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RESEARCH ARTICLE

STUDY ON NESTING TRENDS OF AVIAN FAUNA IN MACHKOT FOREST RANGE AND URBAN ENVIRONMENT SITE OF JAGDALPUR, BASTAR DISTRICT, CHHATTISGARH

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Abstract

The present study offers a detailed examination of bird nesting patterns observed from April to June 2024 in two distinct environments: the urban area of Jagdalpur and the forested Machkot region. A total of 199 nests, spanning 24 species and 17 families, were recorded across these locations. In the urban setting of Jagdalpur, 135 nests from 9 species in 7 families were found, with birds primarily using man-made structures like electric poles and boxes due to the limited availability of natural nesting sites. In contrast, the Machkot forest supported 58 nests from 22 species across all 17 families, with a strong preference for natural tree sites. Species such as the Indian pied myna and House sparrow demonstrated notable adaptability to artificial nesting environments in urban areas, whereas the forest environment offered a wider range of natural nesting options, leading to greater avian diversity. The study also noted the severe impact of environmental disturbances, such as summer forest fires which resulted in a total loss of nests in affected areas, and a significant negative correlation between high red ant densities and nesting success. Differences in nesting preferences were evident, with urban birds frequently employing artificial materials and structures, while forest-dwelling species utilized natural materials and tree features. Various nest types including cup, platform, pendant, cavity, ground, and mud nests - reflected the availability of materials and environmental conditions. The findings emphasize the need for conservation measures, such as providing artificial nest boxes and planting trees in urban areas, alongside addressing environmental threats in forested regions. This study underscores the stark differences in nesting ecology between urban and forest habitats, illustrating the adaptability of urban species and the rich diversity of forest environments.

Introduction:-

A bird has been described as a feathered biped. This description is apt and precise and can apply to no other animal. Birds are vertebrate warm-blooded animals (Ali, 1996).

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Birds are found globally and build nests for laying eggs and protecting their young. Nest site selection is crucial for reproductive success, impacting fecundity and population growth (Clark *et al.,* 2014). Nests are built in safe, high-success locations, but site quality varies with environmental changes over time and space conditions like heavy rain, storms, and human activities, as well as predators, disrupt breeding. Harsh weather can cause nests to fall from tree or branches to break with egg or hatching which decline their breeding success (Bhattacharyya and Das, 2020).

Nests are built from two main types of materials: structural and lining. Structural materials like twigs, grass form the nest's shape and provide support, while lining materials create a suitable environment for raising offspring, like feathers, commonly used as lining, which offer the best insulation compared to grasses (Hilton *et al.,* 2004).

The rapid urban expansion and construction can lead to the loss of natural habitats. As urban areas encroach on green spaces and wetlands, which can disrupt bird populations and their nesting patterns. Birds may find it challenging to locate suitable nesting sites and resources in fragmented environments. There are about 10,000 species of birds in the world. India harbors 1318 species, of which 57 are endemic, 03 are breeding endemic, and 85 species of birds are threatened (Jadhav *et al***.,** 2018). According to Bharos (2017), the biodiversity of Chhattisgarh provides a suitable habitat for avifauna and they recorded 429 species in the Chhatisgarh. The avian fauna diversity of Bastar district was updated by Dutta (2017) ,they found the 319 birds species in forest and near water bodies or adjacent areas.

The present study aims is comparing the nesting trends and nesting behavior of avian fauna in two distinct environments i.e. forest ranges and urban roadside areas. Forest ranges typically offer a natural and undisturbed habitat for birds to nest, whereas urban roadside areas may present unique challenges such as noise pollution, and human disturbances.

Study Area

The present study were conducted from two different identified sites, first is in urban environment site Jagdalpur city and second is in reserve forest site namely Dhanpunji and Tiriya forest under Machkot forest range of Bastar forest division, Chhattisgarh. The forest types of study site is characterized by Tropical Moist Deciduous Forests. The study site falls under the Southern Bastar Plateau agro-climatic zone of State. The brief of study sites are as under -

Location I: Urban environment site of Jagdalpur

The study was done in urban area of Jagdalpur city of Bastar district. Jagdalpur is located at 19.07 ^{o}N latitude and 82.03°E longitude. It has an average elevation of 552 meters (1811 feet) . The district Bastar is located in the southern part of Chhattisgarh and situated at a height of 2000 ft the from sea level (Kumar, 2017).

Location II: Machkot Forest at Bastar

The present study are carried out in two beats namely Dhanpunji and Tiriya. The total geographical area covered by both site are 1039.480 hectare and 4118 hectare respectively. It lies between 19^{0}20’25.7”N latitude and 82^{0}10’29.5”E longitude and angle of elevation is 614.0m. The survey has been done in high population density area, natural habitat and water resources of the study site.

Materials and Method:-

The study was conducted during April to June 2024, when the most land birds breed. The methodology of the research work is based on random walk method and visual observation method. The selection of methods for survey was depending upon the bird habitat in study area. The observation is recorded on morning hours at 6:00 A.M. to 10:00 P.M. and from 4:00 P. M. to 6:00 P. M.. Bird was observed using a pair of 10×50 binoculars, and were identified using like “The Book of Indian Bird” (Ali 1996), Merlin application, e-Bird app, iNatuealist and collect the information number of nests, nesting materials, nesting sites and the plant species on which nests were placed, nest height from the ground were collected using established methodologies. Note and photographed during survey periods with help of Nikon Digital Camera.

Results and Discussion:-

The information about the nesting trends of avian fauna was collected and identified. The total 199 bird nests were identified during the study and those avian fauna are frequently make the nests during the breeding season out of those 24 species (table 1 and 3) belong to 16 families, including Sturnidae, Cisticolidae, Muscicapidae, Passeridae, Dicruridae, Pycnonotidae, Estrildidae, Zosteropidae, Paridae, Centropodidae, Megalaimidae, Columbidae, Psittaculidae, Apodidae, Ploceidae, and Charadriidae. Were 24 bird species belong to 16 family these including at Location 1(Urban environment site of Jagdalpur), 135 nests of 9 species from 7 families were observed. In Location 2 (Dhanpunji and Tiriyain Machkot Forest Range), 58 nests of 22 species from all 16 families were recorded. Seven species were common to both locations presented in table no.1 and 2.

Nest Site Characteristics:

In urban areas like Jagdalpur, bird species diversity is lower than in forests. Birds often nest on man-made structures such as buildings, bridges, and streetlights. Common species like the Common myna, Brahminy myna, Indian pied myna, and House sparrow frequently use man made structure for nesting. The scarcity of natural nesting sites means distances between nests are typically larger. Some species like House Sparrows and Indian pied mynas succeed in these environments due to their adaptability to human-made structures.

Forests host more bird species than urban areas due to their diverse habitats and abundant food. They offer various natural nesting sites, including tree cavities and sturdy branches, supporting a rich avian community. However, no nests were found in areas affected by summer forest fires, indicating that such disturbances can greatly impact nesting success and distribution. Additionally, there is a significant negative correlation between red ant (Oecophyllasmaragdina, famly; Formicidae) (Khelkar *et al.*, 2015).Density and the number of bird nests, suggesting that higher red ant densities, as known nest predators, lead to fewer nests. Also recorded by (Holloway *et al.*, 2002).

The study shows that location 1 (Urban environment site of Jagdalpur), an urban area, has many nests but is dominated by adaptable species like the Indian Pied Myna and House Sparrow. In contrast, location 2 (Dhanpunji and Tiriya in Machkot Forest Range), a forest area, supports a wider range of species across various orders and families. This highlights how urban environments favour a few adaptable species, while forested areas host wider variety of wildlife.

Host plants

The study identified 16 nesting species at location 1(Urban environment site of Jagdalpur), which had 11 tree species, while location 2 (Dhanpunji and Tiriya in Machkot Forest Range), had 10 tree species. Four host plant species were common to both locations. (table 3 and 4).

In (table 2), from location 1 (Urban environment site of Jagdalpur), a highly urbanized area, the survey identified several host plant species used for nesting, including Banyan tree (*Ficus benghalensis*), Australian Babul (*Acacia auriculiformis*), Peepal tree (*Ficus religiosa*), Jungle Jalebi (*Pithecellobium dulce*), Babul (*Acacia nilotica*), Gulmohar (*Delonix regia*), Iml tree (*Tamarindus indica*), Ber (*Zizyphus mauritiana*), Maize crop (*Zea mays*), and Neem tree (*Azadirachta indica*), *Kaner (Cascabelathevetia)* with some species unidentified. A total of 135 nests were recorded, with electric poles being the most prominent nesting sites. In table 4, for location 2 (Dhanpunji and Tiriya in Machkot Forest Range), 58 nests were recorded across various host plants; with Tendu tree (*Diospyros melanoxylon*) supported the highest diversity of bird species. Other significant host plants included Ber (*Zizyphus mauritiana*), Date Palm (*Phoenix dactylifera*), Bamboo (*Bambusa vulgaris*), Chironji (*Buchanania lanzan*), Banyan tree (*Ficus benghalensis*), Australian Babul (*Acacia auriculiformis*), Sal tree (*Tectona grandis*), Amla tree (*Emblica officinalis*), and Iml tree (*Tamarindus indica*) with some species unidentified

Nesting Preferences:

In location 1 (Urban environment site of Jagdalpur), found that the Indian pied myna predominantly used electric poles, with 62 nests compared to 25 in trees. House sparrows, Common myna, Brahminy starling frequently use electric poles and boxes for nesting. Other species, such as the Baya Weaver, House crow, Black drongo, and Red-vented bulbul, Scaly-breasted munia rarely used electric poles or boxes and they proffered tree for nestng (table no. 2).

This underscores the Indian pied myna adaptation to urban environments and the diverse nesting preferences among bird species (figure -1). In location 1 birds like Indian pied myna and House sparrows adapt to nesting on artificial

structures such as buildings and bridges, often due to the scarcity of natural sites and the stability these man-made environments provide. This preference may be influenced by the lack of natural nesting sites.

In location 2 (Dhanpunji and Tiriya in Machkot Forest Range), (table 2), forests offer a diverse array of natural nesting sites within their varied vegetation and tree structures. Birds in forest environments prefer natural trees for nesting, supporting a range of nesting behaviours from cavity-nesting species like woodpeckers to canopy-nesters like the Indian Robin and ground-nesters like the yellow-wattled Lapwing. The birds proffered tree for nesting. The Tendu tree being the most frequently used for nesting. In forest range, on nesting trees climbers wrap around trees, creating a bundle-like structure that birds use for nesting. This network of climbers offers protection from predators and harsh weather, such as heat, storms, and heavy rain.

At location 1 (Urban environment site of Jagdalpur), there were 43 trees, 65 electric poles, and 27 electric boxes. Most nests were found on electric poles, with fewer on electric boxes and trees. The low number of trees limited the availability of host plants for nesting. In contrast, at location 2 (Dhanpunji and Tiriya in Machkot Forest Range), all nests were found on trees, with the Tendu tree being the most frequently used for nesting.

Nesting Materials:
In urban areas, birds often use a mix of man-made and natural materials for their nests, reflecting the proximity to human settlements and the availability of materials. They incorporate artificial items such as cotton, plastic, and cloth due to their abundance, alongside natural materials like grass blades, straw, dry sticks, and feathers. In contrast, birds in forest environments primarily use natural materials for nesting, including grass blades, straw, dry sticks, and rootlets, as these are readily available and abundant in their surroundings.

Nesting Structure:
In location 1(Urban environment site of Jagdalpur), bird nesting structures are less varied compared to forests, with common types including Cup nests, Platform nests, and Pendant nests. Birds like the Common myna, Brahminy myna, Indian pied myna, and House sparrow often use man-made structures such as electric poles and boxes .Cup nests are built by the Brahminy myna, House sparrow, Yellow-vented bulbul, Black drongo, and Scaly-breasted munia. The Common myna, Indian pied myna, and Common crow create Platform nests, while the Baya weaver constructs Pendant nests (table 2) . In location 2(Dhanpunji and Tiriya in Machkot Forest Range),Forests offer a wider range of nesting practices, including Cup nests, Platform nests, Pendant nests, Cavity nests, Ground nests, and Mud nests (figure -2). Cup nests are made by the most of bird in shrubs, trees. Platform nests are used by the Indian pied myna and Crow, typically found on ledges or in dense vegetation. Pendant nests are built by the Baya weaver, hanging from leaves. Cavity nests are favoured by the Brown-headed Barbet and Alexandrine parakeet, utilizing tree hollows or man-made cavities. The Yellow-wattled Lapwing nests on the ground, and the Little swift constructs mud nests on sheltered structures (table 4).

Nest Building Time
Birds build various types of nests for breeding, and the time required for construction varies. Cup nests, built by species such as Brahminy myna, Scaly-breasted munia, Ashy prinia, Common tailorbird, Indian robin, Oriental magpie robin, Pied bushchat, Indian white eye, Gray-breasted prinia, Cinereous tit, House sparrow, Red-vented bulbul, and Black drongo, take more time due to the need to gather materials. Platform nests require less construction time, though finding suitable materials can be time-consuming. Baya Weaver's hanging nests and the mud nests built by Little swift also take considerable time to construct. Cavity-nesters like Brown-headed barbet, Alexandrine parakeet, and Heart-spotted woodpecker use their strong beaks to drill into tree trunks, which can be time-consuming and may involve using pre-existing holes. Ground nests built by Yellow-wattled lapwings are the quickest to construct, though selecting the right location is crucial.

Nest Height:
In the study, bird species constructed their nests at different heights across two locations. At location 1 (Urban environment site of Jagdalpur), Pied myna built their nests on electric poles and boxs at 15-26 feet, while House Sparrows. preferred electric boxes at 20 feet, with their nests varying in height from high to low. In location 2 (Dhanpunji and Tiriya in Machkot Forest Range), nests were typically found at medium heights of 10-17 feet, with hole nests observed from mid-height upwards. Little swifts built their nests at 5 feet, and Red-wattled lapwings constructed theirs on the ground at 0 feet.

Conclusion:-

The study comparing avian nesting in Jagdalpur urban environment and Machkot forest reveals distinct adaptive strategies. In Jagdalpur, birds like the Indian pied myna and House sparrow nest in artificial sites such as electric poles, which can pose risks like short circuits. Their nests often mix man-made and natural materials, reflecting their adaptation to limited natural nesting sites. Conversely, Machkot forest offers natural nesting options and supports diverse species, though challenges such as forest fires and predatory ants can impact nesting success. Forest birds benefit from abundant natural tree hosts and a suitable environment. This contrast highlights the adaptive strategies of urban and forest birds. Urban birds face limitations due to the scarcity of natural nesting sites and large distances between them. To support urban avian species, it is recommended to rapid afforestation activity should be planning where the green cover/density is decrease and provide the nesting tools for the conservation of nesting bird at this region of Chhattisgarh.

Table 1:- Checklist of birds recorded in the urban environment site of Jagdalpur, district- Bastar (CG).

S.No.	Common Name	Scientific Name	Family	Genus	No. of nests observed
Order- Passeriformes					
1.	Common myna	*Acridotheres tristis*	Sturnidae	*Acridotheres*	5
2.	Brahminy starling	*Sturnus pagodarum*	Sturnidae	*Sturnia*	5
3.	India pied myna	*Gracupica contra*	Sturnidae	*Gracupica*	87
4.	House sparrow	*Passer domsticus*	Passeridae	*Passer*	26
5.	Black drongo	*Dicrurusmacrocercus*	Dicruridae	*Dicruridae*	2
6.	Red vented Bulbul	*Pycnonotuscafer*	Pycnonotidae	*Pycnonotus*	2
7.	House crow	*Corvus splendens*	Corvidae	*Corvus*	3
8.	Scaly breasted Munia	*Lonchurapunctulata*	Estrildidae	*Lonchura*	1
9.	Baya weaver	*Ploceusphilippinus*	Ploceidae	*Ploceus*	4
Total					135

Table 2:- Checklist of birds recorded in the Dhanpunji and Tiriya site of Machkot forest range, district – Bastar (CG).

S. No.	Common Name	Scientific Name	Family	Genus	No. of nests observed
Order – Passeriformes					
1.	Ashy prinia	*Priniasocialis*	Cisticolidae	*Prinia*	3
2.	Common tailorbird	*Orthotomussutorius*	Cisticolidae	*Orthotomus*	2
3.	Indian robin	*Saxicoloidesfulicatus*	Muscicapidae	*Copsychus*	2
4.	Oriental magpie robin	*Copsychussaularis*	Muscicapidae	*Copsychus*	1
5.	Pied bushchat	*Saxapraticolaca*	Muscicapidae	*Saxicola*	2
6.	Indian white eye	*Zosterops palpebrosus*	Zosteropidae	*Zosterops*	2
7.	Common house sparrow	*Passer domesticus*	Passeridae	*Passer*	10
8.	Indian pied myna	*Gracupica contra*	Sturnidae	*Gracupica*	6
9.	Black drogo	*Dicrurusmacrocercus*	Dicruridae	*Dicrurus*	2
10.	Common myna	*Acridotheres tristis*	Sturnidae	*Acridotheres*	2
11.	Gray breasted prinia	*Priniahodgsonii*	Cisticolidae	*Lonchura*	3
12.	Cinereous tit	*Parus cinereus*	Paridae	*Parus*	1
13.	House crow	*Corvus splendens*	Corvidae	*Corvus*	2
14.	Red vented	*Pycnonotuscafer*	Pycononotidae	*Pycnonotus*	2

	bulbul				
15.	Baya weaver	*Ploceusphilippinus*	Ploceidae	*Ploceus*	2
Order – Cuculiformes					
16.	Greater coucal	*Centropus sinensis*	Centropodidae	*Centropus*	1
Order – Piciformes					
17.	Brown headed barbet	*Megalaima zeylanica*	Megalaimidae	*Psilopogon*	3
18.	Heart spotted woodpecker	*Hemicircuscanente*	Piciformes	*Hemicircus*	2
Order – Columbiformes					
19.	Spotted dove	*Spilopelia chinensis*	Columbidae	*Spilopelia*	2
Order – Psittaciformes					
20.	Alexandrine parakeet	*Psittaculaeupatria*	Psittaculidae	*Psittacula*	6
Order – Apodiformes					
21.	Little swift	*Apus affinis*	Apodidae	*Apus*	1
Order – Charadriiformes					
22.	Yellow-wattled lapwing	*Vanellusmalabaricus*	Charadriidae	*Vanellus*	1
Total	58				

Table 3:- Diversity of nesting bird species at Urban environment site of Jagdalpur (location 1).

S. No.	Bird species	No. of nests	Nest site	Nest type	Nesting material	Height of nest from the ground (in ft)
1.	Common myna	3	Electric Pole	Platform Nest	Straw, twigs, grass blades, plastic, cloth, feathers, leaves & feathers, galvanized wires	26
		1	Banyan tree (*Ficus benghalensis*)			10
		1	Australian babul (*Acacia auriculiformis*)			12
2.	Brahmi myna	5	Electric Box	Cup Nest	Twigs, sticks, grass, straw, leaves & feathers	20
3.	India pied myna	62	Electric Pole	Platform Nest	grass, straw, twigs, sticks, plastic threads, paper pieces, plastic, pieces of cloth, feathers, pieces of cotton, leaves & feathers	26
		1	Peepal tree (*Ficus religiosa*)			11
		5	Banyan tree (Ficus benghalensis)			9
		1	Jungle jalebi (*Pithecellobium dulce*)			13
		4	Babul (*Acacanilotica*)			12
		4	Australian babul (*Acacia auriculiformis*)			14
		1	Gulmohar (*Delonix regia*)			10
		1	Iml tree (*Tamarindus indica)*			14
		1	Ber (*Zizyphusmauritiana*)			12
		7	Unknown			10-15

4.	House sparrow	22	Electric Box	Cup Nest	Twigs, grass, straw, sticks, plastic, threads, paper pieces, Plant fibers, leaves & feathers	20
		2	Babul Tree (*Acacia nilotica*)			10
		1	Maize crop (*Zea mays*)			4
		1	Australian babul (*Acacia auriculiformis*)			12
5.	House crow	1	Neem tree (*Azadirachta indica*)	Cup Nest		12
		1	Australian babul (*Acacia auriculiformis*)			15
		1	Mangium (*Acacia mangium*)			14
6.	Red-vented Bulbul	2	Babul Tree (*Acacia nilotica*)	Cup Nest	Twigs, grass blades, leaves	10-12
7.	Black drogo	1	Unknown	Cup Nest	Twigs, sticks, grass, straw, threads, leaves, feathers	12
		1	Australian babul (*Acacia auriculiformis)*			15
8.	Scaly breasted munia	1	Gulmohar (*Delonix regia*)	Cup nest	Grass blades, plant fibers & feathers	6
9.	Baya weaver	1	Kaner (*Cascabelathevetia*)	Hanging type	Grass blades	10
		3	Jungle jalebi (*Pithecellobium dulce*)			8-12

Table 4:- Diversity of Nesting bird species at Dhanpunji and Tiriya in Machkot forest range (location 2).

S. No.	**Bird species**	**No. of nests**	**Nest site**	**Nest type**	**Nesting material**	**Height of nest from the ground (in ft)**
1.	Ashy prinia	3	Tendu (*Diospyros melanoxylon*)	Cup nest	Twigs, grass blades, straw	10
2.	Common tailorbird	2	Tendu (*Diospyros melanoxylon*)	Cup nest	Grass blades, feathers, Straw	12
3.	Indian robin	2	Tendu (*Diospyros melanoxylon*)	Cup nest	Twigs, grass, Straw blades, feathers,	9
4.	Oriental magpie robin	1	Ber (*Zizyphusmauritiana*)	Cup nest	feathers, twigs, grass blades, Straw	12
5.	Pied bushchat	2	Tendu (*Diospyros melanoxylon*)	Cup nest	Twigs, grass blades, feathers, Straw	8
6.	Baya Weaver	2	Date palm (*Phoenix dactylifera*)	Pendant nest	grass blades, straw	15
7.	Indian white eye	2	Tendu (*Diospyros melanoxylon*)	Cup nest	Twigs, grass blades, feathers	10
8.	Common house sparrow	1	Unknown	Cup nest	straw, twigs , grass blades, feathers	10
9.		5	Bamboo (*Bambusa vulgaris*)			8
10.		1	Tendu (*Diospyros melanoxylon*)			

11.	Indian pie myna	1	Banyan tree (*Ficus benghalensis*)	Platform nest	Grass stems, sticks, feathers, Straw	18
12.		2	Tendu (*Diospyros melanoxylon*)			8
13.		1	Kapok (*Ceiba pentandra*)			14
14.		2	Unknown			7
15.	Greater coucal	1	Unknown	Platform nestc	feathers, grass stems, sticks,	16
16.	Crow	1	Australian babul (*Acacia auriculiformis*)	Platform nest	Small stick, straw,	15
17.		1				8
18.	Brown headed barbet	3	Sal *(Tectona grandis)*	Cavity nests	grass blades, feathers,	12
19.	Black drogo	1	Tendu (*Diospyros melanoxylon*)	Cup nest	Straw ,twigs, grass blades, feathers,	15
20.		1	*Unknown*			10
21.	Common myna	1	Amla *(Emblica officinalis)*	Platform Nest	grass blades, twigs feathers, Straw,	8
22.		1	Babul*(Acacia nilotica*)			10
23.	Spotted dove	1	Tendu (*Diospyros melanoxylon*)	Platform nest	grass blades, straw, feathers,	8
24.		1	Amla *(Emblica officinalis*			8
25.	Gray breasted prinia	1	Tendu (*Diospyros melanoxylon*)	Cup nest	Twigs, straw, grass blades, feathers,	10
26.		1	Chironji (*Buchananialanzan*)			12
27.	Red vented bulbul	1	Tendu (*Diospyros melanoxylon*)	Cup nest	feathers, twigs, grass blades, straw	14
28.		1	*Ber (Zizyphusmauritiana)*			8
29.	Cinereous tit	1	Tendu (*Diospyros melanoxylon*)	Cup nest	Twigs, grass blades, feathers,	10
30.	Heartspotted woodpecker	2	Sal *(Tectona grandis)*	Cavity nest	Grass & feathers	7
31.	Alexandrine parakeet	4	*Gulmohar (Delonix regia)*	Cavity nests	Grass & feathers	8
32.		2	*Unknown*			10
33.	Yellow-wattled lapwing	1	Ground	Ground nest	Straw	-
34.	Little Swift	1	Building	Mud nest	Mud , straw	6

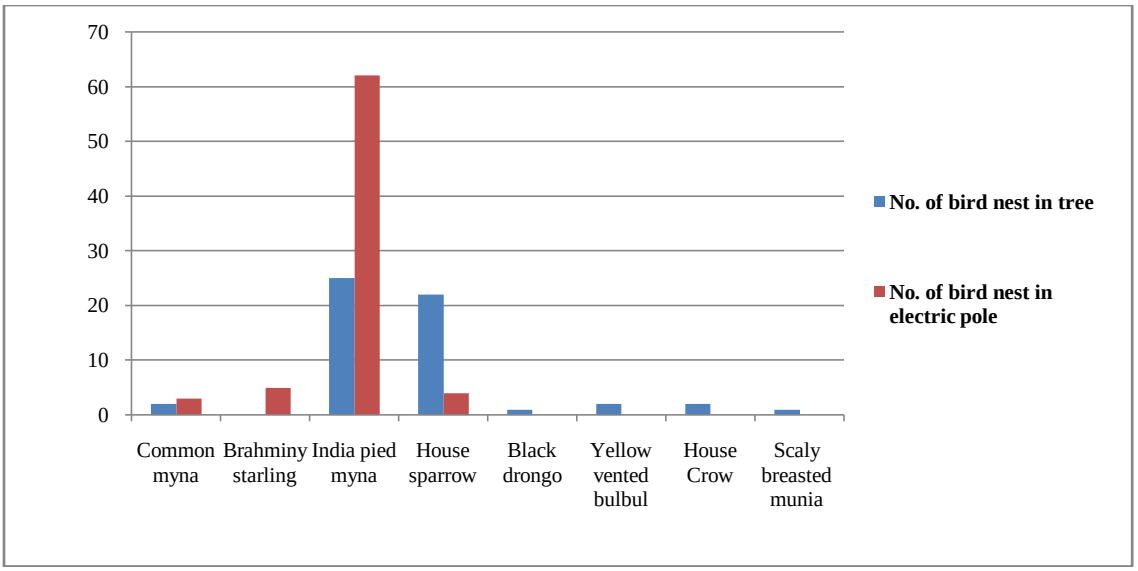

Figure 1:- The different bird species nesting preferences between the trees and electric poles in location 1 (Urban area of Jagdalpur).

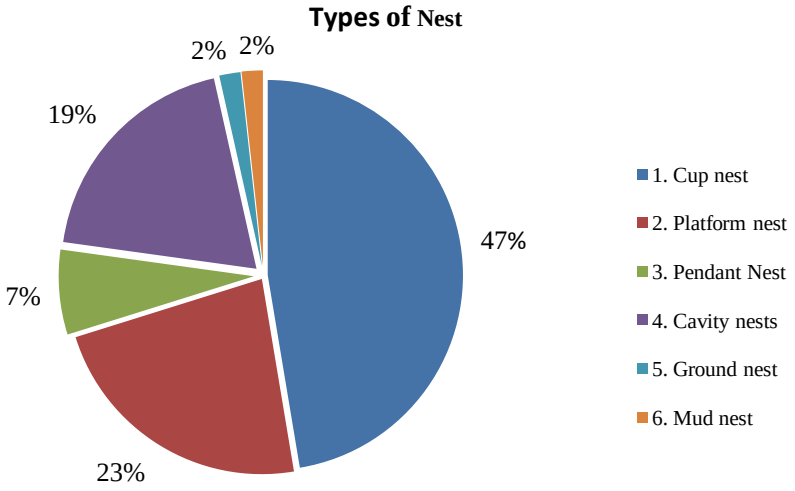

Figure 2:- Different types of nests found in location 2 ((Dhanpunji and Tiria in Machkot forest range).

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