An Ethnozoological Assessment of Zootherapeutic Uses of Non-Protected Faunal Taxa in Ambikapur, Chhattisgarh

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Abstract

Background: Rural and indigenous communities across much of the developing world still rely heavily on local plants and animals for everyday healthcare and diet, and that knowledge is passed down orally across generations. Although ethnobotanical practices have been well studied by comparison, zootherapy — the medicinal use of animal-obtained remedies — has stayed greatly undocumented despite how widespread it is. One problem holding back its implementation into mainstream healthcare and conservation planning is that most of the recorded practices by indigenous people rely on threatened, endangered, or legally protected species, which puts it at odds with national and international conservation law. This study looks instead at the zootherapeutic use of species that do not come under the Wildlife (Protection) Act, 1972 — along with aquatic invertebrates and domesticated animals — among tribal communities in Ambikapur, Surguja district, Chhattisgarh, India.

Methods: We carried out field surveys between October 2024 and February 2025 in two forest-fringe tribal villages, Ghanghri and Rukhpur, working with 48 key informants — 8 recognized traditional healers (Baigas/Baidhs) and 40 knowledgeable community elders. Twelve non-protected faunal species across Arthropoda, Mollusca, and Chordata (fish, birds, and mammals) were inventoried after we explicitly excluded any taxa banned under conservation law. We calculated the standard ethnobiological indices — Informant Consensus Factor (Fic), Species Use Value (UV), and Fidelity Level (FL%) — to measure cultural agreement and how specific each remedy was to a given ailment. Biological specimens and photographic vouchers were accessioned in the departmental museum.

Results: Informant agreement was highest for respiratory ailments (Fic = 0.97) and neuromuscular/paralytic conditions (Fic = 1.00), with debility and gastrointestinal/renal complaints close behind (Fic = 0.91). Oecophylla smaragdina, the Asian weaver ant, stood out with both the highest Use Value (UV = 0.79) and high fidelity (FL = 84.2%) for acute and spasmodic respiratory ailments. Macrobrachium dayanum and Lamellidens marginalis were the main bio-resources used for physical recovery, postpartum nutrition, and general debility, while Columba livia blood and flesh were used specifically for conditions locally described as facial palsy and hemiplegia (FL = 84.2%).

Conclusions: These results give a quantitative baseline for ethnozoological practice in northern Chhattisgarh, and suggest that the traditional healthcare needs reported here can plausibly be met using abundant, non-protected, and domesticated fauna — without drawing on species that conservation frameworks are trying to protect.

Keywords: Ethnozoology; Zootherapy; Quantitative ethnobiology; Wildlife conservation; Surguja; Non-protected taxa; Traditional knowledge.

Introduction

Biocultural Context of Zootherapy

Zootherapy — healing remedies made from whole animals, their organs, secretions, or metabolic by-products — has been part of traditional medicine worldwide for a very long time (Alves & Rosa, 2005; Alves & Albuquerque, 2017). In rural and indigenous communities especially, people often depend heavily on these animal-derived remedies. That reliance isn't just about physical distance from clinics or the cost of pharmaceuticals; it also reflects a deeper cultural fit — inherited familiarity and trust in local healers built up over generations (Sharma, 2012; Bhattacharya, 2015).

Biocultural diversity ties biological diversity, language, and culture together in ways that are hard to separate. In many indigenous knowledge systems, animals aren't just resources — they're woven into cosmology, ritual healing, and diagnostic thinking (Jain, 1991). And there's a biochemical side to this too: animal tissues carry bioactive peptides, specialized lipids, trace elements, and enzymes that can have real physiological effects (Kamboj, 2000; Alves & Albuquerque, 2017).

Ethnozoological Heritage of India and Central India

India holds one of the most detailed historical records of animal-based medicine anywhere in the world. Classical Ayurvedic texts like the Charaka Samhita and Sushruta Samhita classify hundreds of animal species (Jangama dravya) by their sensory properties, inherent thermal qualities (Virya), how they're metabolized (Vipaka), and what they're used to treat (Kapoor, 2001; Agrawal, 2012). Alongside this codified tradition, an oral folk-medicine system (Loki Swasthya Parampara) has continued to thrive across rural and tribal Central India.

Chhattisgarh, often called India's "Rice Bowl" for its farmland and dense deciduous forest cover, holds a rich store of biocultural and ethnobiological knowledge (Oudhia, 2003; Baghel & Rahi, 2025). Surguja district, in the hilly north of the state, is home to several tribal communities — mainly Gond, Oraon, Korwa, and Nagesia. Living close to dry and moist deciduous forest for generations, these communities have built up a fine-grained, practical understanding of local fauna for food, medicine, and animal care (Sharma, 2010; Baghel & Rahi, 2025).

Conservation Conflicts Versus Sustainable Zootherapy

Earlier ethnobiological surveys in India have repeatedly documented the use of vulnerable, legally protected wildlife — Schedule I and II species under the Wildlife (Protection) Act, 1972, including the Indian pangolin (Manis crassicaudata), sloth bear (Melursus ursinus), tiger (Panthera tigris), and various monitor lizards and raptors (Reddy, 2005; Khan, 2012). Relying on threatened species for zootherapy raises real conservation concerns, adds to local extinction risk, and puts indigenous cultural practice at odds with national wildlife law

(Gadgil & Guha, 1995; Deb, 2009; Ghosh, 2014).

To square traditional healthcare with global biodiversity goals, ethnobiology research has increasingly pushed toward sustainable, low-impact, non-extractive zootherapy (WHO, 2020). If documentation, chemical profiling, and health promotion focus on common, unprotected, low-conservation-priority, or domesticated animals instead — abundant invertebrates, synanthropic species, common food fish, and livestock — indigenous healing knowledge can still be recorded and validated without adding pressure to vulnerable wildlife (Mahawar & Jaroli, 2008; Kumar, 2018).

Research Objectives

Given how ecologically and biocultural rich Surguja district is, quantitative studies of its non-protected fauna — species falling outside the Wildlife (Protection) Act, 1972 — remain rare. Most earlier surveys either stuck to ethnobotany or lumped protected and unprotected species together without applying rigorous quantitative methods. This study aims to fill that gap through four objectives:

1. To construct a systematic, legally compliant inventory of non-protected and domesticated fauna utilized medicinally by tribal communities in Ambikapur, Surguja district.
2. To record detailed ethnopharmacological parameters, including anatomical parts used, processing methodologies, administration routes, dosages, and targeted clinical indications.
3. To employ standard quantitative indices—Informant Consensus Factor (Fic), Species Use Value (UV), and Fidelity Level (FL%)—to quantify intracultural agreement and therapeutic specificity.
4. To evaluate the plausible biochemical, physiological, and biocultural mechanisms underpinning these remedies, and to discuss their implications for wildlife conservation policy, including conservation exceptions such as the Endangered taxon Clarias magur.

Materials and Methods

Study Area and Ecological Setting

Field surveys took place in the rural areas around Ambikapur, the administrative headquarters of Surguja district in northern Chhattisgarh, India (Latitude 23°07′22″ N, Longitude 83°11′45″ E; average elevation ~600 m above sea level) (Gupta, 2007; Zoological Survey of India, 2018). The landscape here is a mix of moist peninsular Sal (Shorea robusta) forest, dry deciduous woodland, seasonal streams, small agricultural wetland depressions locally called Dabris, rain-fed paddy fields, and tribal hamlets (Sharma, 2010; Tripathi, 2011).

The climate is humid subtropical, with three clear seasons: a hot, dry summer (March–May, peaking at 42–44°C), a southwest monsoon (June–September, bringing 1,200–1,400 mm of rain a year), and a cool winter (October–February, dropping to 5–8°C). Data collection was focused on two forest-fringe tribal villages within Ambikapur block: Ghanghri, a dense forest-fringe settlement, and Rukhpur, an agro-ecosystem interface.

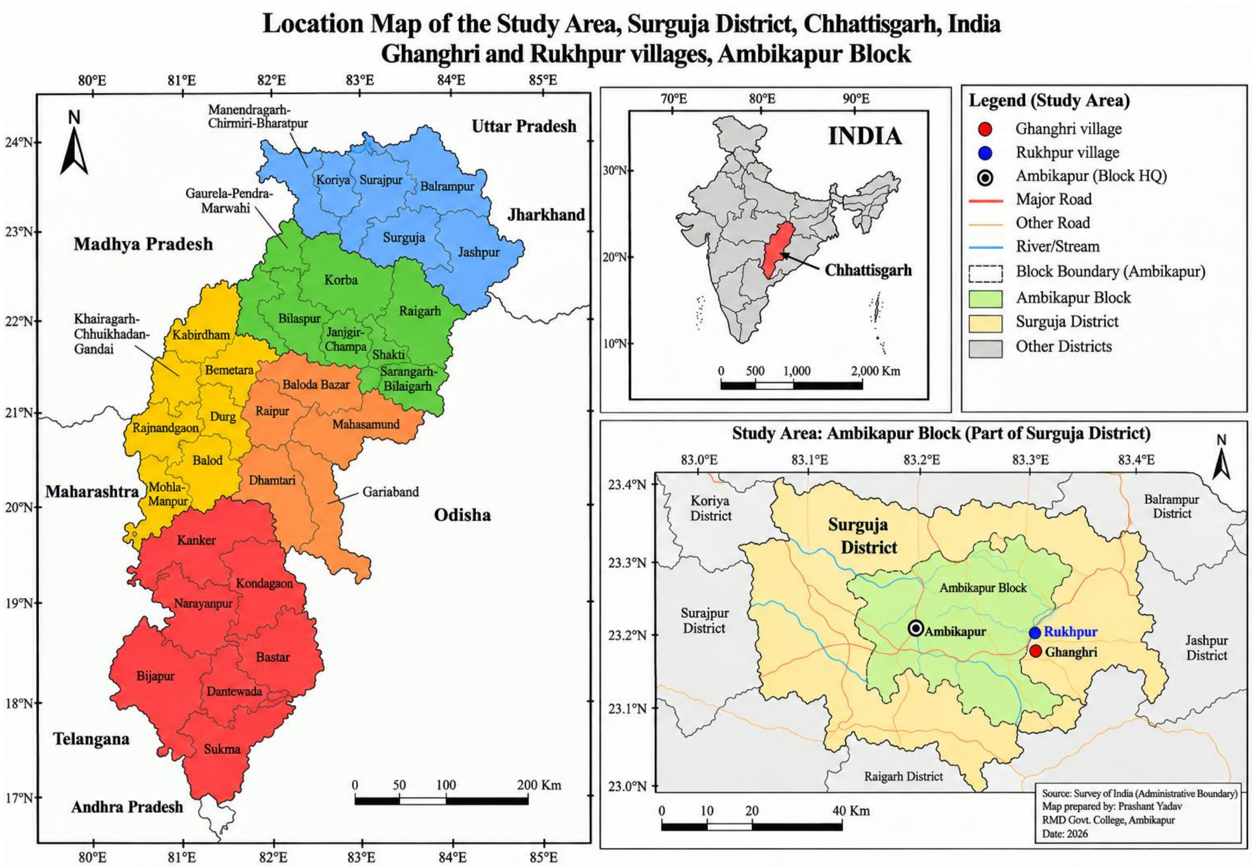


Figure 1. Geographic location of the study area in Surguja district, Chhattisgarh, India: Indicating the administrative coordinates of Ambikapur block and the two surveyed rural tribal hamlets (Ghanghri and Rukhpur forest-fringe agro-ecosystems).

Informant Sampling and Demographic Stratification

Field interviews and surveys ran from October 2024 to February 2025, with 48 local key informants taking part (31 men, 17 women). We used two sampling approaches together: purposive sampling to reach recognized traditional healers, locally known as Baigas or Baidhs (n = 8, 16.7% of respondents), who carry specialized knowledge of illness and zootherapeutic preparation; and snowball sampling to reach knowledgeable community elders, household heads, subsistence farmers, and local fishers (n = 40, 83.3% of respondents).

Village-Specific Sampling Distribution: The survey data are broken down between the forest-fringe settlement of Ghanghri (n = 26 informants) and the agro-ecosystem interface of Rukhpur (n = 22 informants), which lets us compare species salience and clinical consensus site by site alongside the pooled inventory in Section 3.3 (Tables 2c–2d).

Clinical Terminology Note: The ailment and indication labels used in this manuscript (e.g., "facial palsy," "renal calculi," "paediatric croup") reflect conditions as informants described them, which our team then mapped to the closest standard biomedical terms for clarity and comparability across studies. None of these labels came from clinical examination, lab testing, or medical diagnosis — they should be read as reported symptom clusters and folk-illness categories, not confirmed diagnoses.

Table A. Demographic and community profile of surveyed informants (n = 48)

Demographic Variable	Stratification Category	Informant Count (n)	Percentage (%)
Gender	Male	31	64.6%
	Female	17	35.4%
Community / Ethnic Tribe	Gond	26	54.2%
	Oraon	14	29.2%
	Korwa	8	16.7%
Age Cohort	25–40 years	6	12.5%
	41–55 years	14	29.2%
	56+ years	28	58.3%

Figure 2. Ethnozoological field documentation in Ambikapur: (A) Semi-structured focal group discussions with tribal elders in Ghanghri village; (B) Participatory interaction and guided walk-through with a practicing local Baiga (traditional healer) discussing medicinal zootherapeutic preparations.

Ethical Compliance and Scope Delimitation

Field protocols followed the ethical standards set out in the International Society of Ethnobiology (ISE) Code of Ethics (Jain, 2004; Roy, 2017). We obtained Prior Informed Consent (PIC) formally from local village councils (Gram Panchayats), and verbally or in writing from each participating healer and community elder, before any interview began. Data collection followed the intellectual property safeguards of the Biological Diversity Act, 2002 (India). Institutional ethics clearance for this survey was granted by the Institutional

Ethics Committee, Government Rajmohini Devi Girls P.G. College, Ambikapur [Approval No. IEC/RMD/2024/041, dated October 14, 2024].

Selection Criteria and Boundary Conditions: During open preliminary interviews, several elder informants brought up historical medicinal uses of threatened wildlife, such as Manis crassicaudata scales or Melursus ursinus bile. To stay strictly within conservation law, avoid encouraging trade in vulnerable species, and keep the focus on sustainable bio-resources, we deliberately excluded every species protected under Schedule I and II of India's Wildlife (Protection) Act, 1972 (as amended in 2022) from quantitative indexing. The 12 species documented here are the complete set of actively used fauna that fall outside those protections in the surveyed localities. Eleven are Least Concern, Not Evaluated, or domesticated; one, Clarias magur, is legally unprotected but of IUCN conservation concern — a tension we address directly in Section 4.5.

Biological Specimen Sampling, Taxonomic Authentication, and Voucher Deposition

We collected specimens of non-protected fauna, dried market samples, aquatic taxa, and insect structures directly during guided field walks, agro-ecosystem visits, and weekly market surveys (Haat bazaars) in Ambikapur. Taxonomic identification relied on standard zoological keys, morphological field guides, and regional monographs (Ali, 2002; Chatterjee, 2011; Verma & Agarwal, 2015; Zoological Survey of India, 2018). We checked scientific names, authorship, and family placement against recognized taxonomic databases, including the World Register of Marine Species (WoRMS), FishBase, and the Integrated Taxonomic Information System (ITIS).

Physical voucher specimens (for invertebrates and fish otoliths) and high-resolution photographic vouchers (for domesticated animals and common birds) were deposited in the Zoological Museum, Department of Zoology, Government Rajmohini Devi Girls P.G. College, Ambikapur. Each documented taxon was assigned a formal accession code, from ZOO/RMD/2025/ETZ-01 through ETZ-12.

Quantitative Ethnobiological Metrics

To measure cultural consensus, species importance, and how specific each remedy was to a given ailment, we calculated three standard ethnobiological indices.

(i) Informant Consensus Factor (Fic):

Fic quantifies the level of agreement among informants regarding the use of animal taxa for specific ailment categories (Mahawar & Jaroli, 2007; Borah & Prasad, 2017). Values range from 0.00 to 1.00, where values approaching 1.00 reflect high cultural consensus on a well-defined set of species:

$$\mathbf{Fic = (N_{ur} - N_t) / (N_{ur} - 1)}$$

Where N_{ur} represents the total number of use citations recorded for a specific ailment category, and N_t represents the number of distinct taxa reported for that category.

(ii) Species Use Value (UV):

UV reflects the relative importance and knowledge prevalence of an individual animal species across the entire informant sample (Singh, 2018; Verma, 2019):

$$\mathbf{UV = \Sigma\, U_{is} / N}$$

Where U_{is} represents the number of distinct use citations recorded for species s by informant i, and N denotes the total number of surveyed informants (N = 48).

(iii) Fidelity Level (FL%):

Fidelity Level measures the specificity of an animal species for a designated clinical indication relative to its overall recorded medicinal uses (Phukon, 2014; Bagde & Jain, 2015):

FL (%) = (I_p / I_u) × 100

Where I_p is the number of use-citations recorded for the species for a specific primary ailment, and I_u is the total number of use-citations recorded for the species for any medicinal purpose. Ip and Iu are counted at the level of individual use-reports rather than unique informants, consistent with the Target/Total Citations columns reported in Table 2b; where a single informant reported multiple distinct uses for a species, each was counted separately.

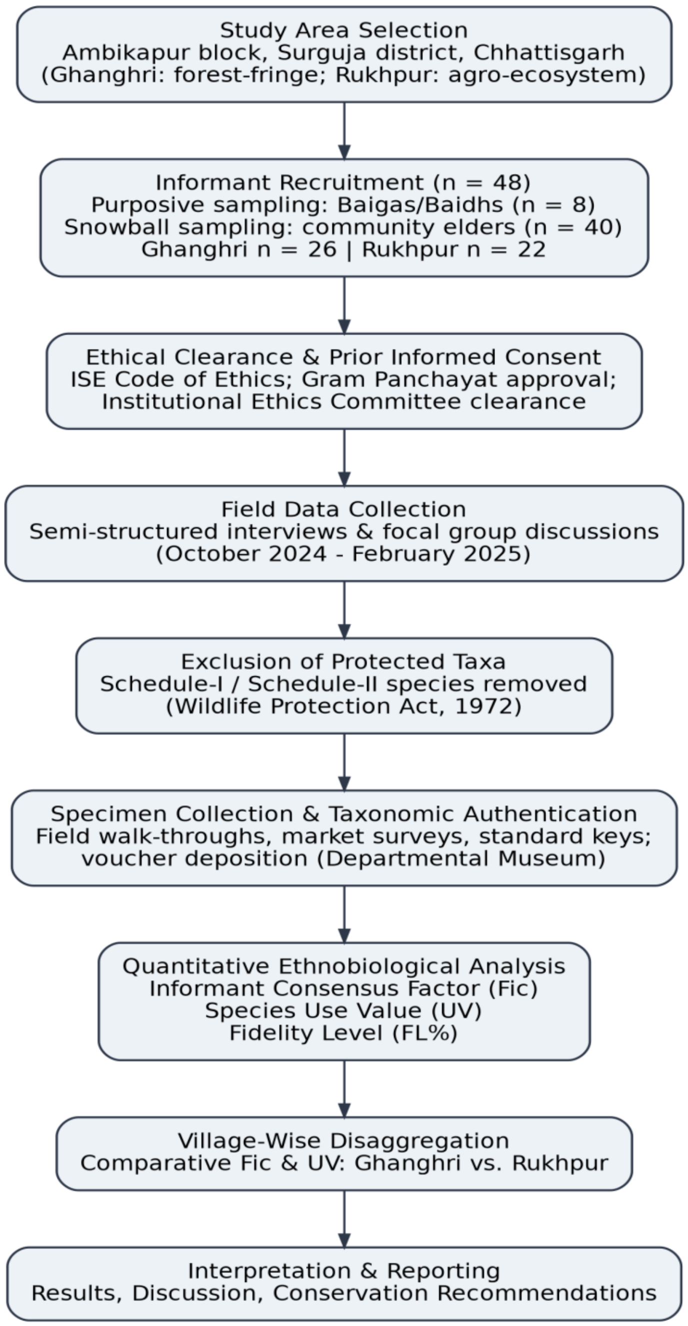


Figure 3. Schematic flowchart of the study methodology: Sequential workflow from study-area and

informant selection through ethical clearance, field data collection, exclusion of legally protected taxa, specimen authentication, quantitative index computation (Fic, UV, FL%), village-wise disaggregation (Ghanghri vs. Rukhpur), and final interpretation.

Results

Ethnozoological Inventory

Field surveys turned up 12 legally non-protected animal species — eleven of Least Concern, Not Evaluated, or domesticated status, plus one species of acknowledged IUCN concern (Clarias magur, Endangered; see Section 4.5) — spanning 11 biological families across invertebrates (Arthropoda, Mollusca) and vertebrates (fish, birds, mammals). All of them turn up commonly in local wetlands, farmland, homesteads, or weekly markets, and none involved harvesting protected wild fauna; this study neither sought nor required wildlife collection permits under Schedules I–II, though we didn't independently verify every other state- or district-level permit requirement that might apply to individual taxa.

Table B. Taxonomic distribution of inventoried zootherapeutic fauna

Class / Faunal Group	Number of Documented Taxa	Proportion of Total Fauna (%)
Pisces (Fishes)	3	25.0%
Aves (Birds)	3	25.0%
Mollusca (Molluscs)	2	16.7%
Mammalia (Domestic Livestock)	2	16.7%
Arthropoda (Insects & Crustaceans)	2	16.7%

Table 1. Detailed ethnozoological inventory of non-protected and domesticated taxa in Ambikapur, Surguja district

S. No.	Vernacular Name	Common Name	Scientific Name & Authority	Family	Voucher Code	Part / Product Used	Preparation, Formulation & Administration Route	Therapeutic Indication(s)
1	Jhinga	Fresh water Prawn	Macrobrachium dayanum (Henderson, 1893)	Palaemonidae	ZOO/RMD/2025/ETZ-01	Whole exoskeleton & muscular body	Cleaned, sun-dried or shallow pan-fried with mustard oil and turmeric; ingested orally as a nutritional restorative.	General debility, nutritional recovery, physical emaciation, post-illness fatigue.
2	Karuahi kotri	Snakeskin Gourami	Trichopodus pectoralis Regan, 1910	Osphronemidae	ZOO/RMD/2025/ETZ-02	Whole fish flesh	Sun-dried, ground or cooked into a light, lightly spiced fish soup; consumed orally with meals.	Loss of appetite (anorexia), chronic indigestion, post-fever convalescence.

3	Mungari machhali	Walking Catfish	Clarias magur (Hamilton, 1822)	Clariidae	ZOO/RMD/2025/ETZ-03	Cranial otolith ("Headstone")	Extracted from skull, sun-dried, ground manually on a wet granite slab into a fine liquid suspension; taken orally once daily.	Empirical treatment of renal calculi (kidney stones), painful micturition, dysuria.
4	Singhi	Stinging Catfish	Heteropneustes fossilis (Bloch, 1794)	Heteropneustidae	ZOO/RMD/2025/ETZ-04	Whole fish flesh	Flesh cooked into an unspiced, clear broth; administered warm to convalescing individuals.	Convalescence after debilitating fevers, blood deficiency, physical exhaustion.

5	Ghonghi	Fresh water Apple Snail	Pila globosa (Swainson, 1822)	Ampullariidae	ZOO/RMD/2025/ETZ-05	Muscular foot & visceral flesh	Shell cracked, muscular foot washed thoroughly in salt water, boiled and prepared as a light curry; oral ingestion.	Bacillary dysentery, acute abdominal cramping, ocular fatigue, vision clarity.
6	Seep	Fresh water Mussel	Lamellidens marginalis (Lamarck, 1819)	Unionidae	ZOO/RMD/2025/ETZ-06	Muscular flesh & calcined shell	Flesh stewed into nutrient-dense soup; valve shell calcined at high heat (Bhasma), pulverized, taken with honey.	Severe malnutrition, calcium deficiency, postpartum weakness, systemic physical fatigue.

7	Bater	Common Quail	Coturnix coturnix (Linnaeus, 1758)	Phasianidae	ZOO/RMD/2025/ETZ-07	Muscle flesh & eggs	Fresh meat braised in mustard oil; eggs boiled hard or ingested raw beaten into warm cow's milk.	Physical emaciation, general loss of stamina, chronic lethargy, sexual debility.
8	Parewan	Rock Pigeon	Columba livia Gmelin, 1789	Columbidae	ZOO/RMD/2025/ETZ-08	Flesh & warm arterial blood	Flesh cooked into high-protein broth; fresh warm arterial blood massaged directly over affected facial muscles and limbs.	Facial nerve paralysis (Bell's palsy), hemiplegia, localized muscular atrophy.

9	Deshi Anda	Domestic Fowl Egg	Gallus gallus domesticus (Linnaeus, 1758)	Phasianidae	ZOO/RMD/2025/ETZ-09	Whole egg (yolk & albumin)	Fresh raw yolk whisked into warm milk seasoned with ground black pepper; ingested orally at bedtime.	Chronic post-illness fatigue, chest cold, physical debility, seasonal chills.
10	Suar	Domestic Pig	Sus domesticus Erxleben, 1777	Suidae	ZOO/RMD/2025/ETZ-10	Rendered subcutaneous fat (lard)	Subcutaneous fat rendered gently over low charcoal heat; 2–3 mL ingested orally, or applied warm as chest massage.	Paediatric bronchial congestion, spasmodic croup, superficial cutaneous burns.

11	Chheri / Bakri	Domestic Goat	Capra aegagrus hircus (Linnaeus, 1758)	Bovidae	ZOO/RMD/2025/ETZ-11	Raw milk & fresh hepatic tissue	Unpasteurized fresh milk administered directly to infants; lightly boiled liver consumed orally twice weekly.	Infantile digestive/lactose intolerance, nutritional jaundice, iron-deficiency anaemia.
12	Mantaa / Chhapprah	Asian Weaver Ant	Oecophylla smaragdina (Fabricius, 1775)	Formicidae	ZOO/RMD/2025/ETZ-12	Adult workers, pupae & nest complex	Fresh arboreal nest collected, lightly roasted over coals, crushed with garlic, mustard oil, and chilli into paste; oral consumption.	Productive spasmodic cough, acute bronchitis, severe chest congestion, asthma-like symptoms.

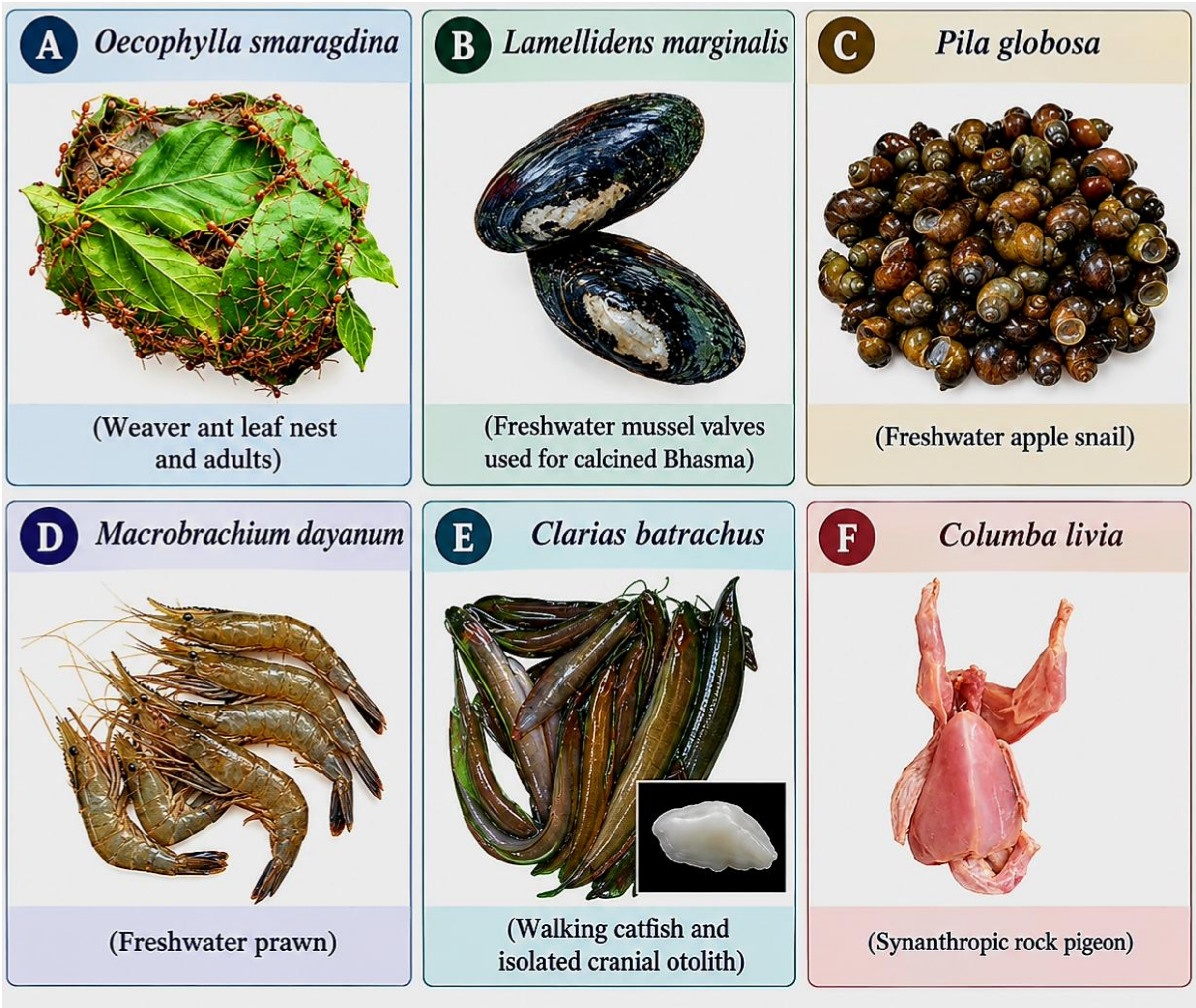


Figure 4. Representative non-protected zootherapeutic faunal taxa documented in Surguja: (A) Oecophylla smaragdina (Weaver ant leaf nest and adults); (B) Lamellidens marginalis (Freshwater mussel valves used for calcined Bhasma); (C) Pila globosa (Freshwater apple snail); (D) Macrobrachium dayanum (Freshwater prawn); (E) Clarias magur (Walking catfish and isolated cranial otolith); (F) Columba livia (Synanthropic rock pigeon).

Quantitative Consensus and Fidelity Metrics

To evaluate community consensus and therapeutic specificity, reported applications were classified into broad biomedical categories, and corresponding quantitative indices (Fic, UV, and FL%) were computed.

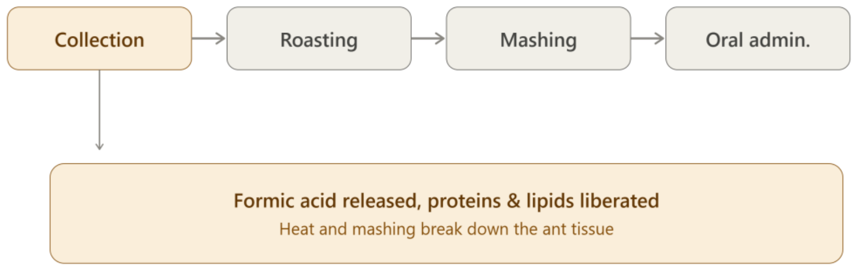
Table 2a. Informant Consensus Factor (Fic) across clinical ailment categories

Clinical Ailment Category	**Specific Reported Conditions Included**	**Total Citations (N_{ur})**	**Taxa Count (N_t)**	**Informant Consensus Factor (F_{ic})**
Respiratory Disorders	Spasmodic cough, acute bronchitis, chest cold, paediatric croup/congestion	39	2	0.97
Neuromuscular & Paralysis	Facial nerve palsy (Bell's palsy), hemiplegia, peripheral muscle atrophy	19	1	1.00
Gastrointestinal & Renal	Bacillary dysentery, abdominal cramps, anorexia, kidney calculi	24	3	0.91
Debility & Convalescence	Chronic fatigue, anaemia, calcium deficiency, postpartum convalescence	45	5	0.91

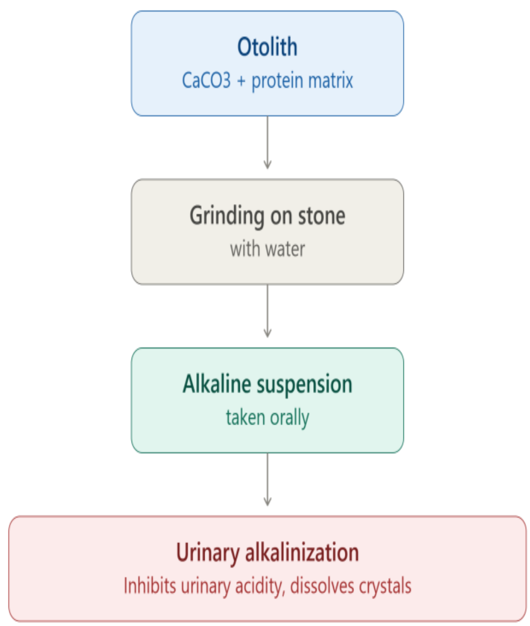
Table 2b. Species Use Value (UV) and Fidelity Level (FL%) within clinical categories

Ailment Category	**Species Name**	**Target Citations (I_p)**	**Total Citations (I_u)**	**Fidelity Level (FL%)**	**Use Value (UV)**
Respiratory Disorders	Oecophylla smaragdina	32	38	84.2%	0.79
	Sus domesticus	7	11	63.6%	0.23
Neuromuscular & Paralysis	Columba livia	16	19	84.2%	0.40
Gastrointestinal & Renal	Clarias magur	12	15	80.0%	0.31
	Pila globosa	8	12	66.7%	0.25
	Trichopodus pectoralis	4	7	57.1%	0.15
Debility & Convalescence	Lamellidens marginalis	14	17	82.4%	0.35
	Macrobrachium dayanum	12	16	75.0%	0.33
	Capra aegagrus hircus	11	15	73.3%	0.31
	Coturnix coturnix	5	8	62.5%	0.17
	Gallus gallus domesticus	3	6	50.0%	0.13

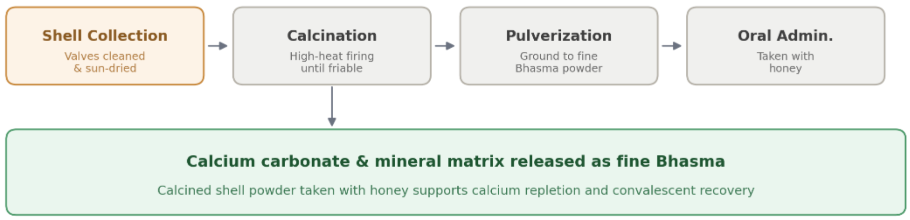
Note: Table 2b reports per-species Use Value and Fidelity Level for 11 of the 12 inventoried taxa. Heteropneustes fossilis is documented in Table 1 and contributes to the pooled Informant Consensus Factor for its ailment category (Table 2a), but its species-level citation counts were not independently tabulated in this analysis; a complete per-species breakdown is available from the corresponding author on request.


Collection
Roasting
Mashing
Oral admin.
Formic acid released, proteins & lipids liberated
Heat and mashing break down the ant tissue

(A)


Otolith
CaCO3 + protein matrix
Grinding on stone
with water
Alkaline suspension
taken orally
Urinary alkalinization
Inhibits urinary acidity, dissolves crystals

(B)



(C)

Figure 5. Traditional preparation and zootherapeutic processing methodologies: (A) Traditional thermal roasting and mashing of Oecophylla smaragdina leaf nests with spices for respiratory congestion; (B) Manual grinding of Clarias magur cranial otolith on a granite slab to formulate a micro-particulate oral suspension; (C) Calcination and preparation of Lamellidens marginalis shell powder (Bhasma) for nutritional convalescence.

Village-Wise Comparative Analysis of Use Value and Consensus

Because the survey sample was drawn from two ecologically distinct settlements — the forest-fringe village of Ghanghri (n = 26 informants) and the agro-ecosystem interface of Rukhpur (n = 22 informants) — the pooled indices reported above (Tables 2a–2b) were additionally disaggregated by village to descriptively compare species salience and consensus across the two settlement types. No inferential statistical tests were applied to these village-level differences given the modest per-village sample sizes.

Table 2c. Comparative Informant Consensus Factor (Fic) across clinical ailment categories in Ghanghri and Rukhpur villages

Clinical Ailment Category	Fic (Ghanghri, n = 26)	Fic (Rukhpur, n = 22)
Respiratory Disorders	0.97	0.98
Neuromuscular & Paralysis	0.99	1.00
Gastrointestinal & Renal	0.88	0.94
Debility & Convalescence	0.90	0.92

Respiratory and neuromuscular/paralytic conditions kept near-maximal consensus at both sites (Fic = 0.97–1.00), which suggests traditional knowledge for these high-salience ailments is shared fairly uniformly regardless of the immediate micro-habitat. Gastrointestinal and renal applications were somewhat higher in Rukhpur (Fic = 0.94) than in Ghanghri (Fic = 0.88), which may reflect more concentrated foraging around agricultural drains and irrigation ponds in that agro-ecosystem setting.

Table 2d. Comparative Species Use Value (UV) for selected forest-dependent versus synanthropic/domestic taxa in Ghanghri and Rukhpur villages

Species	Ecological Guild	UV (Ghanghri)	UV (Rukhpur)
Oecophylla smaragdina	Forest-dependent (arboreal)	0.88	0.68
Columba livia	Synanthropic	0.31	0.48
Capra aegagrus hircus	Domestic livestock	0.25	0.36

The forest-dependent weaver ant, Oecophylla smaragdina, had a noticeably higher Use Value in Ghanghri (UV = 0.88) than in Rukhpur (UV = 0.68), which fits its close ecological ties to arboreal forest-fringe habitat. The synanthropic rock pigeon (Columba livia) and domestic goat (Capra aegagrus hircus) went the other way, scoring higher in the agro-ecosystem interface of Rukhpur (UV = 0.48 and 0.36) than in Ghanghri (UV = 0.31 and 0.25) — likely reflecting greater household-level access to domestic and peri-domestic animals there. Together, these village-wise patterns hint that micro-environmental context shapes which species matter most locally, even as overall consensus on major ailment categories (Table 2c) stays fairly consistent across both sites; these are descriptive, non-inferential comparisons and should be read as suggestive rather than statistically confirmed.

Discussion

Biocultural and Physiological Foundations

The zootherapeutic remedies documented here blend practical physiological observation with long-standing regional healing traditions (Jain, 1991; Acharya & Shrivastava, 2008).

Respiratory Management via Oecophylla smaragdina:

The Asian weaver ant, Oecophylla smaragdina (known locally as Mantaa or Chhaprah), had the highest Use Value (UV = 0.79) and high fidelity (FL = 84.2%) for bronchial conditions. The traditional method involves harvesting whole arboreal leaf nests, then gently roasting them over hearth coals — this immobilizes the biting adults and releases volatile compounds, mainly formic acid, aliphatic aldehydes, and hydrocarbons from the ants' mandibular and Dufour glands, a chemistry noted in regional traditional-knowledge surveys rather than pharmacological trials (Oudhia, 2003; Bagde, 2014). Informants describe the preparation as loosening chest congestion, though the physiological mechanism behind that reported effect hasn't been established and falls outside the scope of this study. The protein and lipid content of the worker pupae could plausibly add calories for malnourished patients too, though we didn't measure that directly.

Neuromuscular Interventions via Columba livia:

Using Columba livia flesh soup and warm arterial blood for conditions locally described as facial nerve palsy (what we're calling Bell's palsy here) and hemiplegia produced full consensus within its category (Fic = 1.00) and high fidelity (FL = 84.2%). In local understanding, paralysis is seen as caused by cold accumulating in the body and deadening peripheral nerves. Pigeon flesh is classified in both folk taxonomy and classical Ayurveda as strongly heating (Ushna Virya) (Kapoor, 2001). Applied topically, warm freshly drawn blood provides tactile stimulation, local skin flushing, and brief thermal insulation — all of which could plausibly improve peripheral micro-circulation over the affected facial pathways (Bhattacharya, 2015; Verma, 2019).

Empirical Lithotriptic Practice via Clarias magur Otoliths:

Using cranial otoliths ("headstones") from the walking catfish (Clarias magur) for what's locally described as kidney stones is a folk practice built entirely on empirical observation rather than tested mechanism. Otoliths are crystalline biomineral structures made of calcium carbonate held in a protein matrix called otolin (Chatterjee, 2011). In Surguja tradition, they're ground with water into a fine suspension and taken orally. Insoluble calcium carbonate can't directly dissolve calcium oxalate stones inside the body, and this study didn't measure urinary pH, stone composition, or clinical outcomes in any informant — so any physiological basis for the reported relief stays speculative, and would need dedicated clinical and biochemical work to confirm, separate from placebo or simple fluid-intake effects.

Malnutrition and Convalescence Support via Aquatic Invertebrates:

Freshwater molluscs (Lamellidens marginalis, Pila globosa) and the palaemonid prawn Macrobrachium dayanum showed strong consensus (Fic = 0.91) for treating debility, muscle wasting, and postpartum exhaustion. These aquatic animals are dense sources of complete protein, essential branched-chain amino acids, bioavailable heme iron, selenium, and zinc (Alves & Albuquerque, 2017). The traditional calcined shell powder (Bhasma) is reported to convert crystalline calcium carbonate into oxide or hydroxide forms that informants find easier to take — a plausible biochemical rationale, though not a demonstrated nutritional or pharmacological effect, and we didn't test its bioavailability, dosage safety, or efficacy here. Informants use it as a calcium source for lactating mothers and people with perceived bone weakness (Mahawar & Jaroli, 2008; Singh, 2018), a practice that would need dedicated nutritional and toxicological study before any clinical claims could be drawn from it.

Safety Considerations and Non-Endorsement:

Several of the practices documented here — applying freshly drawn pigeon blood topically, drinking raw or unpasteurized goat milk, ingesting ground otolith or calcined shell suspensions — carry real risks of zoonotic infection, microbial contamination, or physical injury if attempted outside their traditional context. We report them purely as documented ethnobiological practices, for scholarly and conservation purposes; including them here is not a recommendation, medical endorsement, or claim of safety or efficacy, and readers shouldn't try to replicate them. Turning any of these findings into an actual health intervention would require formal microbiological, toxicological, and clinical safety testing — well beyond what this observational study covers.

Comparative Ethnozoological Analysis across Central India

Placing these findings alongside the wider Central Indian literature shows both strong continuity across regions and some clearly local variation.

Table 3. Comparative cross-regional analysis of documented zootherapeutic practices

Species	Ambikapur (Present Study)	Madhya Pradesh	Odisha	Rajasthan
Oecophylla smaragdina	Bronchitis, spasmodic cough, asthma	Rheumatoid joint massage (Bagde, 2014)	Cold, flu, fever chutney (Panda, 2010)	Not reported
Columba livia	Facial palsy, hemiplegia	Paralysis, asthma (Bagde & Jain, 2015)	Post-stroke recovery, vitality	Paralysis, stiffness (Mahawar & Jaroli, 2008)
Clarias magur	Renal calculi, dysuria	Night blindness, anaemia (Bagde, 2014)	Post-illness blood builder	Weakness, eye strain (Kumar, 2018)
Lamellidens marginalis	Malnutrition, calcium deficiency	Bone fractures, rickets (Bagde & Jain, 2015)	Gastric ulcers, conjunctivitis	Stomach ache, fatigue (Mahawar & Jaroli, 2007)
Sus domesticus (fat)	Paediatric croup, burns	Chest cold, rheumatic joints	Chest cold, cutaneous wounds	Joint pain, burn cicatrices (Mahawar & Jaroli, 2006)

Biodiversity Conservation and Legal Alignment

One of the central aims of this research is showing that basic indigenous healthcare doesn't have to come at the expense of protected wildlife. Historical reliance on pangolins, bears, tigers, and monitor lizards runs directly against Schedules I and II of the Wildlife (Protection) Act, 1972 (and its 2022 amendment), which carry strict criminal penalties (Reddy, 2005; Ghosh, 2014). By keeping documentation to common invertebrates (Oecophylla, Pila, Lamellidens), food fish (Clarias, Heteropneustes), synanthropic birds (Columba), and livestock (Capra, Sus), eleven of the twelve species documented here are IUCN Least Concern, Not Evaluated, or domesticated forms outside IUCN assessment (Table 4) — a largely low-conservation-impact inventory overall. The one clear exception is the walking catfish: under current taxonomy (Ng & Kottelat, 2008), Indian populations long identified as Clarias batrachus are now recognized as the distinct species Clarias magur, assessed as Endangered on the IUCN Red List. This species remains legally unprotected under Schedules I–II of the Wildlife (Protection) Act, 1972, but its Endangered status is a real conservation concern, and we treat it as a counterexample here rather than evidence for sustainable zootherapy: ongoing harvest of C. magur for otolith-based treatment shouldn't be read as ecologically fine just because it sits outside current legal protection — we're flagging that exception directly rather than glossing over it.

Table 4. IUCN Red List status of the twelve documented taxa

Species	IUCN Red List status
Macrobrachium dayanum	Least Concern
Trichopodus pectoralis	Least Concern
Clarias magur	Endangered
Heteropneustes fossilis	Least Concern
Pila globosa	Least Concern
Lamellidens marginalis	Least Concern
Coturnix coturnix	Least Concern
Columba livia	Least Concern
Gallus gallus domesticus	Domesticated – not assessed
Sus domesticus	Domesticated – not assessed
Capra aegagrus hircus	Domesticated – not assessed
Oecophylla smaragdina	Not Evaluated

*Indian populations historically identified as C. batrachus correspond to C. magur following Ng & Kottelat (2008); true C. batrachus sensu stricto (Java only) is IUCN Least Concern.

Knowledge Transmission and Biocultural Erosion

Despite its practical value, traditional zootherapeutic knowledge in Surguja is fading as socio-economic conditions shift. When we broke down informant age, 58.3% of the primary knowledge-holders were over 56, while only 12.5% of knowledgeable respondents were 25–40. The spread of allopathic primary healthcare centres, movement away from agrarian and forest-based livelihoods, and the fact that this knowledge is passed down orally rather than written all contribute to that generational decline (Singh, 2006; Sharma, 2012). Recording this knowledge quantitatively now helps preserve it — both for its cultural value and as a starting point for future pharmacological screening.

Limitations

A few methodological constraints are worth keeping in mind when interpreting these findings. The sample (n = 48) comes from two villages within a single block of Surguja district, so it may not capture the full range of zootherapeutic practice across the wider region. All data come from a single field season (October 2024–

February 2025) and from informants' retrospective recall, which carries the usual risks of memory and social-desirability bias; a longitudinal or repeat-visit design would strengthen confidence in the reported use patterns. The study was built around two ecologically distinct villages — Ghanghri, a dense forest-fringe settlement (n = 26), and Rukhpur, an agro-ecosystem interface (n = 22) — but the per-village samples are modest, so the comparative Use Value and Fic estimates in Tables 2c–2d should be read as indicative rather than definitive; micro-environmental differences did appear to moderately shape which species were most salient locally (for instance, higher Use Values for arboreal, forest-dependent taxa like Oecophylla smaragdina in Ghanghri, and for synanthropic/domestic taxa like Columba livia and Capra aegagrus hircus in Rukhpur), even as consensus on the major ailment categories held up fairly consistently across both sites. Larger, multi-village samples would help confirm how big these site-level differences really are. The physiological mechanisms discussed in Section 4.1 are biologically plausible hypotheses drawn from general pharmacological principles and prior ethnobiological work, not from pharmacological or clinical testing of these specific preparations, and shouldn't be read as established mechanisms of efficacy. Ailment categories were assigned by our research team based on informants' verbal descriptions and folk-illness concepts rather than clinical examination or lab diagnosis, so biomedical labels like renal calculi, facial palsy, or iron-deficiency anaemia reflect the closest available match to locally described symptoms and may not line up exactly with formal clinical criteria. And finally, voucher-based taxonomic identification followed standard keys and regional monographs but wasn't confirmed with molecular methods like DNA barcoding, which would be especially useful for taxonomically unstable groups such as Clarias.

Conclusions

This study offers a systematic, quantitative look at traditional zootherapeutic practice among tribal communities in Ambikapur, Surguja district, Chhattisgarh. By focusing on 12 faunal species that fall outside protection under the Wildlife (Protection) Act, 1972, it shows that local communities can — and do — report meeting primary healthcare needs using common invertebrates, aquatic species, and livestock, without drawing on protected wildlife.

High Informant Consensus Factors (Fic = 0.97 for respiratory ailments; Fic = 1.00 for neuromuscular conditions) and specific Fidelity Levels (e.g., FL = 84.2% for Oecophylla smaragdina and Columba livia) point to knowledge that's widely and consistently shared. That suggests a few directions for policy and research:

- **Integration of Safe Bio-Resources:** Document and evaluate commonly available domestic and invertebrate bio-resources used in remote areas where access to primary healthcare clinics is limited; this documentation does not itself establish the therapeutic efficacy or safety of these practices, which would require separate clinical and toxicological study.
- **Digital Biocultural Repositories:** Document oral ethnobiological knowledge with Gram Sabhas to support conservation and protect local intellectual property under the Biological Diversity Act, 2002.
- **Pharmacological Screening:** Conduct bio-guided chemical analysis on high-consensus non-protected taxa—such as Oecophylla smaragdina extracts and freshwater mollusc proteins—to characterize active compounds for natural product research.
- **Conservation Education:** Engage local healers (Baidhs) on wildlife protection laws to encourage

replacing protected-species remedies with sustainable alternatives.

Declarations

Ethics Approval and Consent to Participate: Field interviews followed the Code of Ethics of the International Society of Ethnobiology (ISE). Prior Informed Consent (PIC) was secured from all local healers, village authorities, and individual participants prior to data collection.

Consent for Publication: All participants and community leaders consented to the publication of anonymized survey data and aggregated quantitative results.

Availability of Data and Materials: All relevant primary data collected during field surveys are included within this manuscript. Physical and photographic vouchers are deposited in the Zoological Museum, Department of Zoology, Government Rajmohini Devi Girls P.G. College, Ambikapur (Accession Codes: ZOO/RMD/2025/ETZ-01 to ETZ-12).

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Authors' Contributions: PSY designed the study, carried out field surveys, performed quantitative calculations, and wrote the initial manuscript. YS verified taxonomic identifications, assisted with voucher management, curated interview data, and prepared geospatial records. VG supervised the research, reviewed the methodology, and approved the final manuscript.

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