

Comparative characteristics and ecological features of rollers (coraciiformes) in Uzbekistan

Fakhriddin Kholboev^{1*}, Oybek Mamarakhimov¹, Oygul Abdumuminova¹, Roza Shausmanova¹, Muzraf Rabbimov², and Lola Ortiqova²

¹National University of Uzbekistan, Tashkent, 61010333, Uzbekistan

²Jizzakh State Pedagogical University, Sharof Rashidov street 4, 130100, Jizzakh, Uzbekistan

Abstract. This paper comparatively studies and analyses the ecological characteristics of four species belonging to the order Coraciiformes (*Coracias garrulus*, *Alcedo atthis*, *Merops apiaster*, *Merops persicus*) that are widely distributed in Uzbekistan. Additionally, the frequency, feeding behaviour, nesting station distribution, unique reproductive cycles, economic importance, distribution areas, and dynamics of these species are thoroughly presented. By identifying the mutual similarities and differences in the ecological characteristics of these species, the paper aims to contribute their conservation and in urgent cases, the management of their behaviour. Notably, in recent years, the illegal hunting of *Merops apiaster* and *Merops persicus* species, belonging to the genus *Merops*, to mitigate the damage caused to bee farms and the destruction of their nests has negatively impacted other species within the genus.

1 Introduction

Over the past few decades, mankind has faced numerous environmental challenges, including global warming, agricultural pollution, misuse of natural resources, and natural habitat destruction and degradation [1]. Similarly, in the context of a warming climate and increasing human activities, conservation and maintaining the sustainability of the bird population must be essential assets for human beings [2, 3]. Despite the fact that this issue has drawn significant attention at the international scale, some species of birds have sharply decreased in number and their protection status has changed, particularly in recent years [4]. For instance, the European roller (*Coracias garrulus*), the common kingfisher (*Alcedo atthis*), the European bee-eater (*Merops apiaster*), and the blue-cheeked bee-eater (*Merops persicus*) could be the vivid examples of these species belonging to the Coraciiformes family. In turn, these birds are confronting unprecedented challenges due to increasing human activities and impacts on their habitats [5]. In order to eliminate these issues, protection measures are required. However, insufficiency of in-depth studies on their significance in nature as well as economy could make it challenging to implement such measures. Therefore, detailed studies are necessary in areas where the bird population is facing environmental challenges.

* Corresponding author: xolboevfakhriddin66@gmail.com

Although the European roller (*Coracias garrulus*), the common kingfisher (*Alcedo atthis*), the European bee-eater (*Merops apiaster*), and the blue-cheeked bee-eater (*Merops persicus*) share the same ecological features, they might present slight difference in some respects. By identifying the mutual similarities and differences in ecological features, potential opportunities could be created to determine and evaluate the importance of these species and to develop appropriate measures for their protection. In past few decades, the countries with highly developed beekeeping have witnessed that bee-eater (*Merops apiaster*) and blue-cheeked bee-eater (*Merops persicus*) might have a detrimental impact on bees. In many cases, this problem is caused by insufficient assessment impact of these species on economy. From this point of view, a detailed study of the ecology of the species and an assessment of their importance in nature and economy is necessary.

So far, numerous studies have been performed on bioecological characteristics of the species belong to the rollers (Coraciiformes) in developed countries. For instance, H. M. Alfallah et al studied the feeding behavior of *Merops apiaster* with *Apis mellifera*, its predation relationship in Libya. According to their studied, on average 90.8% of the birds' diet is made up of bees, 9.2% of hard-winged insects [6]. P. Heneberg studied the influence of the soil composition on burrow nest birds in Central Europe (Riparia riparia, *Merops apiaster*, *Alcedo atthis*) and pointed out that soil hardness or soft soils could be the preventive factors of birds' nesting [7]. I. Smally et al., conducted research on the impact of soil properties on the nesting behavior of *Merops apiaster* [8]. H. Hoi et al., claimed in his research that the reproductive efficiency of *Merops apiaster* highly correlates with the size of the nest colony [9]. S. M. Kossenko et al., determined the mutual competition of Bee-eater and Blue-cheeked Bee -eater in mixed colonies of *M. apiaster* and *M. persicus*, its causes and consequences [10]. The literature review reveals that the majority of these studies have focused on the distribution areas, nesting characteristics of the species [11]. However, the ecological characteristics of these species in the case of Uzbekistan have been poorly studied or have not been sufficiently studied.

Hence, at present, it is of great scientific and practical importance to determine the distribution of species in local areas, their number and dynamics in different biotopes, their importance in nature and economy, and the development of measures to control the behavior of problematic species [12, 13]. Considering this, the current study focuses on ecological and distributional characteristics, their importance of these species. Also, the study considers the nesting areas, morphological characteristics of their chickens, the ways they use to catch their preys, and their occurrence in Uzbekistan. By identifying mutual similarities and differences in ecological features, we could have potential opportunities to determine and evaluate the importance of these species and to develop appropriate measures for their protection.

2 Materials and methods

This study was carried out in Tashkent, Fargona, Samarkand, Bukhara, Surkhandaryo, and the republic of Karakalpakstan from 2021 to 2024. The data on the occurrence characteristics, distribution, number dynamics, reproduction and feeding behavior and other necessary elements were collected from natural landscapes, agrocenoses, residential areas, areas where bee farms are located, and bird nesting stations. As extra materials, copies of the roller (Coraciiformes) species series preserved in the ornithological collection funds of the museums of Uzbekistan were utilized. Generally accepted methods used in the field of ornithology were used in the collection and processing of materials. In particular, when determining the number of birds per unit of area, based on the characteristics of the environment in which they are found, calculations were carried out based on route and stationary methods.

3 Results and Discussion

The similarity of ecological characteristics of the rollers creates an opportunity to live and spread in a similar environment. By comparing the ecological features of the rollers, it was found that their behavior in the process of finding food, the nature of meeting, distribution in habitats, places for nesting, are nearly similar. Thus, similarities and differences in the distribution areas of the species were studied and analyzed in this study. Also, in the ponds belonging to “DAMACHI” specializing in fishing, the Bozsu canal passing along the edge of the ponds, and in the gorge formed on the bank of the canal, the roller (*Coracias garrulus*), the bee-eater (*Merops apiaster*), the blue-cheeked bee-eater (*Merops persicus*), the kingfisher (*Alcedo atthis*) have been found.

The Euroasian roller was observed mainly in natural and partially modified landscapes, the kingfisher in all types of clear and slow-flowing water bodies and their coastal zone, and both species of woodpeckers were observed mainly in cultivated and partially modified landscapes. This situation could be explained by their choice of similar habitats due to the mutual similarity of the ecological characteristics of Coraciiformes.

Nesting sites were studied, and it was found that both species of the Euroasian roller and the blue-cheeked bee-eater choose exactly similar sites. For example, it was found that the bee-eater and the the Euroasian roller nest in the same cliff in Koshrabad district of Samarkand region, Nurota of Navoi region, Zangiota and Bekobad districts of Tashkent region. Nesting of the common kingfisher was not observed in such cliffs. Nests of this species were found in shallow places on the banks of water bodies. In both species of the blue-cheeked bee-eaters, unlike other species of the genus, a thick pack was observed under the heel joint of chicks. When they were adults, it was found that such packaging was not found. Such packaging makes it easy for the chicks to move back and forth in the nest. Such an adaptation was evaluated as one of the adaptations typical of birds that make nests by digging nests in the soil (table 1).

Table 1. Ecological characteristics of the studied species

Species	Ecological characteristics				
	Distribution area	Nesting sites	The chickens with packs	Catching the bait	Natural occurrence
The roller (<i>Coracias garrulus</i>)	Mostly natural or modified landscapes	Cliffs	No packs	In the air	Migratory
The kingfisher (<i>Alcedo atthis</i>)	All types of clean and slow-flowing water bodies	Water banks	No packs	At the water surface	Sedentary
The bee-eater (<i>Merops apiaster</i>)	Mostly cultural and modified landscapes	Cliffs	Pack	In the air	Migratory
The blue-cheeked bee-eater (<i>Merops persicus</i>)	Mostly cultural and modified landscapes	Cliffs	Pack	In the air	Migratory

Almost all of the studied species (except the kingfisher) are adapted to catch their prey in the air, and the kingfisher is adapted to catch its main food (which is fish) in the water. Despite that, there are some similarities between air and water foraging. For example: in both types, the appropriate prey is eaten by birds; tries to catch the targeted prey at high speed; the captured prey is eaten by landing on a tree or similar substrate.

According to the nature of the occurrence, all of the studied species are migratory (nesting) species for Uzbekistan, while the kingfisher is local species. In recent years, in Uzbekistan and in many countries with developed beekeeping, bee farms have been seriously affected by the bee-eater (*Merops apiaster*) and the blue-cheeked bee-eater (*Merops persicus*), and in order to limit the number of these species, the practice of exterminating them in various ways has been used. Such negative situations occur as a consequence of not correctly and objectively assessing the importance of the listed species in nature and economy.

4 Conclusion

Based on the above, it can be concluded that in the conditions of Uzbekistan, opportunities for the protection and behavioral management of species belonging to the Coraciiformes family will be created through a comparative study of their ecological characteristics. Today, species in this category are severely impacted by various anthropogenic factors (e.g., nest and chick destruction, shooting in bee farms, etc.). Recommendations aimed at preventing these negative impacts are as follows: (1) By recultivating old quarries around bee farms or relocating them to areas that prevent beehives from building nests, and, as much as possible, avoiding placing beehives near cliffs, steep rocks, collectors, ditches, or places where bee colonies are located. (2) Taking into account that the blue-cheeked bee-eater is strongly dependent on nesting sites during the reproductive cycle and remains relatively stable, while in the post-reproductive cycle, it migrates in large swarms, feeding on bees. Protecting them involves moving them until August to prevent harm from bees. (3) When placing beehives, choose areas without wires, pipes, dead trees, or thick vegetation around them. Installing hives on cypresses and other communication poles reduces the chances of bees moving and being caught. (4) Identifying hornet colonies located within at least 3-5 km from bee farms by April, closing the nest holes, and thereby creating unfavorable conditions for hornets to build nests in such areas. This encourages them to select other nesting locations. (5) Introducing bioacoustic repellents as a deterrent to prevent the blue-cheeked bee-eater from gathering in bee farms. (6) Limiting reproduction by preventing the shooting of blue-cheeked bee-eaters with various hunting weapons, destroying their nests with nets, and completely prohibiting the killing of eggs and chicks. These actions should be classified as illegal hunting.

References

1. Boltabaev et al. Identification of the major insect pests and their biological characteristics in apple orchards (Uzbekistan). *BIO Web Conf.* **126**, 01006 (2024). <https://doi.org/10.1051/bioconf/202412601006>
2. F. Shodiyeva. Current status of birds of the genus of beam (*Merops*) in Uzbekistan. *Int. Sci. Res. J.* **3**(6), 745-750 (2022).
3. Shodieva F.O., Kholboev F.R. Distribution, ecology and significance of the genus beeter (*Merops*) in Uzbekistan // *International Journal of Research Publications (IJRP.ORG)*, 2021,-Vol. **84**, Iss. 1. ISSN: 2708-3578, pp. 209-214.

4. J.P. Silva, A.T. Marques, C. Carrapato et al. A nationwide collapse of a priority grassland bird related to livestock conversion and intensification. *Sci Rep*, **13**, 10005 (2023). <https://doi.org/10.1038/s41598-023-36751-8>
5. L. Yang, H. Xu, S. Pan, W. Chen, J. Zeng. Identifying the impact of global human activities expansion on natural habitats. *J. Clean. Prod.* **434**, 140247 (2023). <https://doi.org/10.1016/j.jclepro.2023.140247>
6. H.M. Alfallah, M. Alfituri, M. Hmuda. The impact of Bee eater *Merops apiaster* on the behavior of honey bee *Apis mellifera* L. during foraging. *Mansoura J. Plant Prot. Pathol.* **1**(12), 1023-1034 (2010).
7. P. Heneberg. Soil penetrability as a key factor affecting the nesting of burrowing birds. *Ecol. Res.* **24**(2), 453–459 (2008). <https://doi.org/10.1007/s11284-008-0520-2>
8. I. Smalley, K. O’Hara-Dhand, S. McLaren, Z. Svircev, H. Nugent. Loess and bee-eaters I: Ground properties affecting the nesting of European bee-eaters (*Merops apiaster* L.1758) in loess deposits. *Quatern. Int.* **296**, 220–226 (2012). <https://doi.org/10.1016/j.quaint.2012.09.005>
9. H. Hoi, C. Hoi, J. Kristofik, A. Darolova. Reproductive success decreases with colony size in the European bee-eater. *Ethol. Ecol. Evol.* **14**(2), 99–110 (2002). <https://doi.org/10.1080/08927014.2002.9522749>
10. S.M. Kossenko, C.H. Fry. Competition and coexistence of the European Bee-eater *Merops apiaster* and the Blue-cheeked Bee-eater *Merops persicus* in Asia. *Ibis.* **140**(1), 2–13 (1998). <https://doi.org/10.1111/j.1474-919x.1998.tb04535.x>
11. J. Avilés, J. Sánchez, A. Sánchez, D. Parejo. Breeding biology of the Roller *Coracias garrulus* in farming areas of the southwest Iberian Peninsula. *Bird Study.* **46**(2), 217–223 (1999). <https://doi.org/10.1080/00063659909461133>
12. M. Manzoor, M. Zafar, T. Yaqoob, M. Ahmad, M. F. Ramadan, A. T. Althobaiti, et al. (2023). Micromorphological sculptural diversity in foliar epidermis and trichomes features among invasive species. *Microsc. Microanal.*, **29**(4), 1531–1555. <https://doi.org/10.1093/micmic/ozad063>
13. S. Jabeen et al. Micrometer insights into *Nepeta* genus: Pollen micromorphology unveiled. *Micron.* **177**, 103574 (2023). <https://doi.org/10.1016/j.micron.2023.103574>