Identification of Wild Fauna in Illegal Trade through Integrated Forensic Approach: A Case Study

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Abstract - Every now and then, there are reports of the hunting and poaching of the Himalayan Monal *(Lophophorus impejanus, Phasianidae)*, a protected species, which in turn burdens forensic investigators to provide irrefutable evidence and reveal the truth behind these illicit activities. Although technological advancements have helped investigation agencies reach criminals at a faster pace and collect objective evidence, wild flora and fauna remain under great threat due to the lucrative nature of the illegal wildlife trade. During a routine check at an inter-state barrier, the police seized a consignment of suspected feathers and crests of the Himalayan Monal, along with the cell phones of the vehicle's occupants. The biological materials were examined using multifaceted forensic techniques, including morphological, microscopic, and serological analyses, and were identified as the crests of the Himalayan Monal, a species protected under Schedule-1 of the Indian Wildlife Act of 1972. Furthermore, the lab analysis of the seized cell phones of the suspects using highly sophisticated tools revealed incriminating chats and photographs related to the illegal trade of the Monal's crests, which helped the authorities connect the suspects to the crime.

Keywords: Wildlife Forensics, Digital Forensics, Himalayan Monal *(Lophophorus impejanus)*, Species of origin test, microscopical analysis, UFED, UFED Physical Analyser

INTRODUCTION

Since the beginning of time, humans have used wildlife for fundamental necessities, but the modern commercialization of the wildlife trade has driven some species to the brink of extinction. [1] Wildlife trafficking is the third largest illegal business after drugs and arms trafficking in the world and which involves $ 20 billion per year [2]. The world wide fund for nature reported that the illegal wildlife trade is the fourth largest illegal trade behind drugs, people trafficking, and counterfeiting, worth an estimated 15 billion Euros per annum [3]. Between 1999 and 2018, about 6,000 different species of animals and plant species were apprehended with nearly every country in the world playing role in the illicit wildlife trade. Furthermore, according to the United States Senate Foreign Relations Committee in 2009, some organized forms of wildlife crime and trade have also been linked to funding terrorist activities. According to studies, the fall in the population of many endangered species is mostly caused by habitat degradation, with hunting for commerce and pet collection ranking as the second-biggest factor. This practice affects mammals (33%), birds (30%), and amphibians (6%). [4]

Wildlife forensics is a critical field that aims to provide scientific evidence to support investigations into wildlife crimes, such as the poaching and trafficking of protected species. The primary focus of wildlife forensics is to establish the identification of seized wildlife products, addressing key issues including the determination of species, the geographic origin of the samples, the identity of individual animals or plants, and the age of the specimens. By applying various analytical techniques and scientific methods, wildlife forensics plays a vital role in assisting law enforcement efforts to combat the illegal wildlife trade and protect threatened or endangered species around the world.

The widespread adoption of portable electronic devices, such as cell phones, tablets, GPS units, and drones, across various domains of human activity has led to the proliferation of digital data and evidence that can be leveraged in the investigation of a wide range of criminal offenses. This technological advancement has proven particularly beneficial in the context of wildlife crime cases, where the digital data and evidence stored on these devices can play a crucial role in successfully investigating and prosecuting individuals engaged in the illegal wildlife trade. The availability of such digital evidence can significantly enhance the ability of law enforcement agencies to gather crucial information, identify perpetrators, and build robust cases against those involved in the unlawful exploitation and trafficking of protected wildlife species and their products. The digital evidence collected from these devices can provide valuable insights into the activities, communication networks, and logistical arrangements of wildlife traffickers, enabling law enforcement to disrupt their operations and bring them to justice more effectively.

The Monal *(Lophophorus impejanus)* is a magnificent pheasant species that is highly prized for its vibrant and colorful plumage. Known for its distinctive crest, the Monal is revered as the state bird of Uttarakhand, India, and the national bird of Nepal, where it is affectionately referred to as the "danphe" [5]. Up until 2007, it also held the esteemed title of the official bird of the Indian state of Himachal Pradesh. Despite its protected status, the Monal has unfortunately become a target for poachers who seek to exploit the bird's striking appearance, with its decorative crest often used to adorn various accessories and garments. Even though hunting Monals was made illegal in Himachal Pradesh in 1982, the poaching of these birds has continued unabated, and their highly coveted plumes continue to be smuggled into illegal wildlife trade markets.

CASE HISTORY

On one fine Sunday, four individuals—three men and a woman—traveling in a car became police-operated roadblock to allow for a routine vehicle examination. The car's driver resisted the police and received unsettling responses, which increased the amount of scepticism after which the police forced the car to be examined.

After a thorough examination of the car and its contents, including several bags and pieces of luggage, a light grey jacket with six crests on its right sleeve was found. In the initial inquiry into the illegal bird crest case, the police seized the vehicle and keys because they did not receive a suitable response from the accused.

All of the aforementioned individuals were the subject of additional investigation, and during that process, other things including car documentation, insurance documents, and the vehicle's driver's license were also taken. The car's driver verified during the investigation that the item was the crest of a monal bird and that he had paid 9,000 rupees for it. If required, he was able to identify the seller's face. The other three suspects were released after it was discovered that they were not aware of the trafficking case.

Upon examining the bank account statements of both suspects, it was discovered that money had been transferred between them for the purpose of procuring illegal wildlife items. The suspect who had disclosed that he had purchased the crest/kalgis, a decorative ornament made from the feathers of a monal pheasant, was also questioned. Following receipt of a detailed report from the local wildlife specialist, it was revealed that the crest/kalgis belonged to a protected monal bird, a species of Himalayan pheasant that is often targeted by poachers for its distinctive plumage.

MATERIALS & METHODOLOGY

Biological & Serological Evidence

The materials (whole feathers/crests) were analyzed by using standard protocols in the Biology & Serology Division in order to establish the identity of the seized biological material and compared the results with the known standard reference samples. The analysis of the exhibit viz. jacket crests/feathers along with skin tissues were carried out for the presence of blood and it was tested by using Benzidine reagent. The gel diffusion technique was used to determine the species of origin by extracting blood from exhibit viz. Jacket, crests/kalgis tested positive with anti-fowl serum and showed blood stain of Avain blood which furthermore compared with the known standards and hence, was a positive identification that the crests/kalgis were of Himalayan Monal (*Lophophorus impejanus*), [6]. The seized feather/crests were identified by matching macroscopic characters (colour pattern, shape, texture, size) to specimens in a reference library maintained in the Biology & Serology division and comparing the microscopic characters (node shape, pigment distribution and morphology) of the plumulaceous barbs with a micro-slide reference collection of known samples using light microscope at 100X (Leica, DM 3000 LED)

Digital Evidence

The suspects' mobile phones, SIM cards, and memory cards were thoroughly examined and analysed at the state-of-the-art Digital Forensics Laboratory. The team employed advanced data extraction techniques, utilizing the cutting-edge UFED 4PC version 7.50.0.137 to perform both logical and physical data extraction. The extracted data was then meticulously analysed using the powerful Physical Analyzer version 7.50.0.27, enabling the retrieval of a vast array of files present in the internal storage, including database files, system files, and comprehensive logs. The primary focus of this comprehensive digital forensic investigation was to uncover crucial evidence, such as chat records and photographs of the seized animal crests, which could potentiality establish a direct link to the suspects' involvement in the illegal trafficking of protected wildlife species. Digital forensic analysis has become an indispensable tool in investigations related to wildlife trafficking. This specialized field of forensics can provide pivotal evidence that is crucial for identifying the individuals behind these unlawful activities and unravelling the intricate modus operandi employed by the perpetrators [7]. Criminals have increasingly turned to digital technologies to facilitate their illicit operations, using mobile devices to coordinate the poaching and transportation of endangered species, storing photographic evidence on computers, and communicating through various online platforms to evade detection. [8]

RESULTS AND DISCUSSION

Species of Origin

To ensure that the results of the study of unknown bloodstains are highly probative, it is necessary to identify the species of origin. The purpose of the species origin test is to determine the species of origin for the biological sample in question. This is typically done through an antigen-antibody agglutination reaction, which serves as the foundation for the species origin test. The antibodies used in this test are highly selective, exclusively binding to the specific antigens present in the sample. By observing the pattern of agglutination, or clumping, of the sample, analyst can infer the species of origin for the biological material. Periodically, it can be required to do a species of origin analysis on any bodily fluid, including blood. Examining the genesis of a species is crucial to forensic investigations. This technique uses gel as a supporting medium while the biomolecules are separated by the impact of an electric charge.

The exhibits viz. crests (Kalgis Vern. Name) and jacket showed positive reaction with Benzidine reagent indicating presence of blood. Blood extracted from the said exhibits tested positive by showing presence of precipitin bands on reaction with anti-fowl serum that showed questioned blood stain was of avian origin.

The seized materials (crests and feathers) showed brilliant metallic green, iridescent blue and purple, cinnamon-brown colors and spatulate-tipped wire-like crest which were comparable with the known reference standards mentioned in the literature and the library of reference feathers maintained in the laboratory. (Fig. 1). The details are given in the Table-1. The morphological and microscopical examinations of Monal Bird are shown in figure 2-4.

* Wildlife Institute of India (2016). National Studbook of Himalayan Monal (Lophophorus impejanus), Wildlife Institute of India, Dehradun and Central Zoo Authority, New Delhi. TR. No.2016/007

** Dove, C.J. & Koch, Sandra. (2010). Microscopy of feathers: A practical guide for forensic feather identification. Journal of American Society of Trace Evidence Examiners. 1. 15-61.

***Observation made in RFSL NR, Dharamshala during examination.

EXAMINATION OF DIGITAL EVIDENCES

The digital artifacts recovered during the analysis provided compelling incriminating evidence against the accused. The WhatsApp chat history retrieved from the seized electronic devices revealed multiple copies of photographs depicting the protected species' crests that were sent to the client on different dates and at regular intervals. These photographs served as visual documentation of the illegal wildlife specimens being traded. Additionally, the detailed financial transaction records obtained from the traders further confirmed the involvement of the accused individuals in the illegal wildlife trade. These records showcased the monetary exchanges associated with the illicit activities, exposing the accused's continued commitment and plans for future unlawful trade endeavours. The comprehensive digital evidence collected through this integrated forensic approach proved pivotal in substantiating the allegations against the accused and their participation in the unlawful wildlife trafficking enterprise (Fig.5 and Fig.6).

DISCUSSIONS

The wildlife trade is a lucrative economic activity and birds become the most heavily traded animals worldwide. [9]. Popularity and rarity are the two main factors which influence the choice of bird species traded illegally. Monal pheasants are among the most iridescent in the world with the Himalayan Monal being considered one of the most beautiful and magnificent pheasants of the western Himalayas. Further, adult males possess metallic green head and spatulate-tipped wire-like crest, brilliant metallic green and bronze on hind neck and mantle, iridescent blue and purple and green on wings and upper tail-coverts, cinnamon-brown tail, and velvety-black under-parts [10]. Because of the male’s metallic, rainbow-coloured plumage, valuable iridescent blue head crest and its meat could be the possible reason for being targeted by hunters leading to wildlife crime.

The data of macroscopic characteristics of the seized materials compared favourably with the previous studies [6]. Likewise, the microscopic features of the crest and feathers of the seized material were examined in the Laboratory. The ring-shaped structures that surrounds the nodes is the most diagnostic characteristics of order Galliformes [9] and was observed in the seized materials. In addition, some nodes of the barbules showed spike formations at proximal end which were more prominent towards distal end. The macroscopic and microscopic characters observed in the seized materials compared favourably with the previous studies [10, 11, and 14] and on the basis of data comparison, the seized material was identified as Himalayan male adult Monal. Since, the Himalayan Monal habitat is at the altitude (2300-4875 m) and the seized material was from the personnel who inhabited high altitude region (2000-3500m) and that made easy access to the prey for financial gains.

Himalayan Monal populations were discovered to be falling owing in the late 1990s [12 and 13] and is listed in Schedule I of the Wildlife (Protection) Act 1972 and in Appendix I of the CITES due to threats to its survival. [14]

CONCLUSION

With the increased illegal trafficking of wildlife products, an integrated forensic approach has become invaluable in identifying poached materials. By combining the tools and techniques of cell phone forensics with conventional biological and serological investigations, researchers have proven effective in uncovering data, such as photographs and chat records related to the trading of Monal crests, stored on seized cell phones. This consolidation of various forensic methods has directly linked poachers to wildlife crimes. Moving forward, the integration of even more sophisticated techniques, such as advanced DNA analysis and spectroscopic analysis of seized materials, promises to provide robust methods for identifying wildlife crimes and strengthening the evidence against offenders. The advancement in forensic identification using modern tools has been a boon for investigation agencies, offering not only the means to identify seized materials but also providing crucial evidence for presentation in court, aiding in the conviction of the real perpetrators and acting as a deterrent for future crimes. With the continued development and application of integrated forensic approaches, the fight against the illegal wildlife trade can be significantly bolstered, serving as a critical step towards the protection and conservation of endangered species like the Himalayan Monal.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Aditi Sinha: Methodology, Investigation, Writing - Original draft, Writing - Review & Editing, Visualization**;** Meenakshi Mahajan: Writing, - Review & Editing; Asheesh Maihla: Investigation, Writing - Review & Editing.

Table-1 Morphological and Microscopical Examinations (Fig. 2 to Fig 4)

S.No.	Parameters	Known Standard Features[*,**]	Sample
1	Color pattern	Metallic green, Brilliant metallic green and bronze, iridescent blue & purple, cinnamon brown and velvety black	Multi-colored with green, metallic green, bronze, iridescent blue & purple, and velvety black particularly dominant on the crests
2	Size	28.9-32.0 cm	28.0-30 cm
3	Barbule length	Long	Long
4	Texture	Smooth	Smooth
5	Barb length	Long	Long
6	Shape	Spatulate tipped	Spatulate tipped
7	Distance between nodes and internodes	Lab observation	At Proximal End (40X)- 57.057 µm
		Lab observation	At Distal End (40X)- 48.785 µm
8	Width of nodes	Lab observation[***]	At Proximal End (40X)- 6.364 µm
		Lab observation[***]	At Distal End (40X)- 3.868 µm
9	Width of internodes	Lab observation[***]	At Proximal End (40X)- 6.364 µm
		Lab observation[***]	At Distal End (40X)- 10.202 µm
10	Shape of node	Ring-Shaped	Ring Shaped
11	Barbule tip	Fork Shaped	Fork Shaped
12	Pigmentation	Dark and more concentrated at node or just below the node but can also be darkly stippled in the internode and throughout barbules	Dark and concentrated at nodes

Figures

Fig 1. A view of the seized crests

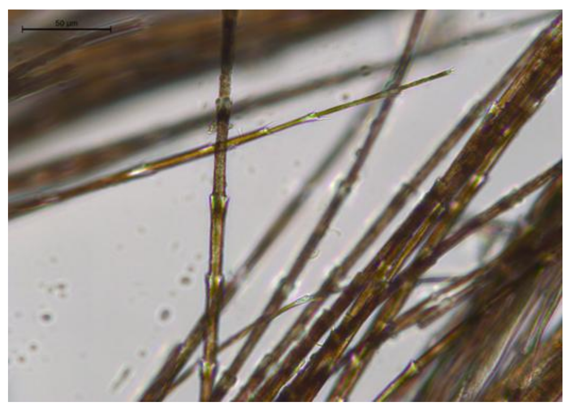

Fig 2 Microscopic features Monal bird feather

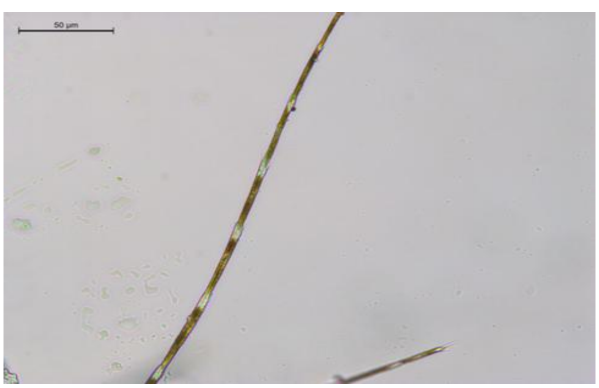

Figure 3 Microscopic features Monal bird feather

Fig 4 Microscopic features Monal bird feather

	SHA256:	14d542d9 1edda91f7b64356693fbed6f 85691d11 70c9c7838fd5478a124e7a3f 2db5792d			
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16	Name: Path: MD5: SHA256:	imgcache.0_embedded_1359 .jpg Realme_RMX3081_DS 8 Pro.zip/data/media/0/Android/data/com.coloros.gallery3d /cache/imgcache.0/imgcache .0_embedded_1359.jpg 4b566c1fe73ffc8a0302dfc34d 764b91 229305b2d797dd1a24332dd 5a3146315 3ddc9acd60f3aac2a06ee5d0 352bd313	Size (bytes):	18556	

Fig 4 Microscopic features Monal bird feather

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