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continued on the back inside cover

Cover: Orange Oakleaf *Kallima inachus* with colour pencils and watercolor wash by Elakshi Mahika Molur adapted from a workshop by Lenin Raj.



First photographic evidence of mange manifestation in Panna Tiger Reserve, India

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Abstract: We report the first ever photographic evidence of mange-infested Golden Jackal *Canis aureus* from Panna Tiger Reserve, central India. The infested animals were photo-captured during the ongoing camera trap sampling in 2019 as a part of a long-term study on the ecology of reintroduced tigers and co-predators. This new record triggers wildlife health and monitoring issues and, subsequently, the importance of restricting the disease outbreak and treatment measures among other associated species within the protected area.

Keywords: *Canis aureus*, carnivore, disease, Golden Jackal, Madhya Pradesh, Mange, Vindhya Hills.

Sarcoptic mange is a commonly widespread and highly contagious skin disease found in wild mammals (McCarthy et al. 2004; Currier et al. 2011). The microscopic mite, *Sarcoptes scabiei*, is the causative agent that infests the skin of its host epidermis by burrowing tunnels (Fuller 2013). Females lay eggs there; subsequently, nymph starts to burrow new tunnels by cutting, secreting, and infesting the epidermal skin (Arlian et al. 1984, 1989), resulting in uncontrolled itching, hair

loss, erythema (redness of the skin due to inflammation), and secondary skin infection, which may further lead to death of the host animal (Radi 2004; Oleaga et al. 2008; Nakagawa et al. 2009). These epizootics have been reported in various host species and well documented in Europe, America, Australia, Africa and Asia (Zumpt & Ledger 1973; Mörner 1992; Kraabøl et al. 2015; Fraser et al. 2016; Old et al. 2018; Niedringhaus et al. 2019). The mite spreads from infested animals to a new host through both direct (rubbing) and indirect contact by sharing common dens and resting places (Devenish-Nelson et al. 2014; AlMBERG et al. 2015; Ezenwa et al. 2016); moreover, transmission from adult to offspring also occurs (Fthenakis et al. 2001).

Mange is well-documented for domestic animals, though limited knowledge is available for wild animals, especially in the Indian subcontinent. In India, the infestation of mange is common in domestic animals (Chhabra & Pathak 2011) such as cats (Sivajothi &

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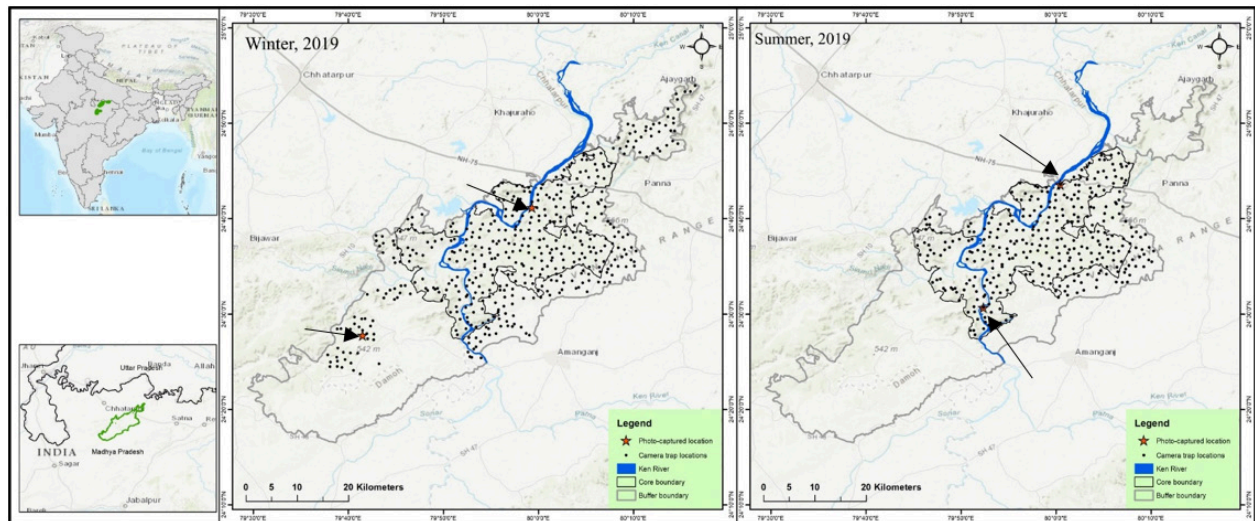


Figure 1. Location of the study area and the season-wise camera trap station locations (black dots) during winter 2019 (left) and summer 2019 (right). The marked areas (red star, indicated by arrow) are the photo-captured sites of mange-infested Golden Jackal.

Reddy 2015), goats (Sreenivasan & Rizvi 1946), and cattle (Tikaram & Ruprah 1986; Gill et al. 1989). Sarcoptic mange was also found in pigs in India (Das et al. 2010; Laha 2015). Earlier, mange-infested Golden Jackal was documented in western India (Dubey et al. 2016).

STUDY AREA AND METHODS

The study was carried out in Panna Tiger Reserve (PTR), situated in the Vindhyan hill range, under biogeographic province 6A Deccan Peninsula – Central Highlands (Rodgers et al. 2002). PTR spreads over 1,574 km² area with two distinct administrative units; core zone (542 km²) and buffer zone (1,032 km²), and covers Panna, Chhatarpur and Damoh districts. PTR is categorized as tropical dry-deciduous forests (Champion & Seth 1968); and Teak *Tectona grandis*, Tendu *Diospyros melanoxylon*, Khair *Acacia catechu*, and Kardhai *Anogeissus pendula* are the major dominated trees in this landscape. Tiger is the apex predator in this ecosystem, while Leopard *Panthera pardus* represents a co-predator. The forest carries a good number of other carnivores like Indian Wolf *Canis lupus*, Striped Hyena *Hyaena hyaena*, Asiatic Wild Dog *Cuon alpinus*, Golden Jackal *Canis aureus*, Indian Fox *Vulpes bengalensis*, Jungle Cat *Felis chaus*, Asiatic Wildcat *Felis silvestris*, and Rusty Spotted Cat *Prionailurus rubiginosus*. Chital *Axis axis*, Sambar *Rusa unicolor*, and Wild Boar *Sus scrofa* are the major prey species, followed by Nilgai *Boselaphus tragocamelus*, Chinkara *Gazella bennettii*, and Chousingha *Tetracerus quadricornis*. The core area is highly protected, while the buffer area of PTR holds 63

villages, most of it being a human-dominated landscape.

We deployed a pair of automated camera traps in 2 km² grid network. A total of 476 and 338 stations were active during the winter (survey period January 2019 to March 2019) and summer (survey period May 2019 to June 2019) season of 2019 (Figure 1) as a part of the study of monitoring released tiger and associated carnivore populations in PTR. The camera trap stations were active for at least 30 days on a 24-hour basis to ensure demographic closure (Kendall 1999), and traps were checked at an interval of 5–7 days.

RESULTS

A total of 476 (14,500 trap nights) and 338 (11,719 trap nights) camera trap stations yielded 2,145 and 757 independent captures of Golden Jackals during winter and summer, respectively. Among those, we found three independent captures of Golden Jackals from two different locations, both in summer and winter. The photo-captured stations were 5.5 km and 2.52 km away (linear distance) from the village during winter, while in summer, the locations were 4.06 km and 500 m away from the nearby village. The captured individuals (Image 1) had severe erythema, alopecia (excessive hair/ fur loss) and infection (Bornstein et al. 1995; Nimmervoll et al. 2013).

DISCUSSION AND MANAGEMENT IMPLICATION

The mite, *Sarcoptes scabiei*, was intentionally introduced during the early 20th century to reduce and control the Wolf and Coyote population in the USA; it was first reported in wolves in Yellowstone National



Image 1. Images of mange-infested Golden Jackal during the camera trap sampling in 2019 in Panna Tiger Reserve, central India.

Park in January 2007. Mange-infested animal death is common (Wydeven et al. 2003; Smith & Almborg 2007) and can spread quickly in the population (Almborg et al. 2012). Therefore, identification of affected individuals is necessary and proper treatment should be provided (Rowe et al. 2019). Mange-infested jackal has the potential to infect other jackals and other species through direct and indirect contact (Alasaad et al. 2012; Valldeperes et al. 2021). Affected individuals are genetically compromised, which may lead to severe detrimental effects in population level (DeCandia et al. 2021). Since transmission may occur from human to domestic animals or domestic to wild animals; thus, the 'One Health' approach should be executed to monitor human-domestic-wildlife health (Lerner & Berg 2015; Mackenzie & Jeggo 2019).

A tiger had died in PTR due to canine distemper virus (CDV; Shetty 2019). Thereafter, a vaccination drive was implemented for domestic animals to restrict the transmission of CDV from domestic animals to wild animals (Nayak et al. 2020). Taking clue from our present observations, we strongly recommend that PTR must adopt a wildlife disease surveillance strategy to reduce and restrict any pathogen transmission. Routine monitoring of the health of domestic and wild population, where feasible (including blood sample collection) and water quality analysis of waterholes should be exercised. Usage of the thermal camera can play an important role in identifying and monitoring the affected individuals, as they emit severe heat loss signatures due to extensive alopecia.

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Articles

Echolocation call characterization of insectivorous bats from caves and karst areas in southern Luzon Island, Philippines

– Renz Angelo Duco, Anna Pauline de Guia, Judeline Dimalibot, Phillip Alviola & Juan Carlos Gonzalez, Pp. 23931–23951

Seasonality, diversity, and forest type associations of macro moths (Insecta: Lepidoptera: Heterocera) in the Shiwalik landscape of northern India and its conservation implications

– Arun Pratap Singh & Lekhendra, Pp. 23952–23976

Vertebrate assemblages on fruiting figs in the Indian eastern Himalaya's Pakke Wildlife Sanctuary

– Akangkshya Priya Gogoi, Janmejay Sethy, Awadhesh Kumar, Dipika Parbo, Murali Krishna Chatakonda & Ajay Maletha, Pp. 23977–23989

Communications

From the Arabian Peninsula to Indian shores: Crab Plover *Dromas ardeola* Paykull, 1805 (Aves: Charadriiformes: Dromadidae) breeding at Point Calimere, India

– H. Byju, N. Raveendran & K.M. Aarif, Pp. 23990–23995

Assessing avian diversity and conservation status in Dighal Wetlands, Haryana, India

– Parul & Parmesh Kumar, Pp. 23996–24008

Studies on the response of House Sparrow *Passer domesticus* to artificial nest-boxes in rural Arakkonam and Nemili taluks, Vellore District, Tamil Nadu, India

– M. Pandian, Pp. 24009–24015

Threat assessment and conservation challenges for the herpetofaunal diversity of Dampa Tiger Reserve, Mizoram, India

– Sushanto Gouda, Ht. Decemson, Zoramkhuma, Fanai Malsawmdawngliana, Lal Biakzuala & Hmar Tlawmte Lalremsanga, Pp. 24016–24031

Taxonomy and conservation status of swamp eels (Synbranchiformes: Synbranchidae) of West Bengal, India

– Ram Krishna Das, Pp. 24032–24042

Sacred river of Pune: boon or bane for the diversity of aquatic beetles (Insecta: Coleoptera)

– Rita Deb, Pallavi Takawane & K.A Subramanian, Pp. 24043–24053

Fine structure of sensilla on the proboscis of the Indian Honey Bee *Apis cerana indica* Fabricius (Insecta: Hymenoptera: Apidae)

– A.G. Suhas Krishna, Shamprasad Varija Raghu & Rajashekhar K. Patil, Pp. 24054–24062

A compendium of *Aphelenchoides* (Fischer, 1894) (Nematoda: Tylenchida: Aphelenchoidea) nematodes with the description of a new species from Manipur, India

– Loukrakpam Bina Chanu & Naorem Mohilal, Pp. 24063–24078

Efficacy of levamisole and oxcyclozanide treatment on gastrointestinal nematodes of ungulates at the Central Zoo, Nepal

– Pratik Kiju, Amir Sadaula, Parbat Jung Thapa & Chiranjibi Prasad Pokheral, Pp. 24079–24085

Ocimum gratissimum L. ssp. *gratissimum* var. *macrophyllum* Briq. (Lamiaceae: Nepetoideae: Ocimeae) a new record from northeastern India

– Mamita Kalita, Nilakshee Devi & Diganta Narzary, Pp. 24086–24091

The study of biogeographic patterns of the genus *Parmotrema* in Wayanad District, Kerala with a new record in India

– Bibin Joseph, Edathum Thazhekuni Sinisha, Valiya Thodiyil Jaseela, Harshid Pulparambil & Nediyaarambu Sukumaran Pradeep, Pp. 24092–24103

Review

Diversity of Calliphoridae and Polleniidae (Diptera) in the Himalaya, India

– Meenakshi Bharti, Pp. 24104–24115

Short Communications

First photographic evidence of mangle manifestation in Panna Tiger Reserve, India

– Supratim Dutta & Krishnamurthy Ramesh, Pp. 24116–24119

New locality record of Forest Spotted Gecko *Cyrtodactylus* (*Geckoella*) cf. *speciosus* (Beddome, 1870) (Reptilia: Squamata: Gekkonidae) from Thanjavur, in the eastern coastal plains of Tamil Nadu, India

– Gopal Murali, Pp. 24120–24124

Preliminary observations of moth (Lepidoptera) fauna of Purna Wildlife Sanctuary, Gujarat, India

– Preeti Choudhary & Indu Sharma, Pp. 24125–24130

On the occurrence of *Audouinella chalybea* (Roth) Bory, 1823, a rare freshwater red algae (Florideophyceae: Acrochaetiales: Audouinellaceae) from eastern Himalaya, India

– Jai Prakash Keshri & Jay Mal, Pp. 24131–24134

Addition of four invasive alien plant species to state flora of Mizoram, India

– Lal Tlanhlu, Margaret Lalhlupuii, Sanatombi Devi Yumkham & Sandhyarani Devi Khomdram, Pp. 24135–24139

Notes

First sighting record of Western Reef-Heron *Egretta gularis* (Bosc, 1792) (Aves: Pelecaniformes: Ardeidae) from Jammu & Kashmir, India

– Parvaiz Yousuf, Semran Parvaiz, Nisheet Zehbi, Sabia Altaf, Showkat Maqbool, & Mudasir Mehmood Malik, Pp. 24140–24143

Rare desmid genus *Bourrellyodesmus* Compère (Chlorophyceae: Desmidiaceae) in India with description of a new species (*Bourrellyodesmus indicus* Das & Keshri sp. nov.) from eastern Himalaya, India

– Debjyoti Das & Jai Prakash Keshri, Pp. 24144–24147

Threats faced by *Humboldtia bourdillonii* Prain (Magnoliopsida: Fabales: Fabaceae), an endangered tree endemic to the southern Western Ghats, India

– Jithu K. Jose & K. Anuraj, Pp. 24148–24150

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