



POPULATION AND SEASONAL DYNAMICS OF THE INDIAN SPARROW (*PASSER INDICUS* JARDINE ET SELBY, 1831) IN DIFFERENT BIOTOPES OF THE LOWER REACHES OF THE ZERAVSHAN RIVER

Orifov S. B.

Doctoral Student, Department of Zoology,
National University of Uzbekistan

Shodiev B. D.

Independent Researcher, Department of Ecology,
National University of Uzbekistan

Kholboev F. R.

Professor, Department of Zoology,
National University of Uzbekistan

Abstract

This article examines the ecological characteristics and significance of the Indian sparrow (*Passer indicus*) in the lower reaches of the Zeravshan River. Data on distribution, abundance, seasonal dynamics, nutrition, the species' role in nature and agriculture, and determining factors are analyzed. The study was conducted from 2020 to 2025 in the Bukhara, Navoi, and Kashkadarya regions of Uzbekistan. The species' specific features are attributed to changes in habitat, life cycle, environmental conditions, and trophic relationships.

Keywords: Biotope, indian sparrow, biodamage, reproductive cycle, trophic links, winter wheat, nesting station, hyperphagy, lipogenesis.

Introduction

The Indian sparrow (*Passer indicus*), like other species within the genus *Passer*, is considered a problematic species due to its detrimental impact on agriculture within its range, including Central Asia. Data on the current status of this species in the lower reaches of the Zeravshan River, encompassing migration timings, distribution, population size, reproduction, feeding habits, and its role in ecosystems and agriculture, are virtually absent from the literature [1, 2, 5, 10]. Investigating the ecological characteristics of the Indian sparrow holds significant relevance for understanding evolutionary changes and developing measures to mitigate damage to agricultural crops.

Materials and Methods

Research materials were collected between 2020 and 2025 in Uzbekistan, specifically in the lower reaches of the Zeravshan River (Bukhara, Navoiy, and Qashqadaryo regions). Studies were conducted across various biotopes where the Indian sparrow (*Passer indicus*) is widely distributed, including urban areas, district centers, agroecosystems, nesting stations, and others. Standardized methodologies [3, 4] were employed to determine bird density per unit area. Particular attention was given to the life cycles of the Indian sparrow when selecting biotopes and conducting surveys, with counts performed thrice monthly in each selected biotope. Surveys utilized transect and point-count methods. For this purpose, stationary plots were established in biotopes subject to counting, and average values were extrapolated to 10 hectares. Bird population data were processed using the formula proposed by N.G. Chelintsev (1985) [7]: $D = n / L \times W$.

To study the structure of nests built in soil, their morphometric characteristics, and condition (presence of eggs or chicks), a USB HY001 endoscope was utilized. Observations were conducted using Viking 10x50 and Balgish 50x50 binoculars. To prevent damage to winter wheat, bioacoustic repellents "KORSHUN-8 PRO" and "SAPSAN-3," along with a newly developed repellent "Distress Signal" based on these, utilizing the calls of local predatory birds (*Accipiter nisus* and *Falco tinnunculus*), were tested. Feeding habits, hyperphagia, and lipogenesis were examined under laboratory conditions through analysis of stomach contents and assessment of their mass.

Results and Discussion

The Indian sparrow (*P. indicus*) in the lower reaches of the Zeravshan River is classified as both a breeding (B) and migratory (M) species. In the study region, spring migration occurs in April (8.IV.2023; 17.IV.2024; 11.IV.2025) from south to north, while mass autumn migration concludes in August, with the last sightings in September (20.VIII.2023; 14.IX.2024).

P. indicus is widely distributed in the lower Zeravshan River region across natural and predominantly cultural landscapes, with its life cycles intricately linked to human agricultural activity. In the study region and throughout Uzbekistan, the species is encountered in large numbers in May, correlating with its spring migration, during which migratory individuals traverse the republic. The sharp decline in population in September is attributed to the completion of autumn migration and the fact that populations breeding in the northern parts of the republic undertake autumn migration in a different direction.

This species exhibits urbo-phobic behavior in the lower Zeravshan, being adapted to life primarily in rural areas and agroecosystems due to limited nesting opportunities in natural landscapes. Primary habitats include agroecosystems and roadside shelterbelts, vegetation along water bodies, abandoned structures, village outskirts, ancient fortresses and hills, cliffs, and quarries.

Population size and dynamics of the Indian sparrow during the breeding season across various biotopes in the region show variable patterns (Table 1).

Table 1. Population size and dynamics of the Indian sparrow in various biotopes of the lower Zeravshan River during the breeding season (per 10 hectares, 2022–2025).

Biotopes	Pre-reproductive cycle	Reproductive cycle	Postreproductive cycle	Average
Cities:				
Bukhara	0,06	0,9	1,2	0,72
Zeravshan	8,4	24,5	36,3	23,06
Uchkuduk	11,8	45,2	52,8	36,60
Agroecosystems:				
Barley	20,3	28,0	9,3	19,20
Winter wheat	44,0	78,3	94,3	72,20
Cotton	4,3	11,6	2,6	6,16
Sunflower	-	-	18,0	6,00
Vegetable/melon crops	2,3	6,3	8,6	5,73
District centers	0,5	2,4	4,8	2,56
Villages	2,9	4,6	7,0	4,83
Edge of agroecosystems and natural landscapes	8,8	12,0	14,7	11,83
Nesting stations	88,3	206,6	55,0	116,63

Note: The cities of Zeravshan and Uchkuduk are not part of the lower Zeravshan River. Counts there were conducted for comparative purposes.

The average density of the Indian sparrow per 10 hectares was exceptionally high at nesting stations (116.63), in winter wheat agroecosystems (72.20), and barley (19.20), but extremely low in Bukhara (0.72) and district centers (2.56). Unlike other cities, the high density in Zeravshan (23.06) and Uchkuduk (36.60) is attributable to the absence of food sources, including agroecosystems, in the vicinity of these cities, as well as limited nesting opportunities [6, 9].

Significant population fluctuations are pronounced in agroecosystems, linked to the maturation of seeds from cultivated plants and weeds, as well as changes in bird behavior during embryonic and post-embryonic cycles. Population size varies considerably, remaining relatively stable only at nesting stations during the reproductive period. Dynamic fluctuations during spring and autumn migrations are driven by local movements associated with nesting site selection and behavior typical of autumn migration.

In the lower Zeravshan, the Indian sparrow occupies nesting sites from April to May. Nests are constructed singly or, more commonly, in colonies. All stages of the reproductive cycle proceed rapidly and are highly organized, occurring nearly synchronously in colonies. Of the nests identified, 97.04% (2101) were colonial, and 2.96% (64) were solitary. Nest distribution was as follows: 40.18% on trees, 22.17% in branch piles, 17.45% on buildings, 9.93% in quarries and cliffs, 7.11% in fortresses and ruins, 2.58% in nests of other birds, and 0.55% in pipes. Average morphometric measurements of eggs were: mass 2.40 g, length 21.04 mm, width 15.02 mm, and shape index 71.35%. Reproductive efficiency in the studied nests averaged 63.59% (56.34–70.84) (Table 2).



Table 2. Reproductive efficiency of the Indian sparrow (*P. indicus*) (n=62)

Quantity and percentage of nests, eggs, and chicks	2024 year	2025 year
Number of nests	42	20
Total number of eggs in nests	271	126
Average number of eggs per nest	6,45	6,30
Number of hatched chicks	228	94
Percentage of dead eggs	15,86	25,39
Number of fledged chicks	192	71
Percentage of dead chicks	15,78	24,46
Overall reproductive efficiency (%)	70,84	56,34
Number of chicks per adult bird	2,28	1,77
Percentage of eggs and chicks that died before fledging	29,16	43,66

Reproductive efficiency of the Indian sparrow in the study region was 70.84% in 2024 and 56.34% in 2025. The average number of chicks per adult was 2.12 (2.28 in 2024, 1.77 in 2025). The difference between the percentage of dead eggs and chicks was minimal (15.86% and 15.78% vs. 25.39% and 24.46%), though interannual variations were substantial.

The dietary regime of the Indian sparrow is conditionally divided into four groups: plant seeds, invertebrates, anthropogenic food waste, and gastroliths. Plant seeds form the dietary mainstay, with the proportion of insects increasing slightly during the reproductive period.

Distinct features, the significance of hyperphagia and lipogenesis in the life of the Indian sparrow and similar migratory species, as well as changes resulting from these processes, were identified. Hyperphagia and lipogenesis manifest in alterations in bird behavior, trophic interactions, stomach mass and condition, and fat accumulation in internal organs. Studying these changes provides a basis for understanding hyperphagia and lipogenesis processes and assessing their role in bird migration (Table 3).

Table 3. Seasonal changes in the weight of the muscular stomach of the Indian sparrow (*P. indicus*) due to hyperphagia and lipogenesis (n=60).

Month	Average total stomach mass (with food, g)	Average net stomach mass (g)	Average food mass in stomachs (g)
May	0,59 (0,57-0,62)±0,02	0,54 (0,52-0,56)±0,02	0,05 (0,01-0,08)±0,02
June	0,63 (0,61-0,65)± 0,02	0,55 (0,54-0,56)±0,01	0,07 (0,07-0,09)±0,01
July	0,68 (0,60-0,64)± 0,02	0,62 (0,60-0,64)±0,02	0,05 (0,03-0,08)±0,02
August	0,76 (0,73-0,83)± 0,03	0,68 (0,68-0,70)±0,01	0,08 (0,05-0,14)±0,03

Analyses revealed that, as a result of hyperphagia and lipogenesis, the net stomach mass increased from 0.54 g (May) to 0.68 g (August), a 25.92% gain. The increase in stomach mass is attributed to the thickening of its walls and the formation of a fat layer around them.

The significance of the Indian sparrow in the lower Zeravshan is defined by its role in human agricultural activity. This species damages winter wheat starting from the milky-waxy maturity phase, consuming and impairing the crop. Damage is particularly noticeable in fields bordering natural biocenoses and at field edges. Awned wheat sustains less damage than awnless varieties.

Naturally, field location, area, and surrounding conditions (presence of nesting colonies, trees and shrubs, and anthropogenic impact) play a critical role.

To date, no measures have been developed to prevent damage caused by the Indian sparrow to grain crops [8, 11]. Developing effective methods to manage its behavior remains a pressing issue. Primary reasons include the species' high adaptability, instability of feeding sites, group feeding behavior, and insufficient understanding of its ecology.

It is known that chemical agents used to control birds pose various problems, including threats to other "species. In our studies, bioacoustic repellents "KORSHUN-8 PRO" and "SAPSAN-3" were tested against the Indian sparrow. Results from trials conducted at feeding and nesting sites indicated low effectiveness of these repellents. Based on data from bioacoustic repellents, we developed the "Distress Signal" repellent, utilizing calls of local predatory birds (*Accipiter nisus* and *Falco tinnunculus*). When applied against the Indian sparrow, this repellent demonstrated relatively high effectiveness. This can be explained by variations in the reaction of populations distributed across different regions to predator calls. The effectiveness of bioacoustic repellents depends on the quality of recorded sound, duration of broadcast, and bird life cycle, imparting a variable character. Such bioacoustic repellents exhibit high effectiveness when used at the initial stage of the reproductive cycle in nesting colonies.

Conclusions

The Indian sparrow in the lower Zeravshan River is a migratory species that breeds in the region for six months. Despite rare encounters of individuals in natural landscapes, its life is entirely tied to anthropogenic activity. Primary habitats include agroecosystems, roadside barriers, abandoned structures, village outskirts, ancient fortresses, cliffs, and quarries. Density per unit area is maximal at nesting stations and in winter wheat fields, minimal in cities and district centers. Nests are predominantly colonial (97.04%), most frequently on trees (40.18%), in branch piles (22.17%), on buildings (17.45%), in quarries and cliffs (9.93%), as well as in fortresses, nests of other birds, and pipes. Reproductive efficiency averages 63.59%, varying annually (70.84% in 2024, 56.34% in 2025) depending on climatic factors. The average number of chicks per adult is 2.12. Changes in behavior, trophic interactions, stomach mass and condition, and fat accumulation in internal organs are driven by hyperphagia and lipogenesis. Net stomach mass increases from May to August by 25.92%. The Indian sparrow damages winter wheat starting from the milky-waxy maturity phase, with the extent of damage depending on field location, area, and surrounding environment. The bioacoustic repellent "Distress Signal", based on calls of local predatory birds, showed high effectiveness in reducing crop damage. This is attributed to individual variations in the perception of sound signals among populations distributed across different regions.

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