan yuva yerlerini ve uygun olmayan habitatları kullanmaları çalışma alanında bu türe yönelik bir koruma programının gerekliliğini ortaya koymaktadır.

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### INTRODUCTION

The European Roller, *Coracias garrulus* is the merely European member of Coraciidae, a migratory bird. These obligatory secondary cavity-nesters breed from north western of Africa to west of Himalayas in temperate, steppe and Mediterranean zones. They winter in the Afro-tropical region (Snow and Perrins,

1997).

The European Rollers were categorized as Near Threatened by the IUCN between 2005 and 2012. Even though the current status of the species is Least Concern, the population is still thought to be declining (BirdLife International, 2018). They have been categorized as Declining by the European Threat

Status and classified as SPEC 2 (BirdLife International, 2017). The European Rollers are confronted important threats such as habitat change, illegal trapping and hunting in their distribution range including migration routes. Furthermore, due to their feeding habits on insects and their behavior of using the electric wires as hunting perches, they are at indirect poisoning and electrocution risk (Tokody et al., 2017).

The European Rollers breed in almost entire Turkey (Boyla et al., 2019). The population is apparently experiencing declines and is categorized as Least Concern (Kirwan et al., 2008).

It is estimated that the biggest population of about 12000-30000 breeding pairs exists in Turkey among 35 European countries but the populations in Turkey have been faced to significant declines (Kovacs et al., 2008). The loss of suitable breeding habitats is thought to be one of the main factors causing the population declines in Europe (Tucker et al., 1994). In secondary cavity-nesting birds, such as the rollers, habitat destruction (Holt and Martin, 1997) and nest-site restriction (Newton, 1994) are considered as the most important reasons of population declines. Therefore, understanding the distribution of breeding pairs and habitat preferences of threatened bird species, such as the European Rollers, is very important, particularly in their key breeding range. Within this scope, we determined the foraging and breeding habitat preferences and nest site selection of the European Rollers in Çorum province of the

Northern Anatolia.

## MATERIAL and METHOD

The study was conducted in Çorum province (40° 33' N - 34° 57' E) of the middle of Black Sea Region with continental climate. The presence of the breeding pairs were investigated using the road transect method in current study area from the end of April to mid-August. Total of 203 km was driven to locate the rollers (Figure 1.). When we see the individuals, we recorded EBCC breeding codes (Hagemeijer and Blair, 1997) and we considered the ones that were categorized as probable and confirmed breeding.

Total of 4 roller sites were defined including Şekerbey [SEK], Gölün yazı [GOL], Seyfe [SEY] and Gökgezler [GOK] (Figure 1.) and each site was visited weekly throughout the breeding season. The distances were measured to the nearest neighbor roller point to calculate the average distance between territories in each of the roller sites using packages sf (Pebesma, 2018) and ngeo (Dorman, 2018) in R 3.4.1 (R Core Team, 2017). Also, the nests were searched in breeding territories. Once nests were found, nest site type was recorded and height of each one from the ground was measured.

Foraging habitat preferences were determined within the buffer areas of 1000 m around the nest sites considering the home range (Robel, 1998) and foraging area sizes (Tienfenbach, 2009).

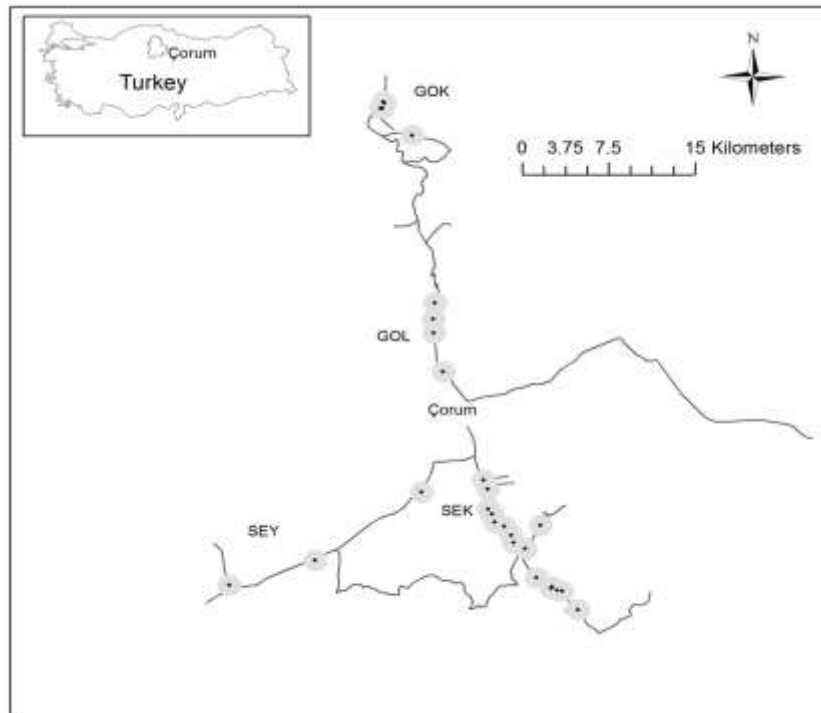


Figure 1. Study area and 4 roller sites (Şekerbey [SEK], Gölün yazı [GOL], Seyfe [SEY], Gökgezler [GOK]). Dots and grey circles show the nests or frequently used perches by the rollers and 1000 m buffers.

Where we could not find the nest, we assumed that the frequently used perch sites by the breeding pairs as the center points for the buffers. Corine Land Cover 2012 database in ArcGIS 10.5 was used. The ratios of each land cover type in foraging areas were calculated. Breeding habitat preferences were determined using same method as foraging sites with 300 m buffers around the nests.

All descriptive analyses were conducted in R (version 3.4.1). The mean values with standard error (se), and range and sample size (n) were presented. Land cover type ratios in breeding and foraging habitats were compared using Z test.

## RESULTS

The early individuals were observed on May 11 in the study area. Total of 31 breeding pairs were observed (Table 1.). Both solitary (n=24) and colonial breeding (n=7) pairs were detected in the study area. In GOK, a colony of five pairs used the holes on a scarp which was about 13 m height and 450 m length and carved out by removing the soil (Figure 2.). The distance between the nest holes was 42 m (n=5, se=25 m, range=12-139 m). A second relatively small colony of 2 pairs was 500 m apart from the first one. The small colony was on the scarp which was about 9-10 m in height and 35 m in length.

**Table 1.** Breeding codes for the roller pairs in the study area.

Breeding code	Number of pairs
B.3 Pair observed in suitable nesting habitat in breeding season	3
B.4 Permanent territory presumed through registration of territorial behavior (song, etc.) on at least two different days a week or more apart at same place	10
B.5 Courtship and display	2
B.6 Visiting probable nest-site	1
C.12 Recently fledged young (nidicolous species) or downy young (nidifugous species)	3
C.13 Adults entering or leaving nest-site in circumstances indicating occupied nest (including high nests or nest holes, the contents of which cannot be seen) or adult seen incubating	11
C.14 Adult carrying a fecal sac or food for young	1



Figure 2. The colony site of the European Rollers

The average distance between breeding territories was 1.2 km (n=17, se=0.3, range=0.13-5.5 km) and 2 km (n=4, se= 0.6, range=1.3-3.8) in SEK and GOL, respectively. In SEY, there were only two solitary breeding pairs. The distance between these pairs was 7.8 km.

Total of 12 nests were located. While 2 breeding pairs used old magpie nests at 10 m height from the ground on electric poles, other 2 breeding pairs used holes in the concrete buildings (a small factory and a house) at 4.5 and 9 m in height from the ground, respectively. We discovered one of the pairs' nest at 3.3 m above from the ground in a small colony of Bee-eater, *Merops apiaster*, on a sandy bank of a dry creek. Seven nests were formed the colonies on scarps.

Non-irrigated arable land was the most common land cover type in both foraging and breeding habitat of the rollers. The percentages of each land cover type in foraging and breeding areas is given in Table 2.

## DISCUSSION

The European Rollers breed solitarily and colonially in our study area. The solitary pairs were relatively close to each other in the sites (Figure 1.). Five pairs used a scarp as colony site. European Rollers are territorial birds that exhibit attractive aerial display for announcing their territory (Snow and Perrins, 1997; Robel, 1998). Nevertheless, it is known that sometimes they form groups of 3-5 pairs in woodpecker nest holes (Sosnowski and Chmielewski, 1996) of more than 10 pairs in cavities of artificial constructions, like bridges (Václav et al., 2011). On the other hand, it is also questionable that if the colonial breeding is favorable for the rollers (Poole, 2007).

The European Rollers prefer to breed in the abandoned nests of woodpecker species' (Bouvier et al., 2014; Sackl et al., 2004) as well as in cavities which are on adobe building in some of their breeding

Table 2. Comparison of land cover ratios for foraging and breeding habitats of the rollers using Z test.

Land cover type	Foraging Area (%)	Breeding Area (%)	PValue
Non-irrigated arable land	40.4	55.3	<0.0000
Permanently irrigated land	26.0	9.1	<0.0000
Land principally occupied by agriculture, with significant areas of natural vegetation	13.6	30.1	<0.0000
Sparsely vegetated areas	5.5	4.0	0.2848
Rice fields	5.1	0.4	<0.0000
Natural grasslands	3.0	0.0	0.0021
Others (complex cultivation patterns, industrial or commercial units, pastures, vineyards, discontinuous urban fabric)	6.2	1.1	<0.0000

areas within their distribution range (Catry et al., 2011). In our study area, besides the concrete buildings and an active Beas Eater colony site, Magpie nests are served as nest sites for the rollers. Previously, an unusual nest site in a White Stork nest was reported (Avilés and Costillo, 1997), but, to the best of our knowledge, Magpie nests are not used by the rollers in any of their breeding range. These unusual nests might be related to the limitation of their nest sites. Since Magpie nests also attracted the Kestrel pairs, the cost of this preference is thought to be high. Competition for the nest sites between rollers and other similar sized secondary cavity nesters were reported previously (Durango, 1946; Václav et al., 2011). Moreover, for cavity nesters such as rollers, the suitability of magpie nests is arguable. In the vicinity of the sites where magpie nests were used by the rollers there were some dry riverbeds. This area might be a traditional breeding site of rollers. With the increase of human activities related to agricultural practices might be forced the rollers to use these unsuitable but probably safer nest sites which were high from the ground.

We studied the habitat selection of the European Rollers in two scales, namely foraging and breeding area. In our study area, the percentage of agricultural areas (non-irrigated arable land, permanently irrigated land, land principally occupied by agriculture with significant areas of natural vegetation) were very high in both foraging (80%) and breeding (94%) habitats of the European Roller. However, the percentage of these land cover types was quite different for foraging and breeding areas, especially for major habitat types in our study area (Table 2). More than half of the breeding area consisted of non-irrigated land and the percentage of this land cover type was significantly higher for the smaller scale area than foraging area. Here, natural vegetation together with agricultural area around the nest might play an important role on nest site selection. The importance of the traditional agricultural areas is also underlined in some studies (Catry et al., 2011).

According to Avilés and Parejo (2004) meadows were the most suitable habitats for the rollers because of sustaining food source (Bouvier, 2014). Based on a nest box population study, cereal fields were avoided by the rollers (Avilés et al., 2000). Moreover, breeding in agricultural areas might have a negative effect, including predator treat or low breeding population. Sackl et al. (2004) suggested that the use of pesticides might be one of the reasons for the declining of the European Roller population in Europe. As a result of the habitat destruction by the climate change, inappropriate water management and agricultural practices, and the human disturbances; the rollers might tend to breed in new areas within a close proximity to their traditional breeding areas. In addition, the distribution of the rollers might be related to the locations of dry riverbeds where they used as breeding sites previously, rather than agricultural areas. Finally, the electric poles and wires, which serve as hunting perches in breeding area, might be another factor effecting their habitat preferences (Tiefenbach, 2009).

It is obvious that the European Roller population have been faced the habitat loss in Çorum. So, the determination of breeding areas of rollers in Turkey and application of an immediate and efficient conservation plan for their key populations is essential for the future.

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