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Morphometry of various organs and flight feathers of House Sparrows (*Passer domesticus*) from India and comparison with global feather web databases

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Abstract

The House Sparrow [*Passer domesticus* (Linnaeus, 1758)] is a small-sized bird of the family *Passeridae.* The dwindling population of the House Sparrow is a worldwide concern, and understanding the species biology, in general, adds to conservation measures. We collected two dead House Sparrows in the wild, examples 1 and 2 from Purandar Taluka, Pune District, Maharashtra, India in April and June 2019. They consisted of a nestling and an adult male. We measured the number and length of their flight feathers. Morphometry of their external and internal organs was done. Further, we made a list of six prominent global feather web databases. The inclusion criterion was all the databases accessible to us on the internet on House Sparrow feathers. No exclusion criterion was made. We compared our findings with these databases (till July 2023) for the following parameters: number of specimens inventoried, gender, age, and longest flight feather. We found a total of 9 primaries (P1 to P9) on both wings of both examples. Example 1 had 9 secondaries on both wings; example 2 had 8 on the right wing (S6 was missing) and 9 on the left wing. Six pairs of rectrices were present in both the examples. In example 1, the average length of primaries was 37.10 mm (range 33.1-39.7, SD 2.15); secondaries was 29.60 mm (range 14.9-36.1, SD 6.87); rectrices was 22.50 mm (range 20-24.6, SD 1.48). In example 2, the average length of primaries was 60.58 mm (range 51.9-65.2, SD 3.65); secondaries was 47.27 mm (range 30.6-54.3, SD 6.77); rectrices was 59.69 mm (range 55.1-62.6, SD 2.52). We report morphometry of flight feathers, external and internal organs of House Sparrows for nestling and adult male from India. The following parameters were

studied: body mass; length of hand, stretched wing, wing width, wingspan, alula, wing web, spread claw, bill, tarsus, central toe, central claw, gape width, eye diameter, ear diameter, esophagus, trachea; mass of gizzard, heart, liver; and gizzard content.

Keywords: House Sparrow; *Passer domesticus*; Feather morphometry; India; Remiges; Rectrices

INTRODUCTION:

The associations of House Sparrows (*Passer domesticus*) with humans and human habitats are well known; however, its population trend is not proportional to the human population trend (Summers-Smith 2003; Peach et al. 2008; Shaw et al. 2008). 12 sub-species of the House Sparrow are known (Pande 2018).

Diversification of feathers made birds adapt to a variety of habitats occupying most of the planet Earth (Chatterjee 2015). In general, the functions of feathers are flight, thermoregulation (insulation or heat retention), communication, mate attraction (display), camouflage, and protection (Amadon 1966; Ritchie et al. 1994; Feduccia 1999; Chen et al. 2015; Sullivan et al. 2017). Interspecies and intraspecies feather diversity can be observed and is prominently studied in domesticated birds (Maybury et al. 2001; Bartels 2003; Nudds and Dyke 2010; Chen et al. 2015; Pap et al. 2015; Domyan and Shapiro 2017). Terrill and Shultz (2023) have extensively reviewed the diversity and multi-functionality of feathers. They have suggested the need for additional work on feather structure.

Taking into consideration such diversity and speciation, we studied the flight feathers, and external and internal organs of the House Sparrows.

METHODS:

Study site and sampling

We collected two dead House Sparrow individuals found in the wild from Purandar Taluka, Pune district, Maharashtra. Example 1 was a nestling of unknown gender collected on 20 April 2019 at Saswad, Pune (18°21'18.4"N 74°01'32.9"E). Example 2 was an adult male that had died due to a string entanglement of the body while emerging from the natural nest site collected on 20 June 2019 at Pingori, Pune (18°13'16.1"N 74°07'31.5"E). Gender was identified by observation of plumage (Pande 2018). Their external morphometric characters were measured. Their remiges and rectrices were identified and counted according to Zeidler (1966) and Anderson (2006) as follows, primaries numbered from the innermost P1 to the outermost P10, secondaries numbered from the outer S1 to the inner S9, 6 pairs of rectrices numbered from the innermost to outermost on each side (R6 to R1 and R1 to R6).

Morphometric measurements

The length of each flight feather was measured using a digital vernier caliper (make: amiciTools, least count= 0.06 mm) from the base of the calamus to the distal tip. Further, the birds were dissected, and morphometry of internal organs was performed. The procedures and guidelines followed for external morphometry were Eck et al. (2011). Following measurements were made: body mass (weight), and wet mass of internal organs (gizzard, heart, liver, intestine) using an electronic weighing balance (make: Baijnath Premnath, least count= 0.01g); length of tarsus (the joint between tarsus and toes to the intertarsal joint), bill (from the fore- most feathers of the forehead to the tip of the maxilla), central toe (from the base of the claws to the joint between toes and tarsus on the dorsal side), central claw (length of the arc of a circle between dorsal exit of the claw of toe-3 from the skin to the tip of the claw), gape width (width of bill at feathering), eye diameter (eye axial length), ear diameter (height of the ear opening), spread claw (longest distance between streached hind and middle two including talons), using digital vernier caliper; wing width (width of the wing at primary flight feather P1) using a ruler with a zero-stop (make: Ajanta, least count= 1 mm); hand length (length from wrist joint to wing tip of fully streached wing), stretched wing (length between shoulder joint and wing tip of entirely streched single wing), wing span (length between both wing tips of fully streatched wings), alula (length from attachement of the alula at wrist joint to longest alula feather), wing web (length from fore wing to elbow joint). The esophagus and trachea were measured using a ruler. Gizzard content was studied visually.

Feather web databases referred to in this study

The following six databases were considered in this study: 1) Feather Library, 2) Featherbase, 3) The Feather Atlas, 4) Feathers, 5) Alulawebsite.com, and 6) Collins Memorial Library Digital Collections. The inclusion criterion was all the databases accessible to us on the internet on House Sparrow feathers. No exclusion criterion was made. We compared our results with these databases for gender, age, and the longest feather among primaries, secondaries, and rectrices for House Sparrow.

Permissions: The present study was conducted as per the provisions of the Wildlife (Protection) Act, 1972 as a part of the House Sparrow conservation project of Ela Foundation jointly with the Maharashtra Forest Department [Research Wing] (Pande et al. 2018). No birds were trapped or killed in this study.

RESULTS:

House Sparrow morphometry

The total count of primary feathers in two examples was, example 1: right-wing = 9, left-wing = 9; example 2: right-wing = 9, left-wing = 9. Total count of secondaries in example 1: right-wing = 9, left-wing = 9; example 2: right-wing = 8, left-wing = 9. The total count of rectrices in both examples was 12. For both examples; the length in millimeter with average, range, standard deviation of remiges of both wings is given in Tables 1 & 2; and of rectrices of both sides in Table 3.

The morphometry of external and internal organs post dissection was performed for both examples (Table 4). For dissection pictures refer to figures 1, 2 for example 1; and 3, 4 for example 2.

Comparative analysis of feather web databases with our study

A total of six prominent feather web databases were identified and compared with our study (Table 5, 6). A total of 49 individual House Sparrows were inventoried in the listed feather databases. The maximum specimens were included by 'featherbase' (n=34). Refer to Figure 6 for the percentage of House Sparrow specimens documented for the feather database by six feather databases, including contributions from this article. All databases provided data on adults; two databases provided data on juveniles. Nestling data was not provided by any listed web database which we recorded in our study. Refer to Figure 7 for percentage nestling, juvenile, and adult House Sparrows documentation in different feather databases including our study. Refer to Table 6 for details on the longest flight feathers documented by the listed databases along with findings from this article.

DISCUSSION:

Bird studies can be done using museum or live specimens (Winker et al. 1991; Remsen 1995). Museum specimens are precious resources for studying the ecology of birds (Winker 2004). However, due to institutional and ethical factors lesser number of specimens is being added to the natural history collections (Rohwer et al.

Table 1: Number of primaries of House Sparrow in example 1 and 2 with their length

Primaries	Example 1 (measurements in mm*)		Example 2 (measurements in mm)	
	Right-wing	Left-wing	Right-wing	Left-wing
P1	34.5	35.2	56	51.9
P2	35.1	35.7	58.2	55.4
P3	37.2	37.8	60.1	57.9
P4	38.5	39.3	60.6	59.9
P5	38.9	39.5	62.1	62.3
P6	39.3	39.7	64.6	65.2
P7	38.6	38.8	63.7	64
P8	36.9	36.3	63.3	64.2
P9	33.5	33.1	62.2	58.9
P10	Missing	Missing	Missing	Missing
Average	36.94	37.26	61.2	59.96
Range (Standard Deviation)	33.5-39.3 (2.11)	33.1-39.7 (2.31)	56-64.6 (2.77)	51.9-65.2 (4.44)

(*millimeter)

Table 2: Number of secondaries of House Sparrow in example 1 and 2 with their length

Secondaries	Example 1 (measurements in mm*)		Example 2 (measurements in mm)	
	Right-wing	Left-wing	Right-wing	Left-wing
S1	34.6	34.8	54.3	50.8
S2	34.4	34.2	54.3	50.2
S3	36.1	33.9	53	49.6
S4	35.1	33.5	52.8	48.9
S5	34.2	32.7	50.9	45.2
S6	33	30.8	missing	47.7
S7	25.4	26.1	49.8	48.1
S8	22.3	20.7	43.3	39.9
S9	16.2	14.9	34.2	30.6
Average	30.14	29.06	49.07	45.66
Range (Standard Deviation)	16.2-36.1 (7.08)	14.9-34.8 (7.05)	34.2-54.3 (6.99)	30.6-50.8 (6.55)

Table 3: Number of rectrices of House Sparrow in example 1 and 2 with their length

Rectrices	Example 1 (measurements in mm*)		Example 2 (measurements in mm)	
	Right-side	Left-side	Right-side	Left-side
R1	20	20.2	55.3	55.1
R2	23.1	22.6	58.1	58.1
R3	23.3	24.1	60	60.7
R4	23.2	24.6	61.9	61.3
R5	22.8	23.2	62.1	62.6
R6	20.6	22.4	60.2	60.9
Average	22.16	22.85	59.6	59.78
Range (Standard Deviation)	20-23.3 (1.46)	20.2-24.6 (1.55)	55.3-62.1 (2.56)	55.1-62.6 (2.72)

(*millimeter)

Table 4: Parameters recorded for external and internal morphometry of House Sparrow in example 1 and 2

Parameter	Example 1	Example 2	Other references
Gender	Not identified	Male	--
External measurements (measurements are in mm, biomass is in g)*			
Body mass	7.7	16.5	Average 28.4 (n=169) (Dulisz et al. 2016)
Hand length	45	75	--
Stretched wing length	76	105	92 (n=1) (Feather Library, 2023)
Wing width	40	67	--
Wingspan	155	222	214 (n=1) (Feather Library, 2023)
Alula length	16	27	Average 25.9 (n=163) (Dulisz et al. 2016)
Wing web	03	04	--
Spread claw	25	24	--
Bill length	8.9	13.4	Average 12.3 (n=20) Albayrak and Pekgöz (2021)
Tarsus length	16.2	19.3	Average 20.2 (n=42) Albayrak and Pekgöz (2021)
Central toe length	11.5	12.4	12.9 (n=1) (Feather Library, 2023)
Central claw length	3.5	3.5	Average 4.4 (n= 20) Albayrak and Pekgöz (2021)
Gape width	9.8	7.9	Average for a 17-day old nestling 15 (n=2) (Weaver 1942)
Eye diameter	3.8	4.1	Average 6.75 (n=17) (Ensminger and Fernández-Juricic 2014)
Ear diameter	2.9	2.3	--
Internal measurements			
Esophagus length	40	50	Average 36 (n= 10) (Kausar et al. 2022)
Tracheal length	24	35	Average 45 (n=7) (Sakr et al. 2022)
Gizzard mass	0.5	0.5	Average for a 12-day old nestling 0.8 (n=64) (Brzęk et al. 2009)
Heart mass	0.1	0.3	Average 0.32 (n=16) (Dubach 1981)
Liver mass	0.4	0.4	Average for a 12-day old nestling 1.4 (n=64) (Brzęk et al. 2009)
Gizzard content	Some grit particles	Grit	Grit (n=244) (Gionfriddo and Best 1995)
Intestinal mass	0.5	0.7	Average for a 12-day old nestling 1.8 (n=64) (Brzęk et al. 2009)

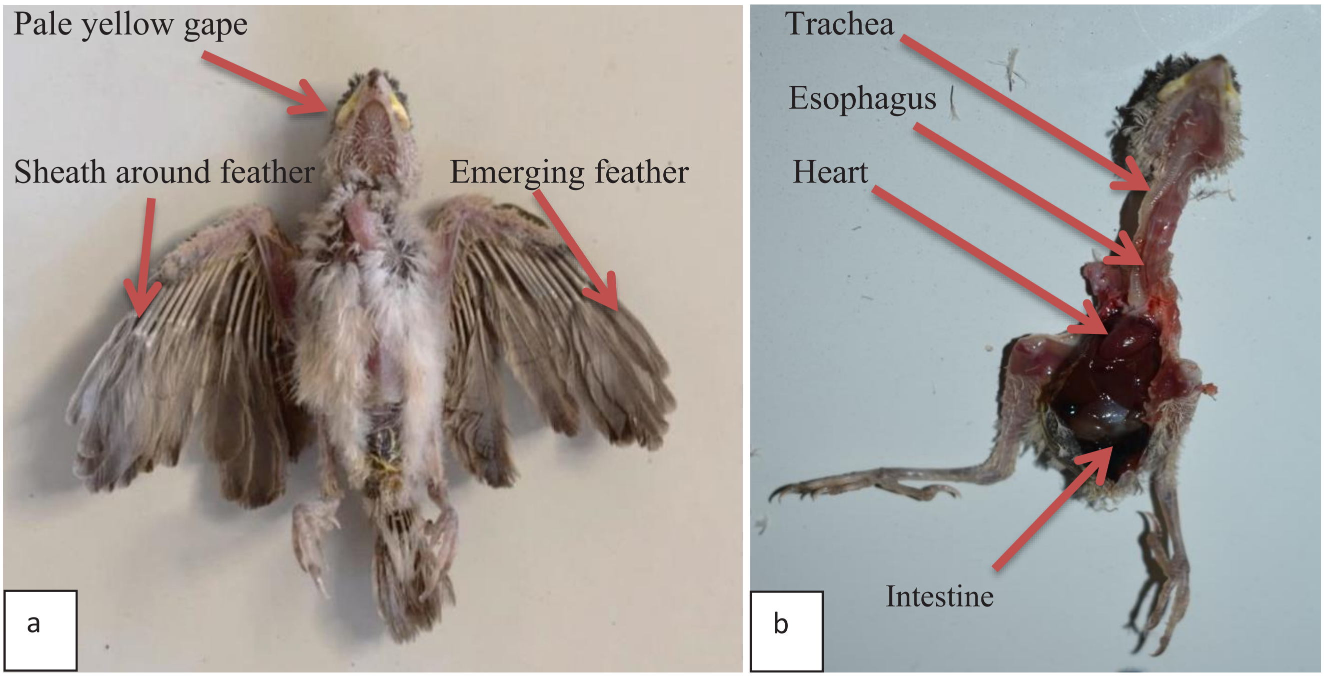

Figure 1: House Sparrow; example 1, before (a) and after dissection (b), the feathers in the pin are emerging from the sheath

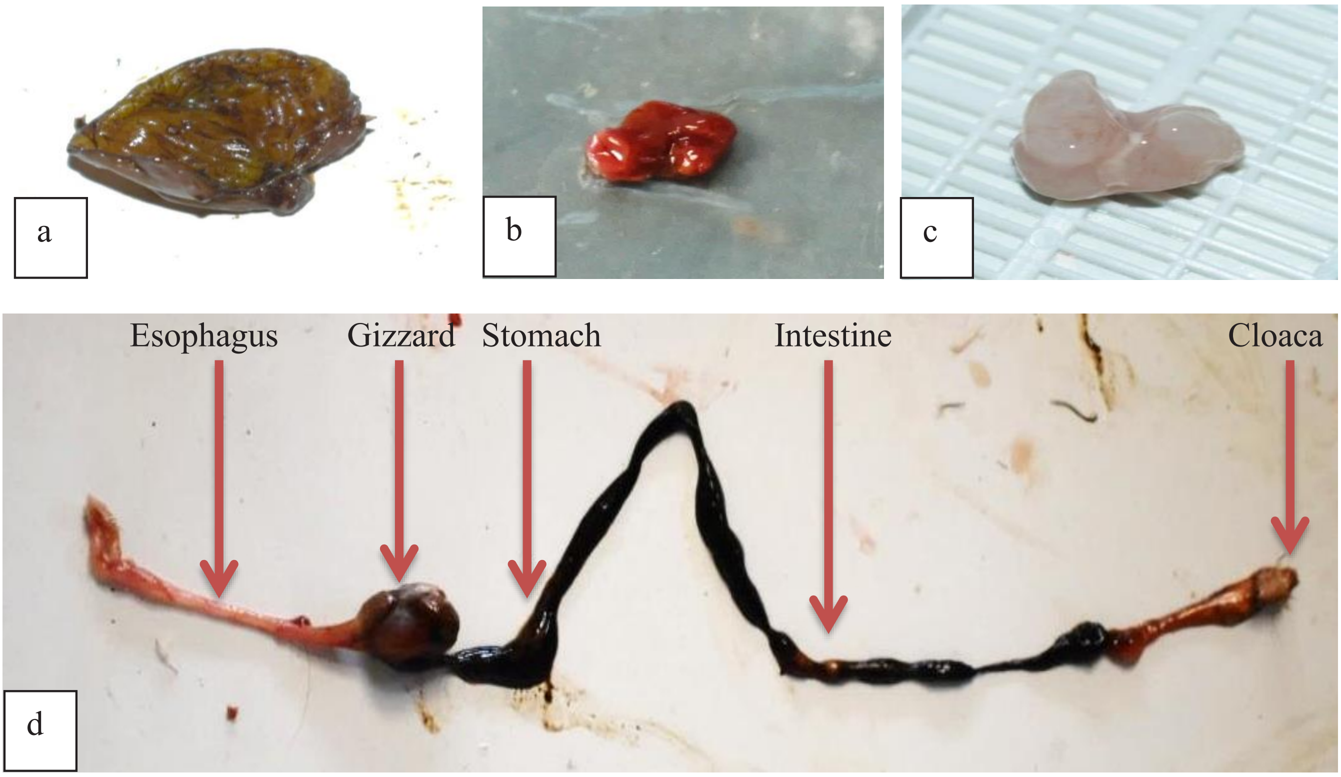

Figure 2: Dissected House Sparrow; example 1 showing internal organs (a- gizzard, b- liver, c- brain, d- alimentary canal)

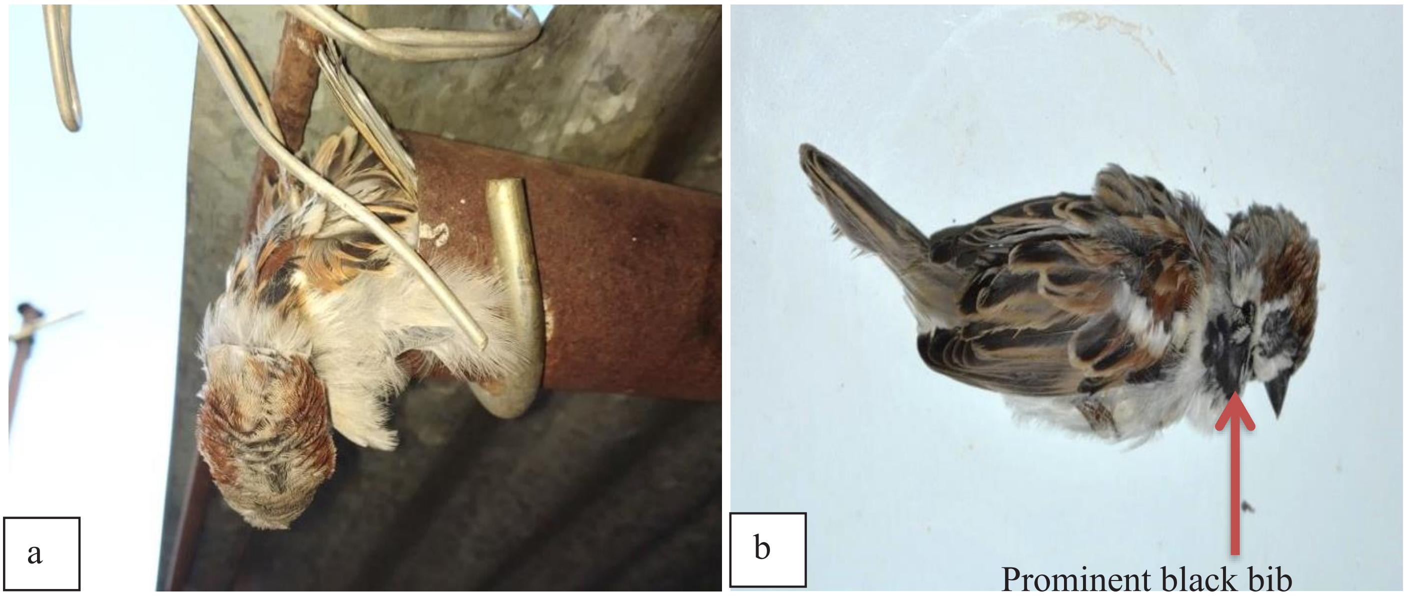

Figure 3: Example 2 a) dead male House Sparrow strangulated by a string b) collected specimen with a black bib and a dark brown to black bill

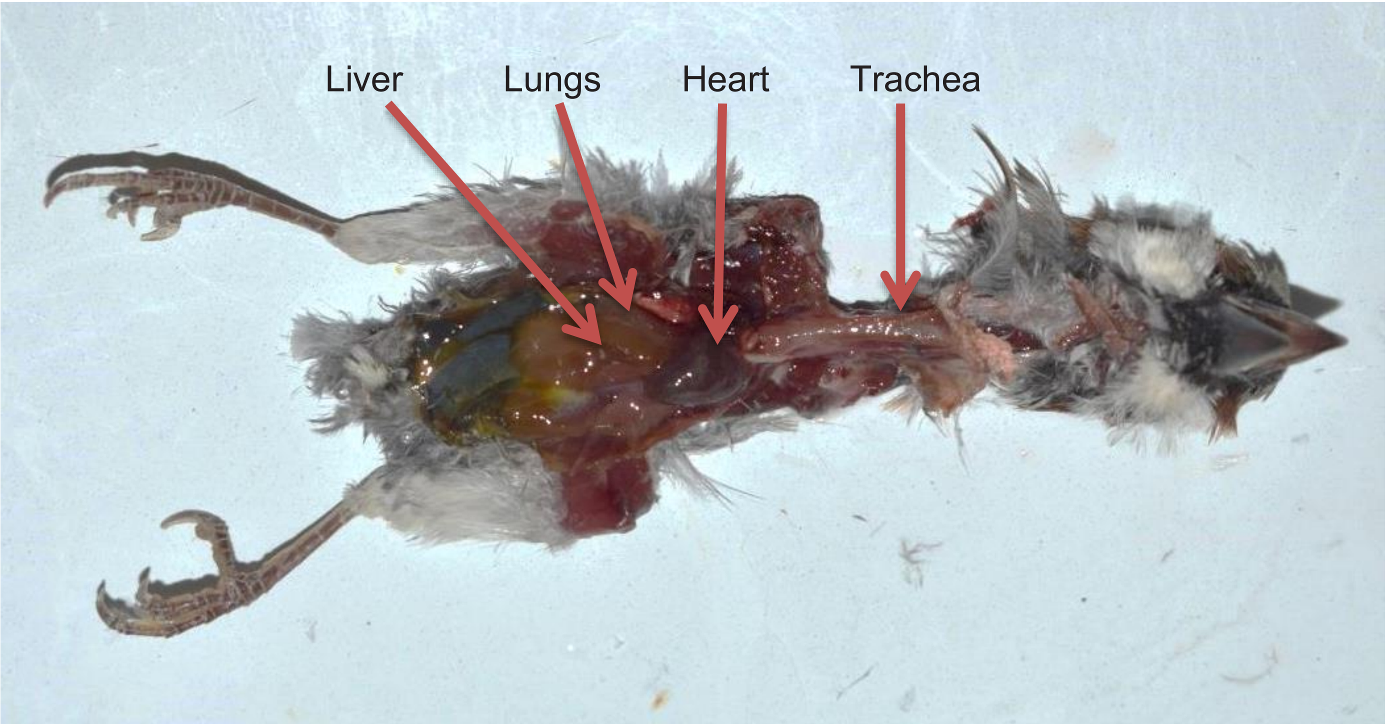

Figure 4: Various internal organs of House Sparrow; example 2

Table 5: List of six feather web databases of House Sparrow and contributions from this article

Database	Feather Inventory of the House Sparrows from	Total number of specimens inventoried (as was available on the website till June 2023)	Adult Gender			Juvenile	Nestling	Reference
			Male	Female	Unidentified			
Feather Library (by Esha Munshi and Sherwin Everett)	Gujrat state of India	1	-	1	-	-	-	Feather Library, 2023
Featherbase (by featherbase.info - feather research and education)	Germany, Austria, Morocco, Spain, France, Greece	34#	10	7	13	4	-	Featherbase, 2023
The Feather Atlas (by U.S. Fish and Wildlife Service)	The US state of Oregon	1	1	-	-	-	-	The Feather Atlas, 2023
Feathers (by Michel Klemann)	The Netherlands	7	3	1		3	-	Feathers, 2023
Alulawebsite.com (by The Alula team : Aymeric Le Calvez and Eric Roualet)	United Arab Emirates, France	3	3	-	-	-	-	alulawebsite.com, 2023
Collins Memorial Library Digital Collections (by the University of Puget Sound, USA)	The US state of Washington	3	1	2	-	-	-	Collins Memorial Library Digital Collections, 2023
Total		49	18	11	13	7	0	
Contribution by our study		2	1	-	-	-	1	This article

#Scans for 24 out of 34 records from Featherbase were accessible.

Table 6: Records of longest primary, secondary, and rectrix of House Sparrow as available in feather web databases and contributions from this article

Database and reference	Longest Primary	Longest Secondary	Longest Rectrix	Other details provided
Feather Library	P8- 61.4 mm, (n=1)	S2- 48 mm, (n=1)	Feather scan available with scale, direct measurement not provided (n=1)	Feather scan of alula with scale; measurements of head, bill, leg, wing, and biomass
Featherbase	P6 (20%), P7 (60%), P8 (20%), range 59 - 69.5 mm (n=20)	S1 (48%), S3 (10%), S2 (43%), range 49.5 - 55.5 mm (n=21)	R5 (40%), R2 (7%), R3 (13%), R4 (40%), range 53 – 68 mm (n=15)	Data on the smallest and largest individual available, feather scans of most of the body feathers
The Feather Atlas	P6 & P7, 67 mm (n=1)	S1, 55 mm, (n=1)	R4, 65 mm, (n=1)	Feather vane length measurement for primaries, secondaries and rectrices
Feathers	Feather scan available with scale, direct measurement not provided (n=5)	Feather scan available with scale, direct measurement not provided (n=5)	Feather scan available with scale, direct measurement not provided (n=6)	Feather scans for greater primary coverts, greater coverts, alula, lesser coverts, marginal coverts, back feathers, rump feathers, and throat feathers are available for some samples
Alulawebsite.com	P6 & P7, 65.5 and 63 mm (n=2)	S1, S2, & S3, 52 to 51 mm (n=2)	R4, 63 & 61 mm (n=2)	Feather scans of Alula and coverts of 1 sparrow
Collins Memorial Library Digital Collections	Only wing scans were available, measurements were not provided	Only wing scans were available, measurements were not provided	Only wing scans were available, measurements were not provided	One female wing scan showed color aberration in flight feathers
This article	P 6 (Refer to Table 1)	S1, S2, S3 (Refer to Table 2)	R3, R4, R5 (Refer to Table 3)	External and Internal organs morphometry (Table 4)

*mm=millimeter

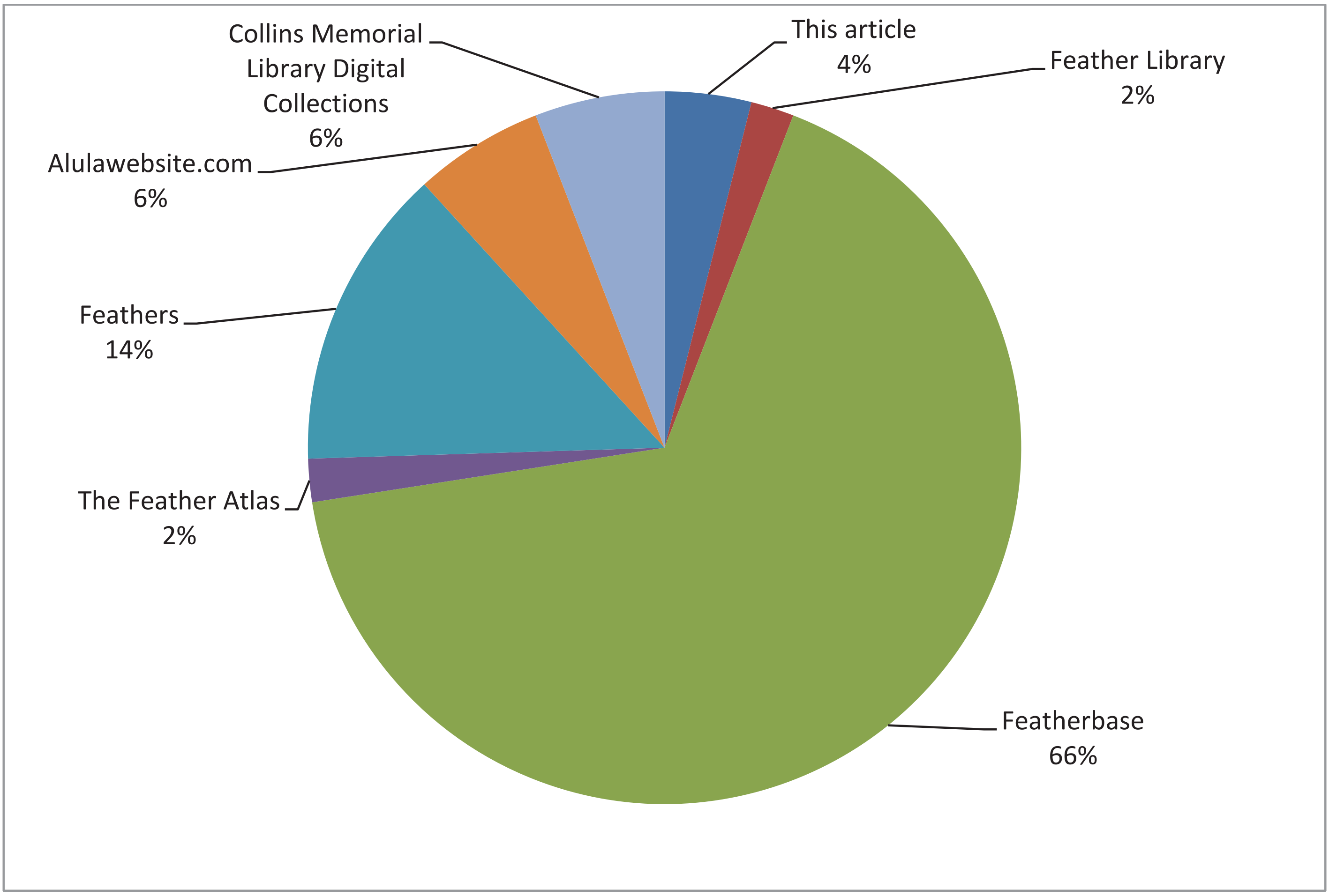

Figure 6: % House Sparrow specimens inventoried by six feather databases, including contributions from this article

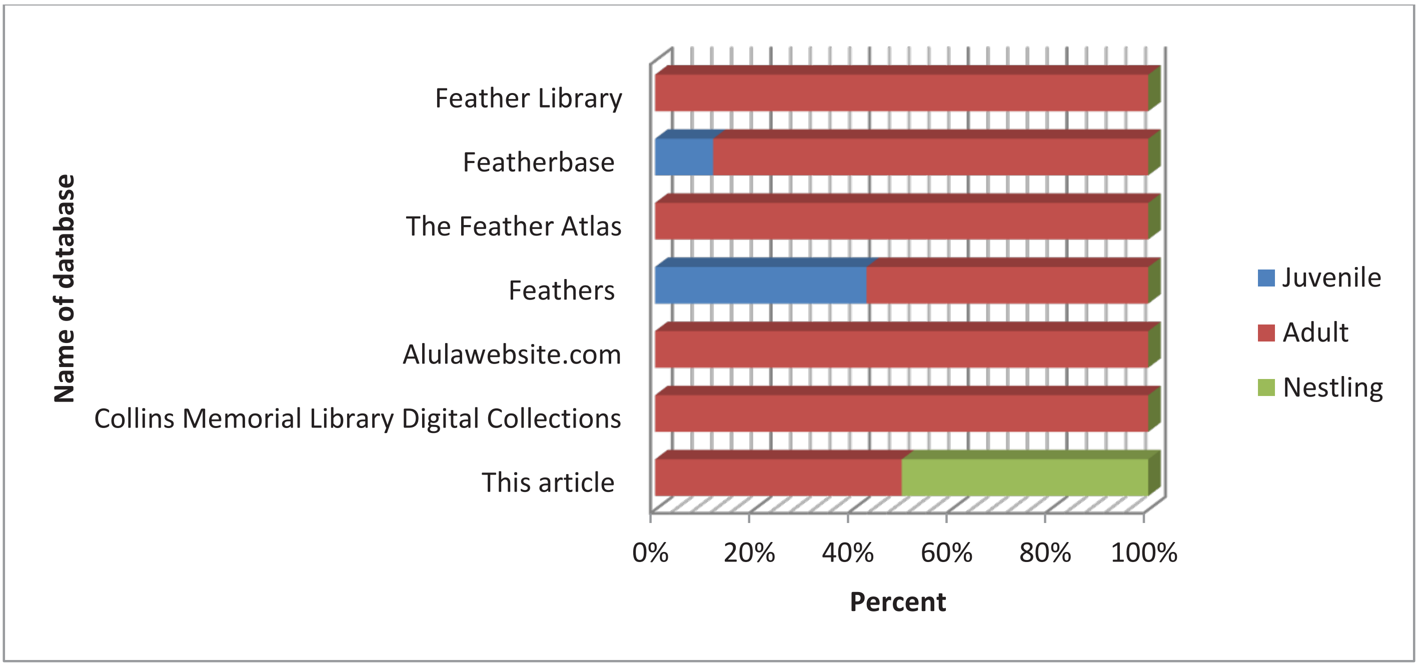

Figure 7: % age wise House Sparrows inventoried in six feather web databases, including contributions from this article

2022). In live specimens, study should be done rapidly to avoid injuries or stress to the bird. Considering above-mentioned points, the feather databases are promising and trustworthy in studies of avian ecology (Malo and Mata 2021). Feather length measurement can be used as a parameter to assess feather quality in House Sparrows (Pap et al. 2008). A study of interspecific variations of flight feathers was conducted by Pap et al. (2015) for various birds. They selected primary 8 (P8) as a parameter in the study as it is the longest distal flight feather in general. However, in our study, on both the wings P6 was the longest feather. Featherbase, 2023; documents in 20% (n = 20) samples P6, 60% samples P7 and 20% samples P8 as the longest in the House Sparrow. While P7 is the longest as per the Feather Atlas, 2023 (n = 1) and alulawebsite.com, 2023 (n = 2). In our study, S1 and S2 were the longest on the right wing and S1 on the left wing. As per Featherbase, 2023; S1 and S2 in 90% of their samples (n = 21) were the longest. The R5 was the longest rectrix in our study (n = 1). In Featherbase, 2023; R3 (13%) and R4 (40%) were the longest (n = 15). None of the web databases reported data on nestling House Sparrow feathers. In our results concerning nestling, the longest primary feather was P6 on both wings, S3 on the right wing and S1 on the left wing, R3 on the right, and R4 on the left side. Results of our study are comparable with other studies concerning length of alula, bill, tarsus, stretched wing, wing span, central toe, central claw; mass of heart and gizzard content. Readings of body mass, gape width, eye diameter, length of esophagous and trachea, mass of gizzard, liver, intestine were observed to be generally comparable (Table 4). Few differences may be a result of age, gender, season, breeding biology, nourishment etc.

CONCLUSION:

We report the morphometry of two examples of dead House Sparrows (nestling and adult) from Maharashtra, India. From the listed feather databases only one was from India as of July 2023. We propose further morphometric studies on House Sparrows. Our study contributes 4% to the existing databases.

RECOMMENDATIONS:

For a common bird like the House Sparrow, with a feather database of a mere three individuals from India (Table 5), the paucity of data is obvious. We recommend interacting with forest department staff, bird enthusiasts, citizen scientists, and rescue center personnel including veterinarians, and ornithologists about this lacuna. With the support of the forest department this gap in databases of House Sparrow and other birds can be bridged.

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AUTHOR CONTRIBUTIONS:

Original Idea: RS, RL, SP; Design of the study: RS, RL, SP; Survey, Data collection and Laboratory Experimental work: RS, RL, SP; Data analysis and Manuscript Preparation: RS, SP. SP supervised work; all authors read and approved the final manuscript.

Conflicts of Interest: None

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Decrease in the potency of toxins in urban insects - a review

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Abstract

Insects exploit diverse urban habitats; however, the impact of urbanization on their venom potency remains poorly studied. We reviewed literature on insect toxins and their ecological roles, focusing on examples with documented medicinal applications. We analysed studies investigating the abundance and distribution of specific insect species across urban and rural gradients. Finally, we examined research on toxin concentration variations within these species. Our analysis suggests a trend of potentially lower toxin potency in urban insect populations compared to their rural counterparts. These findings suggest a potential evolutionary adaptation in urban insects, with a decrease in toxin production probably as a response to altered ecological pressures. However, further research is necessary to strengthen this link and explore the underlying mechanisms. Investigating the potential decline in insect toxin potency is crucial, particularly considering the documented medicinal properties of some toxins. This knowledge could guide future research on harnessing these toxins for therapeutic applications.

Key words – Insects, Venom, Urbanisation, Toxin

1. Introduction

Phylogenetically, phylum Arthropoda, has four extant subphyla – Chelicerata, Myriapoda, Insecta (insects, as included in this study) and Crustacea (Thorp, 2009). The dynamic nature of urban ecosystems, characterized by a mosaic of habitats and resources, provides niches for a multitude of insect species to thrive. The interactions between insects and their urban environment contribute to the ecological complexity and biodiversity of these man-made landscapes. Key factors influencing insect survival in cities include resource availability (food, shelter, breeding sites), human activities (habitat changes, new resources, pest control), and genetic adaptation. Insects exploit these environments through various strategies: using diverse resources (human-made structures, food products), genetic adaptations for urban life, behavioural adjustments (like foraging, nesting, and reproduction), rapid evolution, and interactions with human activities (new habitats, pest control). Common urban insects include ants, cockroaches, flies, mosquitoes, beetles, true bugs, bees, wasps, moths and butterflies. Additionally, grasshoppers/crickets, termites, spiders, dragonflies, damselflies, true bugs, and other flies can also be found in urban areas. The diversity of habitats and resources in cities creates niches for many insect species to survive and contribute to the ecological complexity of urban environments. (Frankie & Ehler, 1978). According to McKinney, (McKinney, 2008), urbanization significantly threatens ecological communities. Ecosystems in urban areas experience various human-caused pressures, for example a substantial accumulation of contaminants within their surface water. (Gilliom, 2007). Modern urbanisation particularly in the neo tropics has become the major cause for decline in the insect population (Fenoglio et al., 2024)

2. Some Toxins produced by members of class Insecta

Insecta (insects) produce a wide variety of toxins, which can be broadly classified into two main categories:

2.1. Small molecule toxins: These are often relatively simple molecules that can have various effects on predators or prey. Some common examples include:

2.1.1. Cantharidin: This toxin is found in blister beetles and can cause blistering of the skin and mouth. Cantharidin was found to have anti tumor effect in many studies as well as a pesticidal effect especially against lepidopterans (Wang et al., 2018), The ancient Greeks and Romans consumed dried bodies of the beetles containing Cantharidin as a diuretic as well as an aphrodisiac, now due to scientific advancement we know that this practice is very dangerous, since 0.5 mg of Cantharidin lodged in the throat is said to cause enough blistering to suffocate and even kill a man (McCormick & Carrel, 1987). Although not known to be major pests they are attracted to flowering plants, which they feed on and can be ingested by farm animals like cattle and horses, where they can be lethal. Blister beetles can also be a nuisance to gardeners, as they can damage plants (*Blister Beetle Management in Forages and Field Crops | NDSU Agriculture*, 2022). Blister beetles are known to be parasitoids of bees and grasshoppers (Ghoneim, 2013). Though true blister beetles belonging to *Meloidae* are the primary source of cantharidin, cantharidin is also found in the venom of false blister beetles belonging to *Oedemeridae.* A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but there are a few examples cited in the "observed trends" section of this paper that indirectly indicate the toxin is more potent in rural insects as compared to urban insects particularly examples like the ones comparing toxicosis in equines (Edwards et al., 1989 and Helman & Edwards, 1987), and the example of leg coloration in ground beetles whose venom predominantly contains cantharidin (Dahirel et al., 2023).

2.1.2. Formic acid: contrary to popular belief formic acid is not present in the sting of ants, but rather in the poison gland of a subfamily of ants called formicinae, thus it is released in the bite rather than the sting (Chen et al., 2012), it is also known to be produced by many carabid beetles as a spray (Rossini et al., 1997).

Formic acid from ants is known to be an efficient pesticidal agent specially against ticks, for example in one study the larvae and nymphs of the blood sucking ectoparasite lone star tick *Amblyomma americanum* showed a very high rate of mortality to formic acid volatiles (Showler et al., 2020). In a recent study it was also shown that formic acid at various concentrations is cytotoxic and genotoxic to human lymphocytes (Aksu et al., 2016) indicating a possible application in targeting apoptotic and necrotic cells. A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but there are a few examples cited in the "observed trends" section of this paper that indirectly indicate the toxin is more potent in rural insects as compared to urban insects particularly examples like the example of leg coloration in ground beetles whose venom predominantly contains cantharidin as well as formic acid (Dahirel et al., 2023) and the example where the formic acid content of an urban ant species is compared to the formic acid content of a rural species (Roth & Eisner, 1962 and O. Rourke, 1950).

2.1.3. Phospholipase-D (PLD) toxins: Phospholipase-D (PLD) toxins are found in the venom of spiders belonging to the genus Loxosceles, commonly known as Brown spiders, known to cause dermonecrosis, thrombocytopenia, hemolysis, and acute renal failure (Gremski et al., 2020. Phospholipase D (PLD) exhibits diverse therapeutic applications. PLD1 and PLD2, key regulators of bone remodelling, are potential targets for bone diseases like osteoporosis and rheumatoid arthritis (Kim et al., 2023). In cancer, PLD inhibition enhances apoptosis in colorectal cancer cells, reduces migration and invasion, and promotes immunogenic cell death, suggesting a role in cancer immunotherapy (Hwang et al., 2022). Moreover, PLD has implications in neurodegenerative diseases like Alzheimer's, with PLD inhibition showing promise in ALS treatment (May-Dracka et al., 2022). Additionally, PLDs found in Loxosceles spiders' venoms are linked to dermonecrosis, and mutant PLDs could serve as antigens for neutralizing antisera production (T. P. da Silva et al., 2021). In prostate cancer, PLD, particularly PLD2, is associated with bone metastasis, highlighting its potential as a therapeutic target for this condition (Borel et al., 2020). A direct comparison of this toxin in urban vs rural species is not present in literature as yet but there are a few examples cited in the "observed trends" section of this paper that indirectly indicate the toxin is more potent in rural species as compared to urban species particularly examples like the production of venom of a particular species of scorpion *Tityus stigmurus* known to contain PLDs among other toxins and its modulation based on perceived threats (Lira et al., 2017) and also the fact that adaptation to Urban environments can lead to smaller body sizes in certain spider species, due to reduced prey availability and the Urban Heat Island effect, this reduction in body size might cause a proportional decrease in the venom gland size (Dahirel et al., 2019).

2.1.4. Cardiac glycosides: cardiac glycosides are not directly produced by insects but rather accumulated in their bodies through their diet, despite being highly toxic to animals, cardiac glycosides, which disrupt a vital molecule (Na,K-ATPase) in their cells, are surprisingly tolerated by over 100 insect species across various orders. These insects can even sequester these toxins from their food sources without any adverse effects (Dobler et al., 2015).

A large quantity of cardiac glycosides are also found in the venom gland of the cane toad *Bufo marinus* (Radford et al., 1987) where it might have accumulated from its diet as according to (Somaweera et al., 2011) the tadpoles caused very less mortality in predators who ate them compared to the adult which almost always caused mortality when eaten by predators. In general, all cardiac glycosides cause gastrointestinal as well as neurological disturbances including cardiac arrhythmia in humans (Radenkova-Saeva & Atanasov, 2014) many other papers have studied and proven therapeutic uses of glycosides in humans, for example a study found that certain cardiac glycosides had an anti-tumour effect on human lung cancer cells by inhibiting cell proliferation and inducing cell death (Kaushik et al., 2017). One study demonstrated cytotoxic effects of certain cardiac glycosides on T-cells and macrophages in humans indicating their immune-modulatory effects (Škubník et al., 2021). Another study found that cardiac glycosides show an inhibitory effect on proliferation of influenza virus infected cells by suppressing translation (Amarelle et al., 2019).

A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but there are a few examples that may provide indirect evidence to this fact like the fact that most insects that sequester cardiac glycosides, have adapted to high concentrations of these compounds in their food sources, which are more prevalent in rural habitats and Insects in rural areas may exhibit genetic adaptations that enhance their resistance to cardiac glycosides, allowing them to thrive in environments where these compounds are abundant (Winter et al., 2020), suggesting that insects in urban areas might potential sequester lower concentrations of this toxin.

2.2. **Peptide toxins:** These are more complex molecules made up of chains of amino acids. They can have a very specific mode of action, often targeting particular ion channels or enzymes in the nervous system of predators or prey. Some well-known examples include:

2.2.1. **Melittin:** This is the main toxic component of bee venom and causes pain, swelling, and inflammation, it is shown to have anti-bacterial (Fennell et al., 1968) anti-tumour (Gajski & Garaj-Vrhovac, 2013) as well as anti-viral properties (Memariani et al., 2020), one study showed that even though Melittin showed cytotoxicity to both normal and cancerous cells by inducing a decline in mitochondrial bioenergetics, it was more cytotoxic to the cancer cells (Shi et al., 2022). A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but the fact that Urbanization has been shown to affect the genetic diversity of honeybee populations, with feral colonies adapting to urban landscapes (Patenkovic et al., 2022) and such adaptions may affect venom production, may indicate that urbanized honeybees may produce less venom and proportional amount of toxins.

2.2.2. **MCD toxin:** The mast cell degranulating peptide (MCDP) is not only found in bumblebee venom but also in honey bee venom, where it exhibits potent immunological and pharmacological activities (Saravanan et al., 2023). MCDP is known for its dual role as an anti-inflammatory agent and a strong mediator of mast cell degranulation and histamine release (Ye et al., 2023). Additionally, MCDP has been identified as an epileptogenic neurotoxin, a blocker of potassium channels, and capable of inducing significant hypotension in rats (Mircevska et al., 2020). A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but the example of honey bees in urban environments which maybe adapting to produce less venom (Patenkovic et al., 2022) could be easily applied to bumble bees too, and this will result in proportionate decrease in toxins in their venom.

2.2.3. **Mastoparan:** A class of mast cell degranulating peptides, that are found in the venom of social wasps and hornets, many having strong antimicrobial properties (Choi & Lee, 2020). One study demonstrated that three Mastoparan peptides extracted from solitary wasps showed potent anticancer activity toward human glioblastoma multiforme cells, which are malignant brain tumor cells. Importantly, the antiglioblastoma action of Mastoparan peptides occurs by membranolytic activity, leading to necrosis (A. M. B. da Silva et al., 2018). A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but there are a few examples cited in the "observed trends" section of this paper that indirectly indicate the toxin is more potent in rural insects as compared to urban insects particularly examples like the comparison between the coloration and the size of the venom glands in a certain species of paper wasps *Polistes dominula*, with brightly coloured individuals with larger venom glands more dominant in rural areas and paler individuals with smaller venom glands more dominant in urban areas (Vidal-Cordero et al., 2012).

2.2.4. **Bradykinin:** Bradykinins are found in the venom of various insects, including wasps and scorpions. Additionally, research has shown that bradykinin potentiating factors, which enhance the effects of bradykinin, are present in the venom of insects like wasps and scorpions (Goudarzi et al., 2019; Watanabe et al., 1976). In the human body, they act on two types of receptors: B1 and B2 (Arapa-Diaz et al., 2020; Brusco et al., 2023; Butenas et al., 2023; Li et al., 2018). B2 receptors are consistently present and play a crucial role in vasodilation by releasing different chemicals, aiding in lowering blood pressure (Mesquita et al., 2017). On the other hand, B1 receptors are typically triggered during tissue injury and may be associated with long-term pain conditions (Brusco et al., 2023). The activation of B2 receptors leads to the relaxation of blood vessels, contributing to improved vascular function. Understanding the distinct roles of these bradykinin receptors sheds light on their involvement in regulating blood vessel tone and potentially influencing blood pressure levels, highlighting their significance in physiological and pathological processes related to vascular health. A direct comparison of this toxin in urban vs rural insects is not present in literature as yet but there are a few examples cited in the "observed trends" section of this paper that indirectly the toxin is more potent in rural insects as compared to urban insects particularly examples like the comparison between the coloration and the size of the venom glands in a certain species of paper wasps *Polistes dominula*, with brightly coloured individuals with larger venom glands more dominant in rural areas and paler individuals with smaller venom glands more dominant in urban areas (Vidal-Cordero et al., 2012) and the production of venom of a particular species of scorpion *Tityus stigmurus* known to contain PLDs among other toxins and its modulation based on perceived threats (Lira et al., 2017).

3. Observed trends

The insect venom with the highest amount of cantharidin toxin is found in the Oedemeridae beetle species *Oxycopis thoracica*, specifically in the females, with quantities ranging from 15 to 35 µg per beetle (Carrel et al., 1986). Additionally, the *Oedemera podagrariae* beetles from central Iran were found to contain an average of 21.68 µg of cantharidin per female beetle, which is sufficient to irritate human skin (Abtahi et al., 2012). Both of these were predominant in forest areas.

In a case study of 70 equines with cantharidin toxicosis conducted in a lab which was located in a rural locality (Helman and Edwards, 1987), around 50% of the animals with acute toxicosis died , while in another study it was found the toxin of two species of blister beetle caused milder toxicosis effects on horses that ingested them (Edwards et al., 1989), comparing the results of these two studies it can be indirectly deduced that the cantharidin in rural beetles maybe more potent than that found in urban beetles.

Black-legged ground beetles are more prevalent in urban areas compared to red-legged ones, indicating a shift in coloration along an urbanization gradient (Dahirel et al., 2023). Beetles like many other organisms display bright colouration to indicate their high toxic content (Dettner, 1987), thus it can be deduced indirectly that the beetles in rural areas would be more toxic than those in urban areas. The red wood ant *Formica rufa*, which is supposedly a forest dweller, contains about 19.6% of its body weight of formic acid (Roth & Eisner, 1962), while its urban cousin the black garden ant *Lasius niger* contains on average 7.7% (O. Rourke, 1950). O'Rourke in his 1850 paper 'Formic Acid Production Among the Formicidae' studied the concentration of formic acid in various ant species but did not identify them as urban or rural.

In one study paper wasps *Polistes dominula* were collected from 30 different nests and it was found that brightly coloured wasps had larger poison glands than those wasps with a comparatively paler colour (Vidal-Cordero et al., 2012). Though it was not directly mentioned by the authors of this study it can be deduced from the sites of collection of sample individuals that paler or blacker individuals dominated urban areas.

A particular species of scorpion *Tityus stigmurus* has been shown to modulate its venom production directly proportional to its perceived level of threat (Lira et al., 2017), assuming forested areas have more threats to these scorpions; the scorpions in such areas would produce more potent toxins.

In a 10 year study in Bangkok, Thailand researchers found that centipede bites to humans caused local benign symptoms like localised mild swelling and pain (Niruntarai et al., 2021) where as one sting from the Chinese red-headed centipede *Scolopendra subspinipes mutilans* is enough to kill a mouse, moreover, most centipedes in the jungle are known to attack and subdue prey tens of times larger than them (Luo et al., 2018). In the same study Luo et al found that severe clinical symptoms, such as vasospasm, acute hypertension, myocardial ischemia, and even death, have been observed following centipede envenomation. The results of Niruntarai et al(2021) compared to the observation of Luo et al(2018) might suggest that the venom of centipedes in forested and semi-forested areas could be more potent than the venom of centipedes dominant in the cities.

4. Conclusion

Many studies have been performed over the years to study the effects of urbanisation on insects, but very few have actually researched and tried to correlate the potential and the concentration of toxins produced, if truly an evolutionary mechanism is acting to decrease the potency of such toxins, further research would be warranted lest these toxins, many of which have been shown to have some beneficial effects become an elusive resource.

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Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used the AI tool scispace in order to summarise reference articles. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Ethnobiological study of traditional medical and cultural practices in Doiwala, Dehradun, India.

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Abstract

As a diverse taxonomic group, insects inhabit various habitats worldwide and have been historically utilized for medicinal and dietary purposes. This study, conducted from September to March 2023, employed a snowball sampling technique to select respondents. Data collection involved semi-structured questionnaires and group discussions. Within the ethnobiological context, the study identified 13 species belonging to 10 genera, with Coccinella comprising 31% of the dominant genus. Cultural uses of these species revealed six categories, including black magic, insecticide, spirituality, sex determination, evil eye and successful marriage. Asthma was notably treated with three species. Some individuals practiced ethnomedicine, receiving compensation in cash or livestock, underscoring insects' role as a livelihood source. The documented species also held mythical significance. This study pioneers entomotherapy based research on regional insect usage, paving the way for future investigations.

Keywords: *Coccinella, ethnomedicine, livelihood, sustainable utilization*.

Introduction

Since ancient periods, insects have been exploited in the therapeutic frameworks of diverse societies (Seabrooks and Hu 2017). Generally considered unclean creatures, many of them are utilized alive, cooked, crushed, in concoction, as salves, in sorcery, and for other purposes (Costa-Neto 2005). The utilization of bugs to combat health issues is termed ethno therapy. As per Costa-Neto 1999, the medical frameworks are arranged as cultural frameworks, thus the utilization of ethno-usage of bugs should be scrutinized from a cultural viewpoint (Jabbar et al., 2023). Pliny the Elder recounted some entomotherapy practices that were employed for a variety of illnesses in the Roman Empire during 285 A.D. Nevertheless, the conviction that bugs are beneficial to humanity can be traced in the tome Insect theology published in 1699 (Berenbaum 1995). The Ebers papyrus, an Egyptian medicinal treatise also encompasses numerous remedies obtained from bugs (Vanitha et al., 2017). Though the practice of utilizing insects for medicinal purposes is exceedingly ancient, it is still comparably unfamiliar to the academic world (Siddiqui et al. 2023). The utilization of insects is not confined to medicine but is seen in other cultural practices, playing a significant role in shaping the traditions, and rituals of the societies (Belluco et al. 2023). Many communities employ insect species for varied purposes. (i.e., sorcery, religion, spirituality, malevolent gaze, malevolent spirit issue (Hassan et al. 2023). Himalayas are opulent biodiversity spots, inhabiting a plethora of fauna, and numerous investigations have been conducted to explore the traditional values of flora (Sekar et al. 2023; Haq et al. 2022; Hassan et al. 2022), however, few ethnozoological investigations focus on animal fauna especially insects (Mulyanto et al. 2021). Furthermore, across the world, we are witnessing urbanization, due to which the lifestyle is changing, causing the obliteration of traditional knowledge (Majeed et al., 2024). In this context the present investigation was carried out with the two prime objectives: 1) To chronicle the insect species utilized in traditional medicinal uses and local cultural practices. 2) To scrutinize the role of insect fauna in their sustenance. The present investigation focuses on the ethnobiological uses of bug species from Doiwala Dehradun-India.

1. Materials and Methods

1.1.Study area

Doiwala, (30.103368oN 78.2947544oE, at1120 ft above msl) is a tehsil on the bank of the Ganges River in Dehradun, Uttarakhand, India (Fig.1). In agreement with the Koppen-Geiger weather categorization, the climate is damp subtropical (Cwa) with typical utmost and minimum temperatures of 40^0C and 7^0C correspondingly (https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,rishkesh,India). The maximum precipitation (444mm) occurs in July and the least rainy month (10mm) is November. The populace of the expanse is 70499 with a compactness of 8851/Km2.

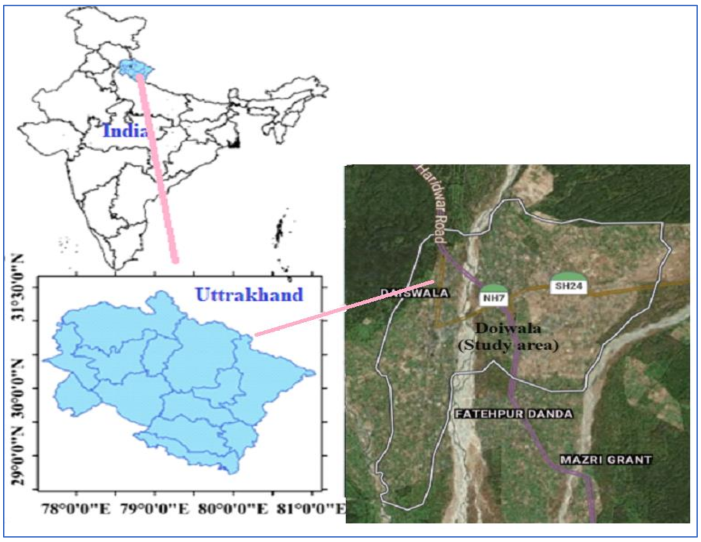

Figure 1. Map showing the study area.

1.2. Ethnozoological data collection

Between September and March 2023, an exploration was conducted utilizing the avalanche method to select participants. Those demonstrating substantial knowledge of insect varieties were chosen for in-depth discussions. Ethical protocols, as outlined in the Code of Ethics by the International Society of Ethnobiology (https://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/), were strictly followed, with prior consent obtained from all participants. Traditional wisdom was recorded through semi-structured conversations followed by group discussions, as described by Haq et al. (2022). A total of 63 respondents (49 male, 14 female) were selected, representing diverse age groups and professions (see Table 1). The higher number of male participants was influenced by cultural factors. Taxonomic verification was conducted using the online database "Integrated Taxonomic Information System" (https://www.itis.gov), and MS Excel was employed for species distribution analysis. Ethnobiological utilization was examined using a chord diagram generated through bioinformatics software (http://www.bioinformatics.com.cn/plot_basic_GOplot_chord_plot_085_en).

2. Results and Discussion

2.1. Taxonomy and medicinal uses in culture

In the realm of ethnobiology, this study revealed a total of 15 species from 10 genera (see Table 3). The genus *Micraspis* had the highest number of species (3), followed by *Coccinella* and *Oenopia*, each with 2

Table 1. Demographic information of respondents from Doiwala Dehradun-India

Demographic features	
Total informants	83
Male	59
Female	24
Profession	
Shopkeepers	15
Farmers	21
Street vendors	24
Herders	12
Government Employees	11
Age range	
25-45	13
46-65	31
66-85	39
Original Language	Hindi
Religion	Hinduism

species. A detailed correlation analysis between species and genera is depicted in Figure 2a, demonstrating a linear relationship (Y=0.0364x + 1.58, R2 = 0.032).

After cataloging the cultural uses of various species, the study identified a total of 6 categories of use (including including including black magic, insecticide, spirituality, sex determination, evil eye and successful marriage). The highest number (8) of species (*Adalia decempunctata, Angelis cardoni, Chilocorus nigritus, Coccinella hieroglyphica, Halyzia sanscrita, Propylea dissecta*) were associated with black magic, followed by 2 species (*Coccinella leonine, Coccinella septempunctata*) as insecticides, 2 species (*Hippodamia convergens, Micraspis discolor*) for protection against the evil eye, 1 species (*Cheilomenes sexmaculata*) for spiritual purposes, and 1 species *(Coccinella undecimpunctata*) for sex determination (refer to Fig. 2b). Hassan et al. (2023) highlighted the significance of insects in cultural practices in the Kashmir Himalayas, while Chakravorty et al. (2013) documented similar insect use in the local culture of Arunachal Pradesh, India.

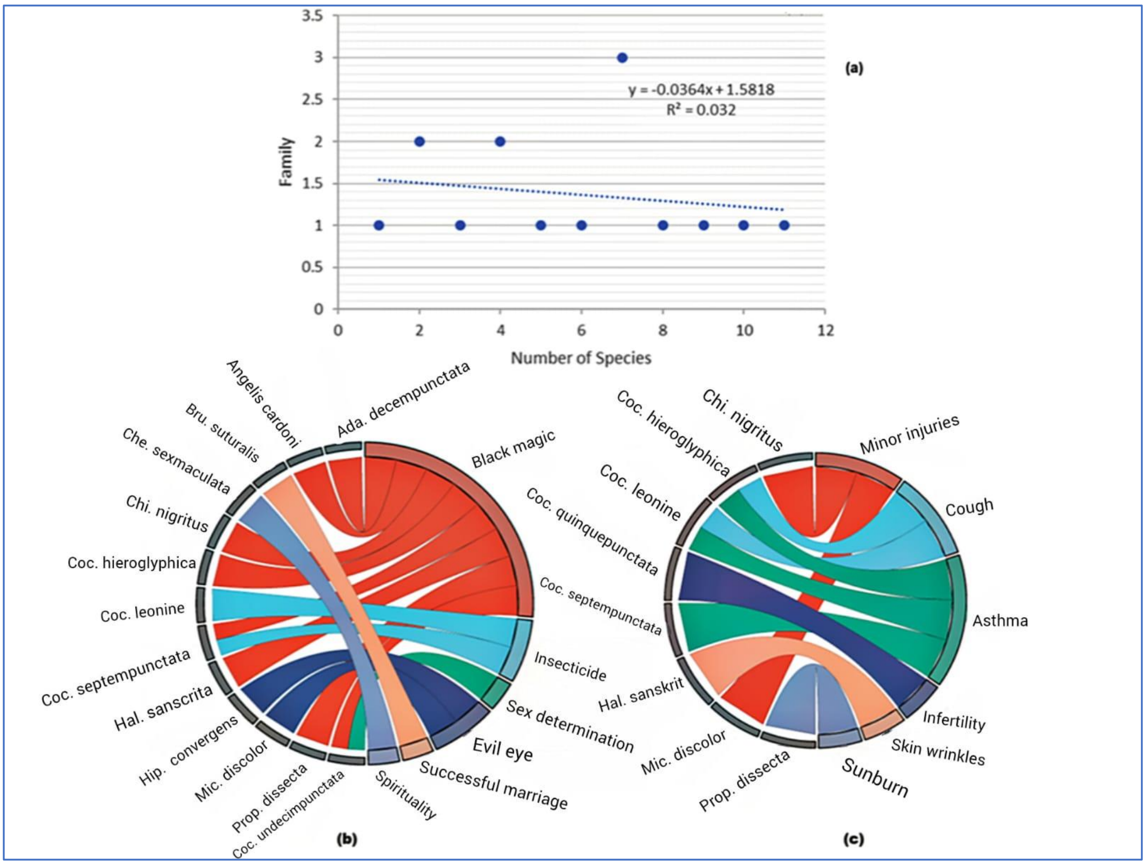

Figure 2. (a) Plot of species against families. Fig (b) Chord diagram revealing the cultural uses; (c) diseases treated by the documented species. The complete names and uses of the species are provided in the Table.3

Table 2. Medicinal values of the collected insect fauna across Doiwala India. (Abb: abbreviation)

Scientific Name	Local name	Abb	Genus	Zootherapy	Cultural usage
***Coccinella undecimpunctata* (Linnaeus,1758)**	Bugi	Coc.axy	Coccinella	Nil	The species are positioned on the abdomen of pregnant women, believing that it promotes the birth of male offspring.
Propylea dissecta (Mulsant,1846)	Goguu	Pro.dis	Propylaea	The entire body is dried and blended with turmeric and olive oil for the treatment of sunburns.	Dried materials are burned to generate smoke, which is used as a defense against black magic. Top of Form

In documenting ethnozoological practices, medicinal uses (zootherapy) are of particular interest. In this study, among all documented species, only 10 were associated with medicinal properties. A total of 6 diseases (asthma, cough, infertility, sunburn, skin wrinkles, minor injuries) were treated, and the recorded insect fauna was used for their treatment. Asthma was treated with the highest number (3) of species (*Coccinella septempunctata, Coccinella hieroglyphica, Coccinella leonine*) (see Fig. 2c). A detailed list of the documented species is given in Table 3.

2.2.Insects and livelihood

Insects serve diverse purposes such as traditional medicine (entomotherapy) and food (entomophagy), offering a potential livelihood for many communities worldwide (Casas Reátegui et al., 2018). Numerous global studies highlight the role of insect fauna as a significant livelihood source (Chakravorty et al., 2013; Langthasa et al., 2018; Gahukar, 2020). In the study's rural areas, where modern medical facilities are lacking, inhabitants rely on nature for primary healthcare. Consequently, various individuals practice ethnomedicine, receiving payment in cash or livestock such as sheep, goats, or lambs, thus creating a livelihood for these practitioners. Those engaged in this form of ethnic medicine are called Hakeem or Vaidh.

2.3. Cultural Myths

As per de Silva et al. (2020), the significance of species within a region is contingent upon the local culture. This cultural valuation is shaped by various factors such as education level, traditional knowledge, and social awareness (Hassan et al., 2022). In our current investigation, we encountered numerous myths (refer to Table 3), with some being particularly unique and previously unrecorded: 1) Deceased specimens of *Cheilomenes sexmaculata* are submerged in freshwater during the early morning for a brief period, after which the water is utilized for bathing, with the belief that it enhances spirituality.2) If *Brumoides saturali* is discovered within gardens during a wedding ceremony, it is interpreted as an auspicious indication of a successful marriage. 3) *Coccinella undecimpunctata* is positioned on the abdomen of pregnant women, with the belief that it promotes the birth of male offspring.

Conclusion

In conclusion, our study reveals the local population's reliance on documented species for both cultural and medicinal purposes. Nevertheless, traditional knowledge, orally transmitted across generations, is diminishing among the elderly due to shifting lifestyles in the region. Therefore, it's crucial to document this fading traditional heritage and present it within the scientific realm. Doing so can help separating superstitious beliefs from factual useful properties. This can facilitate the development of new drugs and enhance comprehension to local communities, aiding stakeholders in formulating policies for the sustainable utilization of regional natural resources. This study marks the inaugural exploration of ethnobiological insect usage in the region, thus pioneering future research endeavors.

Table 3. Zootherapy and cultural uses of the collected insect fauna across Doiwala India.

Scientific Name	Local name	Abb*	Genus	Zootherapy	Cultural usage
Angelis cardoni (Weise,1990)s	Bhundia	Ang.car	Angelis	Nil	Dried insects are burned to produce smoke, which is then used as a defense against black magic.
Adalia decempunctata (Linnaeus,1758)	Gupillu	Ada.dec	Adalia	Nil	Dried insects are burned to produce smoke, which is then used as a defense against black magic.
Brumoides saturali (Fabricius,1789)	Pillu	Bru.sat	Brumoides	Nil	The presence of *Brumoides saturali* within gardens during a marriage ceremony is considered a favorable omen for a successful union.
Coccinella hieroglyphica (Linnaeus 1759)	Kisari	Coc.hie	Coccinella	The whole body is sun-dried and consumed with honey to treat cough, and asthma.	Dried insects are burned to produce smoke, which is then used as a defense against black magic.
Cheilomenes sexmaculata (Fabricius,1781)	Gudbinia	Che.sex	Cheilomenes	Nil	Deceased specimens are submerged in freshwater during the early morning for a period, after which the water is utilized for bathing, with the belief that it enhances spirituality
Chilocorus nigritus (Fabricius,1798)	Kala Bhundia	Chi.nig	Chilocorus	The entire body is dried and combined with spider webs to halt bleeding from minor injuries.	Dried insects are burned to produce smoke, which is then used as a defense against black magic.
Coccinella quinquepunctata (Linnaeus,1785)	Pissu	Coc.qui	Coccinella	The dried entire body is consumed with lemon and honey to address infertility.	
Coccinella leonine (Fabricius,1775)	Sursui	Coc.leo	Coccinella	The sun-dried whole body is ingested with honey to alleviate asthma.	Collected specimens are kept overnight in traditional homes to deter spiders.
Coccinella septempunctata (Linnaeus 1758)	Quleela	Coc.sep	Coccinella	The entire body, dried in the sun, is ingested with honey as a remedy for asthma.	Specimens collected and stored overnight in traditional homes are utilized to deter spiders.
Coccinella undecimpunctata (Linnaeus,1758)	Bugi	Coc.axy	Coccinella	Nil	The species are positioned on the abdomen of pregnant women, with the belief that it promotes the birth of male offspring.
Hippodamia convergens (Guerin-Meneville,1842)	Drakcheeda	Hip.con	Hippodamia	Nil	Burned to generate smoke, used to counteract the effects of the Evil eye.
Halyzia sanscrita (Mulsant,1846)	Behoor	Hal.san	Halyzia	The entire body is dried and processed into a paste by mixing with egg white, then applied topically to address skin wrinkles.	Black magic
Micraspis discolor (Fabricius,1798)	Sooree	Mic.dis	Micraspis	The entire body is dried, then combined with turmeric and resin from *Cedrus deodar* to treat wounds.	Burned to generate smoke, used to counteract the effects of an evil eye.
Propylea dissecta (Mulsant,1846)	Goguu	Pro.dis	Propylaea	The entire body is dried and blended with turmeric and olive oil for the treatment of sunburns.	Dried materials are burned to generate smoke, which is then utilized as a defense against black magic.Top of Form

*Abbreviations

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Author Contributions

All the authors contributed equally.

Conflict of interests

The authors declare that they have no conflict of interest.

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Appendix:

Below is the questionnaire "**Ethnobiological study of traditional medical and cultural practices in Doiwala, Dehradun, India**"

Section 1:
Demographics and Participant Details

1. What is your age range?
   - 25-45
   - 46-65
   - 66-85

2. What is your gender?
   - Male
   - Female

3. What is your profession?
   - Shopkeeper
   - Farmer
   - Street vendor
   - Herder
   - Government employee

4. What is your religion?

5. What language do you primarily speak?

Section 2: Knowledge of Insect Varieties

6. How knowledgeable are you about insect species in your region?
   - Very knowledgeable
   - Somewhat knowledgeable
   - Not knowledgeable

7. How did you acquire your knowledge of insect varieties?
   - Family tradition
   - Observation and experience
   - Formal education
   - Other (please specify)

Section 3: Ethnobiological Practices

8. Do you use insects in traditional practices? If yes, please specify how.

9. Have you ever used insects for medicinal purposes?
   - Yes
   - No

10. What diseases or conditions have you treated using insect-based remedies?

11. Which insect species are most commonly used in your traditional practices?

Section 4: Cultural Myths and Beliefs

12. Are there any cultural myths or beliefs associated with insects in your community?

13. Have you heard of or practiced the use of:
    - Coccinella undecimpunctata to promote male offspring?
    - Cheilomenes sexmaculata to enhance spirituality?
    - Brumoides saturali as a symbol of successful marriage?

14. Do you believe that these practices or myths hold significance?
    - Strongly believe
    - Somewhat believe
    - Do not believe

Section 5: Economic and Livelihood Aspects

15. Do you or your community use insects as a source of livelihood?

16. How are insect-based products (e.g., dried materials or medicines) valued in your community?

17. Have you heard of or interacted with individuals practicing entomotherapy in your community?

Section 6: Ethical and Cultural Considerations

18. Have you provided consent for your knowledge to be recorded and shared for research purposes?

19. Do you believe it is important to document and preserve the cultural practices associated with insect usage?

20. How would you feel about researchers sharing your cultural practices with a wider audience?

Rare occurrence of the Collared Pratincole (*Glareola pratincola*) at Bhigwan wetland, Indapur, Pune, Maharashtra, India.

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Citation: Salunkhe Rajendra V., Gunaware Kiran D., Gaikwad Sanjay K. and Dinesh P. Jagtap. (2024). Rare occurrence of the Collared Pratincole *(Glareola pratincola)* at Bhigwan wetland, Indapur, Pune, Maharashtra, India. *Ela Journal of Forestry and Wildlife*. 13(4): 1674

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Collared pratincole (*Glareola pratincola*)

- **Name of species:** Collared Pratincole
- **Family:** Glareolidae
- **Scientific name:** *Glareola pratincola*
- **Status:** Least concern
- **Date of sighting:** 23rd December 2021
- **Time of sighting:** 12.30 pm
- **Weather:** Sunny
- **Number of times sighted:** Twice in a month
- **Locality:** Bhigwan (18⁰17'01"N 74⁰45'06"E), Tahsil Indapur, Dist. Pune, Maharashtra state, India
- **Habitat description:** Marsh area
- **Distance from human civilization:** 1 km
- **Any other bird/animal associates:** No
- **Bird behaviour:** Observed near water hunting insects
- **Threats to the habitat:** Bird poaching, disturbed habitat
- **Photograph:** Attached
- **Previous records:** No previous document record of Oriental pratincole from this locality

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Rare sighting of the Juvenile Indian Vulture *(Gyps indicus)* at village Dalaj, Indapur, Pune, MS, India.

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Citation: Salunkhe Rajendra V., Gunaware Kiran D., Gaikwad Sanjay K. and Jagtap Dinesh P. (2024). Rare sighting of the Juvenile Indian Vulture *(Gyps indicus)* at village Dalaj, Indapur, Pune, MS, India. *Ela Journal of Forestry and Wildlife*. 13(4): 1675

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Juvenile Indian Vulture (*Gyps indicus*)

- **Name of species:** Indian Vulture- Juvenile
- **Family:** Accipitridae
- **Scientific name:** *Gyps indicus*
- **Status:** Endangered
- **Date of sighting:** 23rd December 2021
- **Time of sighting:** 02.30 pm
- **Weather:** Sunny
- **Number of times sighted:** Single
- **Gender of bird:** Male
- **Locality:** Dalaj, (18⁰13'32" N 74⁰47'42" E) Tahsil Indapur, Dist. Pune, Maharashtra state, India
- **Habitat description:** Scrub area
- **Distance from human civilization:** 2 km
- **Any other bird/animal associates:** No
- **Bird behavior:** Juvenile Indian Vulture was seen perched on a dead and decayed branch of a tree in scrub area.
- **Threats to the habitat:** Poaching and hunting.
- **Photograph:** Attached.
- **Previous records:** This is rare record of Juvenile Indian Vulture from this locality.

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Observation of Leg Disability in Black Kite (*Milvus migrans*) In Urban Area of Udaipur District, Rajasthan

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Abstract

During our field visits, we found a Black Kite (*Milvus migrans*) with leg disability. This individual's legs lacked the tibiotarsus, tarsometatarsus and digits, leaving only the proximal leg structures, or femurs to support the body. We observed this individual at the site for several days. Without its pointed and sharp talons, this bird could not catch its prey, resulting in its consumption of only animal carcasses and non-edible parts of fish from garbage or dump sites. They prefer to perch on thick branches of trees and the walls of buildings. Despite the disability, the kite was able to move with ease. It was also capable of holding the carcass with its sturdy leg stumps and tearing it apart with the beak.

Introduction

The Black Kite *Milvus migrans* is a medium-sized raptor that belongs to the family Accipitridae and order Accipitriiformes and is categorized as Least Concern (LC) (BirdLife International, 2009). The species is found in the Indian subcontinent and is a urban resident raptor (Ali and Reply, 1978; Mahabal and Bastawade, 1987). The global population of black kites is estimated between 1,470,000 to 1,980,000 young individuals, with the European population accounting for 11 percent of the total population, with an estimated 81,200-109,000 breeding pairs (BirdLife International, 2016). The body feathers have dark shafts giving it a streaked appearance. Kites assist in the control and equilibrium of prey populations by killing agricultural pests such as grasshoppers, rodents and small-sized herbivores and also feed upon sick animals including birds (Bowland *et al*., 1993). Their diets are extremely diverse and these birds can meet their nutritional demands in the absence of insects, rodents and other prey (Sharma and Soni, 2017). Black kites have been known to steal food from children's hands (Whistler, 1949; Ali and Ripley, 1978; Sharma and Soni, 2017).

Figure 1: Front view of abnormal legs of black kite sitting on the ground.

Figure 2: A black kite with abnormal legs is sitting near the discarded pieces of meat near a dump site.

Field Observations

At 1121 h on 28 July 2024, Anil Kumar Sharma (AKS), Narayan Lal Choudhary (NLC) and Nadim Chishty (NC), while birding in the urban area of Udaipur city (Rajasthan), in the Mewar Industrial area of Transport Nagar (24.34°N, 73.44°E), observed a leg disability in black kite. We took several photographs of this interesting individual using the NIKON P1000 camera. The tibiotarsus, tarsometatarsus and digits were absent in this individual's legs, and the body was supported only by the remaining femurs (Figures 1 and 2). This individual was observed on this site for several days. This bird was not capable of catching its prey without its pointed and sharp talons, so it was seen eating only the animal carcasses, discarded pieces of meat and non-edible parts of fish (Figure 3).

Figure 3: Illustrates the process of tearing and feeding meat pieces using beaks.

Conclusion

Despite the presence of abnormal legs, the kite was able to move easily and was also capable of holding the carcass with its stout legs and tearing it with its beak. Abnormal legs also influenced its food capturing, sitting, resting and roosting activities as compared to normal kites.

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Recent Sighting of White Tern *Gygis alba* in Dhule, Maharashtra

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- **Name of species**- White Tern
- **Scientific Name**- (*Gygis alba*)
- **Status**- Least Concern. (IUCN Red List).
- **Date of sighting**- 29th August 2024.
- **Time of sighting**- 03:00 p.m.
- **Weather parameters**- Cloudy.
- **Number of times sighted**- Once.
- **Number of birds**- Single.
- **Gender of bird**- Unidentified
- **Locality**- Near S.S.V.P.S. Engineering collage, Datta Mandir Area, Deopur, Dhule, district Dhule, Maharashtra State.
- **Habitat description**- Centre of the Dhule City.
- **Distance from human habitation**- Within the human occupied area.
- **Any other bird/animal associates**- 3 Red-vented Bulbuls were perching on a nearby mango tree with Ashy Prinia.
- **Bird behaviour**- A single bird was found on the terrace of Kalpesh Patil's house; bird was restless and infested by ants.
- **Photographs**- Attached.
- **Previous records**- White Tern is not common bird in India, White Tern has been previously sighted in India only three times, all in the state of Kerala, making this the first recorded sighting in Dhule District as well as in Maharashtra State.

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