Naveen Shodh Sansar (An International Refereed / Peer Review Multidisciplinary Research Journal)
RNI No.- MPHIN/2013/60638, ISSN 2320-8767, E- ISSN 2394-3793, Scientific Journal Impact Factor (SJIF)- 8.054,
July to September 2025, E-Journal, Vol. I, Issue LI (51), ISO 9001:2015 - E2024049304 (QMS)

A Brief Study of Nesting Material and Nesting Behaviour in Pigeon (*Columba livia*)

Dr. Balram Das* **Shree Ram Rolaniya****

*Asst. Prof (Zoology) Govt. PG College, Amarpatan (Satna) (M.P.) INDIA
** Research Scholar, JRF (Zoology) Awadhesh Pratap Singh University, Rewa (M.P.) INDIA

Abstract: In addition to describing important behavioural patterns during nest construction and incubation, including parental behaviour, this study explores the kinds of nesting materials that *Columba livia* use. To learn more about material preference and nest site selection, observations were made over a three-month period in a variety of urban environments, such as rooftops, balconies, and building ledges. The findings show that pigeons build their nests mostly using any easily accessible resources, such as twigs, leaves, plastic strips, and other man-made items. Nesting behaviour is characterized by careful selection of materials, repeated arrangement of structural components, and strategic site selection that provides protection from predators and harsh environmental conditions. The most favoured elements found to be the primary cause of this pigeon's population growth were nest safety, the development of young, and a good supply of nesting material at specific nesting sites. By showing that pigeons adapt by using man-made garbage in nest construction, the study further emphasizes how urbanization affects the availability of materials. These discoveries advance our knowledge of bird adaptability and have ramifications for conservation and urban wildlife management strategies.
Keywords: Nesting behaviour, Nesting materials, Reproductive success, Anthropogenicmaterials, Adaptation.

Introduction - Since prehistoric times, birds have played an important role in human civilization; early Stone Age images show a preoccupation with birds. For breeding and safety from predators, all animals require shelter. Various animals use the easily accessible shelters, alter them, or build specially made nests for their own protection and the safety of their dependent offspring. One sort of animal behaviour showing parental care is the building and refurbishing of nests by birds like Robin, Bulbul, and House sparrows even after their eggs hatch. When the young open their eyes, the parents show them how to maintain the nest and keep it in good shape.This early imprinting most likely lasts until the child reaches adulthood. However, the majority of nest-building knowledge is encoded in the DNA of the bird species.

Because nesting behavioural affects both species survival and reproductive success, it is crucial to a bird's life cycle. It includes methods to shield eggs and young from predators and inclement weather, as well as site selection, material selection, and parental care. Although resources in natural environments are more constant, urbanization presents both new opportunities and challenges, especially when it comes to the availability of traditional nesting materials. Nesting behavioural encompasses all of an individual's interactions with both its young and its mating partner, as well as nest creation procedures. Important elements affecting the breeding success of birds in various settings are nesting behavioural and nesting material selection. Clutch size, hatching success, and fledgling survival are just a few of the reproductive factors that can be impacted by these actions and decisions.Based on past experiences, birds modify their nesting behaviours. When it comes to nesting behaviours like choosing a place, choosing materials, and building a nest, cognitive abilities are essential. These skills increase the success of nesting and help birds adjust to shifting environmental conditions. This study's main goals are to describe important behavioural patterns during nest construction, incubation, and parental care, with an emphasis on the effect of anthropogenic influence, and to investigate the types of nesting materials used by *Columba livia* in urban areas.

The choice of nesting place is the first step in pigeons' nesting behaviour. It favours protected areas that are high and predator-free. Building ledges, rooftops, balconies, window sills, and beneath bridges are common places for nesting. Predation is less likely in these areas, which also offer protection from natural elements including wind, rain, and intense sunlight. Pigeons of both sexes take part in the construction of their nests. First, the materials are gathered from the local area, and then they are arranged into a loosely built platform. Compared to the nests of other bird species, the structure is often simple and disorganized, yet it is adequate to safely house eggs and young.

Depending on environmental factors and material availability, nest building usually takes five to ten days.

The Columbidae family includes the rock pigeon. Its length from beak to tail is about 18 to 20 inches. This pigeon weighs between 250 and 350 grams. Although males are somewhat larger than females and have greater iridescence on their neck feathers, the sexes appear almost identical. Although the body colour varies, wild birds are often grey in colour. One of the most prevalent species on the Indian subcontinent, this bird is classified by the IUCN as a Least Concerned (LC) species because of its widespread distribution. During the breeding season, pigeons are frequently observed in pairs. Rock, wild, and domestic pigeons usually mate for life.Despite their social monogamy and strong long-term relationships, extra-pair mating does happen, frequently at the male's instigation. Pair selection occurs, and female pigeons reach sexual maturity as early as 7 months of age (Burley N, 1997). According to Murton et al. (1972), the female lays one to three (typically two) white eggs after mating, which hatch after 16 to 18 days of incubation. The eggs are incubated by both the male and the female, although the female does so at night. Within 25 to 30 days of hatching, the young depart the nest. The young are initially given "crop milk," which is a thick, fermented liquid made from the parent crops. Before the initial clutch departs the nest, further eggs are laid. Breeding can happen at any time of year.According to Tomasz and Elzbieta (2005), the pigeons never constructed their nests on the ground, near the ground, or as open ground nests for Red Wattled Lapwings.

Review of Literature: The nesting behaviour and type of nesting material used can significantly influence the reproductive success of bird species through various mechanisms, including nest structure, thermal properties, and the presence of pathogens. Research indicates that both natural and anthropogenic materials can have distinct effects on nesting outcomes, which are crucial for the survival of offspring. In Tree Swallows, the presence of old nest material was linked to higher parasite loads, which negatively impacted reproductive output and nestling size(Rendell & Verbeek, 1996).However, the overall reproductive success did not show significant differences between nests with old and clean materials, suggesting that other factors, such as climate, may also play a role(Rendell & Verbeek, 1996).The review on nest materials emphasizes the importance of understanding how different materials contribute to the functional properties of nests, such as insulation and humidity control, which are vital for incubation and chick rearing(Deeming, 2023). The impact of nesting behaviour on breeding success is influenced by various interrelated factors, including cognitive abilities, environmental conditions, social structures, and individual effort. Cognition plays a crucial role in nesting success, as it aids in site selection, material choice, and nest construction(Lehtonen et al., 2023).

Because of their abilities to take advantage of resources, pigeons have adapted their nesting locations to urban environments, using a variety of tree types and heights (Juhász & Varga, 2019).Urban pigeons exhibit behavioural adaptability in response to urban problems, frequently selecting elevated and hidden sites to lower predation risk (Bressler et al., 2020).The materials used by pigeons (*Columba livia*) to construct their nests include straw, grass stems, small twigs, roots, pine needles, and leaves. Non-traditional materials like plastics and other man-made objects, which may provide structural or insulating advantages, are now used in nest construction due to urban settings (Reynolds et al., 2019).The utilization of these materials demonstrates how pigeons may adapt to urban waste and debris and signals a change in the availability of resources (Reynolds et al., 2019).Given that pigeons who nest in unconventional areas frequently face reduced rates of predation, research suggests that urban nesting behaviours can improve reproductive success (Bressler et al., 2020; Garcia et al., 2017). On the other hand, whereas urbanization offers pigeons possibilities, it also brings with it problems including habitat fragmentation and heightened competition for nesting places, which may eventually have a detrimental effect on their populations (Reynolds et al., 2019).

Material and Method: The study was conducted in the metropolitan region of Rewa city, which is situated in the state of Madhya Pradesh in northeastern India. According to Wikipedia, this lovely city is located between latitudes 24° 18' and 25° 12' north and altitudes 81° 2' and 82° 18'. The district is bordered by Satna on the west, Shahdol on the south, Sidhi on the east and southeast, and Uttar Pradesh on the north. With an area of 6,240 km2, it serves as the administrative hub for both Rewa District and Rewa Division. The city is located 230 kilometers north of Jabalpur and 420 kilometers northeast of the state capital, Bhopal. The Kaimur hills encircle the district on the south, while the Vindhyachal mountains split it in half in the centre. The state tree, the banyan (Ficus benghalensis), as well as trees like peepal (Ficus religiosa), neem (Azadirachta indica), and mango (Mangifera indica), which are common throughout the Indian subcontinent, can be found in Rewa city and the surrounding areas of Madhya Pradesh. Sal (Shorearobusta) and bamboo, which are common in Madhya Pradesh, are two more noteworthy plants found in the local forests. Some locations also have Karanj (Pongamia pinnata) and Jamun (Syzygiumcumini) (Wikipedia).For this investigation, a total of 17 randomly chosen buildings were chosen because pigeons nest there. Because there are plenty of nesting spots and resources available, the chosen area was deemed suitable for pigeon breeding and nesting. Key habitats evaluated include historic cement concrete structures and infrastructure, such as rooftops, balconies, building ledges, government office buildings, educational institutions, warehouses, and

residential complexes, that offer suitable nesting conditions for pigeons.

Figure 1: study area

Using a top-notch digital camera, pictures were taken from a safe distance without upsetting the birds or their nest. Microsoft Picture Manager was used for post-capture photo processing, including rudimentary editing. Microsoft Paint software was used to label the photos. Chart creation and data processing were done using Microsoft Excel. Only pictures of the birds, their nests, eggs, and chicks were taken for this study. To track the birds from a distance, a high-quality binocular was also utilized. Data was gathered through field observations, general observations, bird watching techniques, and trekking in order to ascertain the nesting ecology of the Blue Rock Pigeon in the different habitats of Rewa city.The information was gathered between March and May of 2025. 36 nests in all, from 17 carefully chosen structures, were examined. Binoculars or a camera were used to follow the individual or couple once they were seen collecting twigs from the trees or building a nest. Systematic observations were carried out twice a week in the early morning (6 AM–9 AM) and late afternoon (4 PM–6 PM). The location and structure of each nest, the materials used, the time spent building it, the behavioural of the birds during nest building, incubation, the care of the parents, the quantity of eggs and squabs, and any indications of predation or outside disturbance were all examined for at least an hour each time.

Nesting site GPS coordinates, field notes, and photographic evidence were documented. The variables weremethodically logged using a standard data collection form. Material gathering, nest construction, incubation shifts, andfeeding schedules were the categories used to classify behavioural patterns.The presence of an active nest wasindicated by adult birds engaging in breeding activities such as building a nest, incubating it, and feeding the young inside or close to the nest. Both quantitative and qualitative analyses were performed on the collected data. Nesting success rates were associated with the frequencies of particular materials. To find common trends, parental behavioural was categorized and examined.

Result: This is the first scientific report on the ecology of pigeon breeding in the Rewa region. Although the Blue Rock Pigeon's mating season is practically year-round, many areas experience their busiest breeding seasons in the spring and fall. They can reproduce at any time of year, and depending on the environment and the availability of food, breeding may even continue into the winter. Continually used nests solidify with feathers, droppings, and other debris. Because they are monogamous, pairs frequently breed in the same season for as long as both of their birds are alive. The majority will try to raise many broods annually. Up to five or six broods may occasionally be reared in a single year.The roosting locations, nesting locations, food sources, and water sources did vary by season in the comparable study that was intended to ascertain the ecology of Rock Pigeons (*Columba livia*) in the urban areas of Rawalpindi/Islamabad, Pakistan (Ali et al., 2016).These findings align with current data as well. The pigeon population was lowest in parkland and highest in historic structures. The pigeon population density in this study was similarly mostly localized in historic buildings; the pigeons' roosting and nesting locations as well as the food and water sources they used varied according to the season. The type of shelter and available space where the nests were constructed determined the nest density. Nest construction took five to ten days on average. Structural elements were regularly changed, and materials were gathered several times. The nests were widely distributed across the study region, particularly in the vicinity of human habitation on cement concrete buildings and infrastructures, under roofs, and in or above prefabricated boxes like A/C, electric starter, and fuse boxes, among others. In addition to these, pigeon nests were discovered inside the gaps and crevices of ancient and deserted buildings, as well as on rooftops, beneath window shields, balconies, and lintels.

The data of distribution of nesting sites was obtained and same is represented by Table-1.The analysis of this data shows that Readymade boxes are preferred nesting sites for Blue Rock Pigeon. A total of 12 nests out of 36 was constructed in or above the Readymade boxes. Rooftop was the site which was least preferred by Pigeons for nest construction due to vulnerabilityto predators. The percentage of nesting as per the site of nesting was 33% in or above readymade boxes, 22% crevices and holes, 20% balconies,14% window shields and 11% on roof top.Only 9% of the nests were abandoned, however 91% of the nests were found to be rebuilt and reused in subsequent mating cycles by the same pigeon pair, making them active nests.

Table1: Nesting site distribution

S.	Nesting Location	Number of Nests	Percentage of Total
1.	Readymade boxes	12	33%
2.	Crevices and Holes	08	22%
3.	Balconies	07	20%
4.	Window shields	05	14%
5.	Rooftops	04	11%
	Total	36	100%

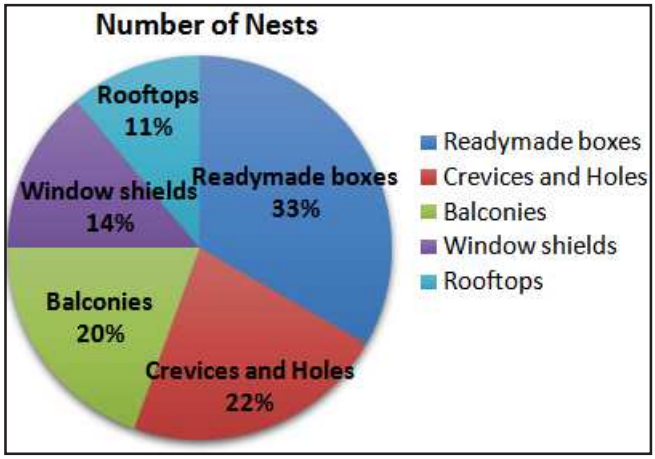

Chart 1: Nesting site distribution

Nesting material composition was as diverse as nesting sites. They make a simple, flat and artless platform of small sticks and thin roots. Pigeons were found to use readily available nesting material. Maximum nesting material used was twigs and leaves of Banyan tree, Peepal tree, Neem tree and Mango tree which are found in Rewa abundantly. But use of other anthropogenic material like plastic strips, paper, clothes and wires could not be denied. Basically, material selection for nest construction is based mainly on local resources availability which may be either natural or anthropogenic nature. The nesting material composition showed following data-

Table 2: Nesting material composition

S.	Material Type	Frequency (%)
1.	Twigs and small branches	87%
2.	Dry leaves and thin roots	68%
3.	Plastic strips	43%
4.	Paper	34%
5.	Cloth pieces, wires	29%

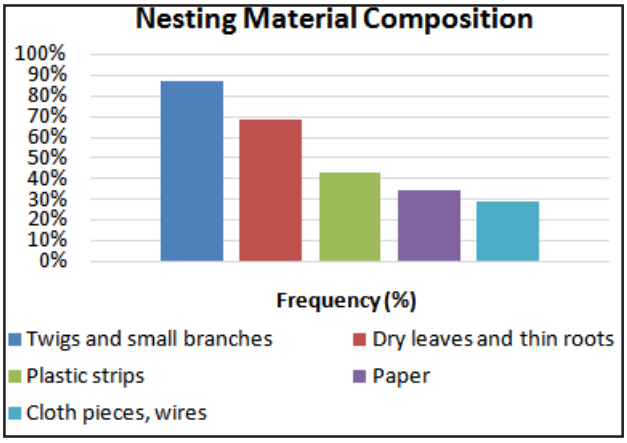

Chart 2: Nesting Material Composition

We can conclude from above data that Twigs and small branches were used in 87% of nests. This material wasthe material of choice for bird in almost all the nests. Dry leaves showed their presence in 68% of nests. Plastic strips was present in 43% of nests, Paper was present in 34% of nests and lastly, cloth and wires were found 29% of nests.

The pattern of their nesting behavioural revealed that pigeons are monogamous. There was a lot of wooing and copulation before the internal fertilization. In a clutch, the female typically lays two oval white eggs at once. Every two to four hours, both parents took turns participating in the incubation process. After around two weeks of incubation, the eggs hatch. At the time of hatching, squabs are altricial. Altricial pigeons need parental care until they reach adulthood because their young are born naked, blind, and defenceless. Pigeon's milk, which was produced in their crops and given to the squabs multiple times a day by both parents, was the main food that they regurgitated. Rearranging materials and other nest management behaviours were regularly noted. There was no evidence of squab or egg predation.Sanitation issues were brought on by the substantial build-up of faecal material close to nesting locations, particularly in building corridors and verandas.

Discussion: This study supports previous results that *Columba livia* has used anthropogenic materials to adapt to urban surroundings. The extensive usage of paper and plastic strips demonstrated how pigeons may recycle human garbage for breeding. High reproductive success was attributed to the study's findings of biparental care. The deliberate selection of high and protected nesting locations may lead to the lack of predation. Nonetheless, it appears that pigeons continuously modify their nest building for maximum stability and safety based on their behavioural adaptability of rearranging materials. An important urban problem is the build-up of faeces.Pigeon nesting is encouraged by poor waste disposal and structural design, which exacerbates sanitation and maintenance issues in urban buildings, as previously mentioned by Bhagat & Singh (2020). The study supports *Columba livia*'s general success in urban environments by demonstrating its behavioural adaptability. The use of man-made materials, however, raises questions about the longevity of the nest and possible toxicity. More research is needed to determine the long-term effects on population health.

The results highlight how pigeons can successfully adapt to urban environments while also posing a threat to human-wildlife harmony. To lessen the detrimental effects of pigeon populations in cities, urban planners and wildlife managers should take into account tactics such improved waste management, structural changes, and public awareness campaign.The degree of pigeons' reproductive activity, particularly in overly dense colonies, was found to influence a number of other factors that resulted in nesting and incubation-related damages, such as the loss of eggs and nestlings, mechanical damage to eggs, eggs and nestlings falling out of the nests, embryo death, and competition among fledglings and nestlings disease. High-stability, well-constructed nests prevent the brood from

falling (Coon et al., 1981). However, in the current study, routine cleaning of some buildings was a significant factor linked to nest damage; otherwise, at 90% of locations, roughly all nests were safe and breeding was successful.

Conclusion: The present investigation substantiates the ecological plasticity and behavioural adaptability of Rock Pigeons (*Columba livia*) within urban environments. The observed reliance on anthropogenic materials such as paper and plastic strips for nest construction highlights the species' ability to exploit human-generated resources in order to facilitate reproduction. The demonstrated reproductive success, supported by biparental care and the preferential selection of elevated and protected nesting sites, underscores the evolutionary advantages that facilitate the persistence of pigeons in densely populated urban landscapes. Nevertheless, this adaptability concurrently generates significant challenges for urban ecosystems, including the accumulation of excreta, the deterioration of infrastructure, and the exacerbation of human–pigeon conflicts. Moreover, reproductive activities within high-density colonies were associated with several negative outcomes, including egg and nestling losses, mechanical breakage, displacement of offspring, inter-nestling competition, and heightened vulnerability to disease transmission. Although a majority of nests exhibited structural stability and successful breeding outcomes, the routine cleaning of buildings emerged as a key disturbance factor contributing to nest damage. Collectively, these findings confirm the species' capacity to thrive in urban habitats while simultaneously presenting considerable implications for urban planning, public health, and wildlife management.

Recommendations: In view of the documented findings, the following recommendations are proposed for effective urban ecological management:

1. Municipal waste management systemsshould be strenthenedto reduce the accessibility of food and nesting materials derived from anthropogenic sources.
2. Pigeon-deterrent architectural designscan be incorporated, including the sealing of crevices, modification of ledges, and installation of exclusion devices to restrict colonization in vulnerable structures.
3. Implementation of public education and awareness programs to discourage the deliberate feeding of pigeons and to disseminate knowledge regarding associated health and sanitation risks.
4. Establishing long-term monitoring and population management initiatives aimed at controlling breeding densities in a humane and ecologically sensitive manner.
5. Promotingmultidisciplinary research to assess the ecological and physiological impacts of synthetic materials on nesting durability, reproductive health, and the longevity of urban pigeon populations.
6. Encouraging the adoption ofnon-lethal, environmentally sustainable management strategies that reconcile human interests with avian conservation and urban biodiversity goals.

Acknowledgements: We wish to express sincere gratitude to the Department of Zoology, S.K.N. Govt College, Mauganj, Madhya Pradesh and Awadhesh Pratap Singh University, Rewa, Madhya Pradesh for providing the necessary facilities and academic support to carry out this research. Special thanks are extended to colleagues and field assistants whose efforts in data collection and observation were invaluable to the successful completion of thisstudy. The constructive feedback and guidance received from faculty members and peers greatly contributed to the refinement of the manuscript. We are also thankful to the local communities of the Rewa region for their cooperation during field surveys. Finally, deep appreciation is conveyed to all those who, directly or indirectly, contributed to the progress of this work.

Image 2: Nesting Material and Nesting Behaviour of Rock Pigeon (*Columba livia*):
a) Breeding Pair, b) Nest constructing Activity, c) Unorganized Nest Material, d) Nest in Crevices, e) Nestmaterial on AC Box, f) Incubation activity, g-h) Eggs in the Nest, i) Scub nearby Nest, j) Faecal matter and remnants of Egg Shell

References :-

1. Burley N. (1997). Mating systems, mate choice and reproductive success in pigeons.
2. Murton R. K., Thearle R. J. P., & Thompson J. (1972). The breeding biology of the feral pigeon *Columba livia*. Journal of Applied Ecology, 9(1), 835–853.
3. Tomasz G. & Elzbieta Z. (2005). Nesting site selection and nest type in various bird species.
4. Rendell W. B. & Verbeek N. A. M. (1996). Effects of old nest material on parasite load and reproductive success in Tree Swallows. Canadian Journal of Zoology, 74(3), 322–325.
5. Deeming D. C. (2023). Functional roles of nest materials in avian reproductive success.
6. Lehtonen J., Seppänen J.-T. & Forsman J. T. (2023). Cognitive abilities in birds and their influence on nesting behaviour and breeding success.
7. Juhasz L. & Varga Z. (2019). Adaptation of pigeons' nesting locations in urban environments.
8. Bressler E., Cooper C. B. &Hochachka W. M. (2020). Behavioural plasticity in urban pigeons: Nesting strategies to reduce predation risk.
9. Reynolds S. J., Smith J. A. & Martin P. R. (2019). Use of anthropogenic materials in urban bird nesting behaviour.
10. Garcia D., Pérez J. & Ramirez L. (2017). Urban nesting behaviour and its impact on reproductive success in pigeons
11. Bhagat R. M., & Singh R. (2020) *Impact of urban waste disposal and structural design on pigeon nesting in city environments.*
12. Ali R., Khan M. A.& Ahmed M. (2016)**.***The ecology of Rock Pigeons (Columba livia) in the urban areas of Rawalpindi/Islamabad, Pakistan.*
13. Shivaji P. Chavan, Komal B. Reddy and Pawan L. Jadhav.Nest structure and nesting ecology of feral pigeon (*Columba livia*) .Int. J. Adv. Res. 6(9), 901-911
14. Maslehuddin A M & Kumar S, Notes on nesting behavioural of Yellow-footed Green Pigeon (*Treron Phoenicopterus),* Journal of Threatened Taxa (2013)
15. Coon N. C., Winker K & Weeden R. B. (1981). *Nest stability and breedingsuccess in urban birds. The Auk, 98(2), 316–321.*
16. Goodwin, D. (1983). Pigeons and Doves of the World. Cornell University Press.
17. Anil Tripathi. (2016). Effect of urbanization on nest building behaviour of *Columba livia domestica* (Gmelin, 1789) Int. Res. Jour. of Envi. Sciences 5 (6): 1-5.
18. Soniya VP. (2002). Unusual nesting material in the nest of Black rock Pigeon *Columba livia.* J. Bom. Nat. Hist. Soc. 99: (3) 527.
19. www.wikipedia.in
20. www.googlemap.in

****