EDITORIAL BOARD

Associate Editors
Dr. Mandar Paingankar, Government Science College Gadchiroli, Maharashtra 442605, India
Dr. Ulrike Streicher, Wildlife Veterinarian, Eugene, Oregon, USA
Ms. Priyanka Iyer, WILD/ZOO, Coimbatore, Tamil Nadu 641006, India
Dr. B.A. Daniel, ZOO/WILD, Coimbatore, Tamil Nadu 641006, India

Editorial Board
Dr. Russel Mittermeier
Executive Vice Chair, Conservation International, Arlington, Virginia 22202, USA

PROF. MOWA SINGH PH.D., FASSC, FNA, FNASC, FNAPSY
Ramanna Fellow and Life-Long Distinguished Professor, Biopsychology Laboratory, and Institute of Excellence, University of Mysore, Mysuru, Karnataka 570006, India; Honorary Professor, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; and Adjunct Professor, National Institute of Advanced Studies, Bangalore

Stephen D. Nash
Scientific Illustrator, Conservation International, Depot of Anatomical Sciences, Health Sciences Center, T-B, Room 045, Stony Brook University, Stony Brook, NY 11794-8081, USA

Dr. Fred Pluthero
Toronto, Canada

Dr. Priya Davidar
Sigur Nature Trust, Chadapatt, Mallivahalla PO, Nilgiris, Tamil Nadu 643223, India

Dr. Martín Fisher
Senior Associate Professor, Battcock Centre for Experimental Astrophysics, Cavendish Laboratory, JI Thomson Avenue, Cambridge CB3 0HE, UK

Dr. John F felonews
Honorary Assistant Professor, The Kadoorie Institute, B/F, T.T. Tsui Building, The University of Hong Kong, Pokfulam Road, Hong Kong

Prof. Dr. Mirco Solé
Universidade Estadual de Santa Cruz, Departamento de Ciências Biológicas, Vice-coordenador do Programa de Pós-Graduação em Zoologia, Rodovia Ilhéus/Itabuna, Km 16 (45662-000) Salobrinho, Ilhéus – Bahia – Brasil

Dr. Rajeev Raghavan
Professor of taxonomy, Kerala University of Fisheries & Ocean Studies, Kochi, Kerala, India

English Editors
Mrs. Mira Bhujwani, Pune, India
Dr. Fred Pluthero, Toronto, Canada
Mr. P. Ilangovan, Chennai, India
Ms. Sindhuara Sthothra Bhashyam, Hyderabad, India

Web Development
Mrs. Latha G. Ravikumar, ZOO/WILD, Coimbatore, India

Typesetting
Mrs. Radhika, ZOO, Coimbatore India
Mrs. Geetha, ZOO, Coimbatore India

Cover: The breathtakingly beautiful Silver Jubilee cover of JoTT is done in color pencils and ink by the 13-year old darling, Elakshi Mahika Molur.
First report of moth species of the family Tineidae (Lepidoptera) in regurgitated pellets of harriers in India

S. Thalavaipandi\(^1\)\(^,\) Arjun Kannan\(^2\)\(^,\) M.B. Prashanth\(^3\)\(^,\) & T. Ganesh\(^4\)\(^,\)

\(^1\) Suri Sehgal Centre for Biodiversity and Conservation, Ashoka Trust for Research in Ecology and the Environment (ATREE), Jakkur P.O., Bengaluru, Karnataka 560064, India.
\(^2\) Manipal Academy of Higher Education (MAHE), Manipal, Karnataka 576104, India.
\(^3\) thalavaipandi@atree.org (corresponding author), \(^4\) arjun.kannan@atree.org, prashanth.mb@atree.org, tganesh@atree.org

Abstract: Caterpillars of Tineidae moths mainly feed on keratin sources and require moisture and warm temperature for emergence. The presence of Tineidae moth caterpillars, pupae, and adults in regurgitated pellets of harriers, diurnal migratory raptors wintering in India, suggests a potential dietary association and highlights the importance of considering associated organisms in raptor diet estimation studies. The caterpillars preferred rodent hairs present in the pellets over feather and arthropod remains. This is the first record of Tineidae moths on the pellets of harriers.

Keywords: Arthropods, caterpillar, diet, grassland, Harrier, Maharashtra, Monopis, pellets, pupae, raptor, regurgitate, Tineidae, Tirunelveli, undigested.

Regurgitating pellets to eject indigestible matter from the gizzard is observed in about 330 species of birds belonging to more than 60 families (Glue 1973). Among these families, pellets ejected by raptors usually contain undigested prey materials such as fur, feathers, bones, scales, and chitin (Philips & Dindal 1979). Pellets generally decompose within a few weeks to months (Wilson 1938; Marti 1974), but it can also remain intact for several years (Brooks 1929; Prestt & Wagstaffe 1973). Most times, pellets either disintegrate on their own due to local weather conditions or are eaten by a variety of arthropods, including ants and beetles. Caterpillars are rarely found in pellets since they mainly feed on plant parts such as leaves, floral tissue, or fruits (Young 1997).

However, a particular group of moth caterpillars belonging to the family Tineidae feed on resources other than plant parts such as fur, feathers, arthropod remains, guano, wool, and hair (Robinson & Nielsen 1993) that are rich in keratin and chitin. Tineidae caterpillars are commonly found in bird nests, and undigested prey contents in raptor pellets form a significant part of their diet (Robinson & Nielsen 1993; Robinson 1998; Terry 2004; Sato et al. 2019). They aid in pellet decomposition by feeding on the fur and feather remains in pellets (Philips & Dindal 1979). Tineidae caterpillars also construct a tube-like larval case made out of the fur and feather remains in pellets (Nasu et al. 2007). Raptor pellets are known to support many invertebrates such as ants, trogid beetles and Tineidae moths for their breeding, feeding, and shelter requirements (Philips &
Previous studies have recorded several moth species of the Tineidae family, i.e., *Monopis congestella*, *M. pavlovskii*, *M. crocipitella*, and *M. longella* in the nests and pellets of the Great Horned Owl (Philips & Dindal 1979), Ural Owl and Goshawk (Nasu et al. 2008), eagles (Sharkov et al. 2003), and in bat droppings (Byun et al. 2014; Heckford & Beavan 2018). In New York, a single pellet of the Great Horned Owl had 60 caterpillars of Tineidae moths in it (Philips & Dindal 1979). However, Tineidae moths have not been recorded from harrier pellets previously.

Here, the occurrence of Tineidae moth caterpillars in harrier pellets and their potential role in influencing raptor diet estimation studies is described.

**Materials and Methods**

The study focused on investigating the diet of harriers in their Indian wintering range, specifically in Rengarajapuram, Tamil Nadu state (8.5474, 77.7039) and Dahiwadi, Maharashtra (17.8243, 76.0504), from 2016 to 2022. Harrier pellets, regurgitated remnants of prey, were collected from roosting sites predominantly utilized by Montagu’s Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, and Western Marsh Harrier *Circus aeruginosus*. To prevent fungal attacks and ensure the preservation, the collected pellets were sun-dried and subsequently packed in zip-lock covers. Morphological measurements including length and breadth were taken for each pellet in the laboratory. Prior to dissection, the pellets were soaked in water, facilitating the identification of prey items. Observations were made within the zip-lock packets to monitor caterpillar emergence, followed by a week-long observation period to determine the number of pupae present in the disintegrated pellets, thus providing an estimate of the emerged larvae or adults. These methods enabled a comprehensive analysis of the harriers’ diet in the specified region and time frame.

**Results and Discussion**

The study provides the first record of Tineidae moth caterpillar, pupae, and adults occurring in harrier pellets. A total of 160 pupae were found in the pellets with a maximum of 38 pupae from one single pellet collected from Maharashtra in 2017; 15 pellets were collected from this harrier roost site and stored in a zip-lock cover. While examining these pellets to ascertain the diet of harriers, we initially observed a few dead caterpillars in the zip-lock packets. The caterpillars were white colored with brownish heads (Image 2). The adult moths were also present on the pellets with creamy white heads, and erect scales on vertex and frons. They had a filiform antenna; scape with black and brownish scales; basal of the wing black; forewings with black and white color in...
equal proportions and the apex was dull black and the termen white. There was a trace of a darker subterminal line originating from the apex and retracting in the middle before which there were two tiny black dots. Based on the above morphological characteristics, the moths were identified to be belonging to the genus *Monopis* (Kristensen 1999).

In 2021, during the collection of pellets from a roosting site in Tamil Nadu, a caterpillar belonging to the genus *Monopis* sp. was once again recorded. Despite the complete disintegration of the pellets, a total of 132 pupae were identified. Notably, within the same set of pellets, another *Monopis* species, specifically *Monopis cf. monachella* (Huang et al. 2011), was documented. This species exhibited distinctive characteristics, including a vertex and frons covered with erect white piliform scales (Image 3), filiform antennae, elongated wings with a moderately rounded apex, and a simple forewing pattern consisting of a round, purple-black color with a large rectangular oblique white marking on the costa, encompassing the subhyaline spot at the end of the discoidal cell (Robinson et al. 1994). Significantly, the collection of these pellets occurred shortly after a period of significant rainfall in the region. Despite the inability to determine the exact number of pellets, these findings provide valuable insights into the presence of *Monopis* species and their association with the harrier diet in the Tamil Nadu roosting site.

Based on the analysis of pellet remains, it was evident that caterpillars exhibited a clear preference for consuming pellets that contained rodent hairs, followed by bird feathers (Figure 1). However, it is noteworthy that the caterpillars did not consume the available grass, seeds, bones, bird gizzard, or eggshells found within the pellets. The outer surface of the pellets remained intact, and the presence of caterpillar frass was observed inside the pellets, indicating that the caterpillars had actively fed on the pellet contents.

The life cycle stages of tineid moths, including their eggs, larvae, and pupae, are known to be sensitive to environmental variables, such as temperature and humidity (Griswold & Crowell 1936). Temperature fluctuations have been shown to significantly influence the egg-laying behavior of these moths (Brimblecombe & Lankester 2013). Although the pellets were thoroughly dried and carefully packed, the emergence of caterpillars and a few adults from the zip-lock packets indicated that the moths may have laid their eggs while the pellets were still in the field before collection. Subsequently, these eggs remained dormant until they were exposed to moisture upon opening the bags in the laboratory. An alternative explanation could be that the larvae were already feeding on the pellet contents from within, and the water soaking process stimulated to come out from the pellet. It is important to note that certain moth species can maintain prolonged dormancy as eggs,
caterpillars, or pupae (Young 1997). To further validate these assumptions, additional in-depth investigations on the ecology and behavior of Tineidae moths are warranted.

This observation marks the first-ever documented instance of Tineidae moth caterpillars within harrier pellets. The identification of Tineidae moths as the decomposers of these pellets highlights the need to explore the factors that facilitate their egg-laying and pupation processes, as not all collected pellets across the years showed signs of infestation. Understanding these conditions is crucial, as they can potentially affect the availability of pellets and introduce biases in dietary estimates, not only for harriers but also for other raptors. If Tineidae moths frequently disintegrate harrier pellets containing feathers and hairs, it can lead to a skewed representation of the dietary preferences of these birds, favoring alternative prey categories in the estimations. Therefore, further investigations into the interaction between Tineidae moths and harrier pellets are essential for accurate dietary assessments and to avoid potential biases in ecological studies involving raptors.

The distribution of tineid moth species in India is currently poorly documented. The presence of *M. monachella* in the pellets collected from Tamil Nadu is noteworthy, as previous records of this species were limited to Kerala and Karnataka, where it was identified using light traps (Pathania & Rose 2004). Therefore, our study provides the first distribution record of *M. monachella* in Tamil Nadu. On the other hand, the tineid moth in the pellets collected from Maharashtra could not be identified at the species level due to the unavailability of type specimens. This highlights the pressing need for comprehensive taxonomic studies on moths, particularly within grassland ecosystems, which have received limited attention thus far. Such preliminary information is crucial for studying host-specificity and can provide valuable insights into the conservation status of these moths, especially considering the declining status of harrier populations due to landscape changes and the loss of grasslands (Ganesh & Prashanth 2018; Saravanan et al. 2021).

**REFERENCES**


NAAS rating (India) 5.64

The opinions expressed by the authors do not reflect the views of the Journal of Threatened Taxa, Wildlife Information Liaison Development Society, Zoo Outreach Organization, or any of the partners. The journal, the publisher, the host, and the partners are not responsible for the accuracy of the political boundaries shown in the maps by the authors.

Print copies of the Journal are available at cost. Write to: The Managing Editor, jottx}@threatenedtaxa.org

c/o Wildlife Information Liaison Development Society,
43/2 Varadarajalu Nagar, 5th Street West, Ganapathy, Coimbatore,
Tamil Nadu 641006, India

ravi@threatenedtaxa.org

Journal of Threatened Taxa

Birds

Dr. Hem Sagar Baral, Charles Sturt University, NSW Australia
Dr. M. Biju, Coimbatore, Tamil Nadu, India
Dr. Chris Bowden, Royal Society for the Protection of Birds, Sandy, UK
Dr. Priya Davdar, Pondicherry University, Kalapet, Puducherry, India
Dr. J.W. Duxworth, WILDLIFE TRUST, Lucknow, India
Dr. Rajay Joyapal, SACION, Coimbatore, Tamil Nadu, India
Dr. Raj S. Kali, M.L.N. College, Yamuna Nagar, Haryana, India
Dr. V. Santharam, Rishi Valley Education Centre, Chittoor Dt., Andhra Pradesh, India
Dr. S. Balachandran, Bombay Natural History Society, Mumbai, India
Dr. M. Praveen, Bengaluru, India
Dr. C. Srinivasulu, Osmania University, Hyderabad, India
Dr. K.S. Gopi Sunder, International Crane Foundation, Baraboo, USA
Dr. Gombobaaan, Professors of Ornithology, Ulaanbaatar, Mongolia
Dr. Reuben Yosef, International Birding & Research Centre, Ellat, Israel
Dr. Taej Murdkur, Wetlands International, Wageningen, The Netherlands
Dr. Carol Inskipp, Bishop Auckland Co., Durham, UK
Dr. Tim Inskipp, Bishop Auckland Co., Durham, UK
Dr. V. Gokula, National College, Tiruchirappalli, Tamil Nadu, India
Dr. Anant Lodhi, Russian Academy of Sciences, Vladivostok, Russia
Dr. Simon Dowell, Science Director, Chester Zoo, UK
Dr. Mário Gabriel Santiago dos Santos, Universidade de Trás-os-Montes e Alto Douro, Quinta de Pardos, Vila Real, Portugal
Dr. Grant Conner, Smithsonian Institution, Royal, VA, USA
Dr. P.A. Azees, Coimbatore, Tamil Nadu, India

Mammals

Dr. Giovanni Amon, CNR - Institute of Systemic Studies, Rome, Italy
Dr. Arunwarudu Chowdhary, AMAN, New Delhi, India
Dr. David Mallon, Zoological Society of London, UK
Dr. Shomita Mukherjee, SACION, Coimbatore, Tamil Nadu, India
Dr. Angie Apostol, WILDLIFE TRUST, Lucknow, India
Dr. O.D. Nameer, Kerala Agricultural University, Thrissur, Kerala, India
Dr. Nirmal Redmond, UNEP Convention on Migratory Species, Landsdown, UK
Dr. Heidi S. Riddle, Riddle's Elephant and Wildlife Sanctuary, Arkansas, USA
Dr. Karin Schwartz, George Mason University, Fairfax, Virginia, USA
Dr. Lala A.K. Singh, Bhubaneswar, Orissa, India
Dr. Mewa Singh, Myors University, Myors, India
Dr. Paul Racey, University of Exeter, Devon, UK
Dr. Honnavalli N. Kumara, SACION, Anakatty P.O., Coimbatore, Tamil Nadu, India
Dr. Nisith Dhariajey, HNG University, Patan, Gujarat, India
Dr. Sagartho Gippolito, Sisio Oratorio Societatal Italiana per la Storia della Fauna "Giuseppe Altobello", Rome, Italy
Dr. Justus Joshua, Green Future Foundation, Tiruchirappalli, Tamil Nadu, India
Dr. H. Raghumur, The American College, Madurai, Tamil Nadu, India
Dr. Paul Bates, Harison Institute, Kent, UK
Dr. Jim Senderson, Small Wild Cat Conservation Foundation, Hartford, USA
Dr. Dan Challenger, Kent, UK
Dr. David Mallon, Manchester Metropolitan University, Derbyshire, UK
Dr. Brian L. Cypher, California State University-Stanislaus, Bakersfield, CA
Dr. S.S. Talmade, Zoological Survey of India, Pune, Maharashtra, India
Dr. Prof. Karan Bahadur Shah, Bhubanakantak University, Kathmandu, Nepal
Dr. Susan Cheyne, Borneo Nature International Foundation, Palangskaria, Indonesia
Dr. Nemanta Kafley, Wildlife Sciences, Tarleton State University, Texas, USA

Other Disciplines

Dr. Aniruddha Belsare, Columbia MO 65203, USA (Veterinary)
Dr. Mandar S. Pangarkar, University of Pune, Pune, Maharashtra, India (Molecular)
Dr. Jack Tordoff, Critical Ecosystem Partnership Fund, Arlington, USA (Communities)
Dr. Ulrike Streicher, University of Oregon, Eugene, USA (Veterinary)
Dr. Hari Balasubramaniam, EcoAdvisors, Nova Scotia, Canada (Communities)
Dr. Raref Avelin Santos Bezerra, Universidade Federal de Sêrro, São Cristópolis, Brazil
Dr. Jeremy R. Wood, Landcare Research, Canterbury, New Zealand
Dr. Wendell Collins-Jonker, Endangered Wildlife Trust, Gauteng, South Africa
Dr. Rajesh Kumar G. Jais, Andhrad Agricultural University, Andhar, Gujarat, India
Dr. D.N. Tiwari, Senior Scientist, ICR-IIndian Agricultural Research Institute [ARI], New Delhi, India
Dr. L.D. Singh, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, India
Dr. Rupika S. Rajakaruna, University of Peradeniya, Peradeniya, Sri Lanka
Dr. Bahar Baviskar, Wild-CER, Nagpur, Maharashtra 440013, India

Reviewers 2020–2022

Due to paucity of space, the list of reviewers for 2020–2022 is available online.
Celebrating 25 years of building evidence for conservation
– Sanjay Molur, Pp. 24819–24820

Articles

Identifying plants for priority conservation in Samar Island Natural Park forests (the Philippines) over limestone using a localized conservation priority index

Status of floristic diversity and impact of development on two sacred groves from Maval Tehsil (Maharashtra, India) after a century
– Kishor Himmat Saste & Rani Babannao Bhagat, Pp. 24838–24853

Faunal inventory and illustrated taxonomic keys to aquatic Coleoptera (Arthropoda: Insecta) of the northern Western Ghats of Maharashtra, India
– Sayali D. Sheth, Anand D. Padhye & Hemant V. Ghate, Pp. 24854–24880

Communications

A checklist of wild mushroom diversity in Mizoram, India
– Rajesh Kumar & Girish Gogoi, Pp. 24881–24898

New plant records for the flora of Saudi Arabia

Seagrass ecosystems of Ritche’s Archipelago in the Andaman Sea harbor ‘Endangered’ Holothuria scabra Jaeger, 1833 and ‘Vulnerable’ Actinopyga mauritiana (Quoy & Gaimard, 1834) sea cucumber species (Echinodermata: Holothuroidea)
– Amrit Kumar Mishra, R. Raihana, Dilmani Kumari & Syed Hilal Farooq, Pp. 24909–24915

Stypopodium Kütz. - a new generic record for India from the Bay of Bengal
– Y. Aron Santhosh Kumar, M. Palanisamy & S. Vivek, Pp. 24916–24922

First report of moth species of the family Tineidae (Lepidoptera) in regurgitated pellets of harriers in India

Notes

Capturing the enchanting glow: first-ever photographs of bioluminescent mushroom Mycena chlorophos in Tamil Nadu, India

Extended distribution of Clematis wightiana Wall. (Ranunculaceae) in the Indian State of Arunachal Pradesh – a hitherto endemic species of the Western Ghats, India
– Debasmita Dutta Pramanick & Manas Bhaumik, Pp. 24999–25002

A record of the Hoary Palmer Unkana ambasa (Moore, [1858]) (Insecta: Lepidoptera: Hesperiidae) from Assam, India
– Kishor Deka, Sagarika Das & Bhaben Tanti, Pp. 25003–25005

Recent record of True Giant Clam Tridacna gigas from the Sulu Archipelago and insight into the giant clam fisheries and conservation in the southernmost islands of the Philippines

Diversity and species richness of avian fauna in varied habitats of Soraiupang range and vicinity in Dehing Patkai National Park, India

D’Ering Memorial Wildlife Sanctuary, a significant flyway and a preferred stopover (refuelling) site during the return migration of the Amur Falcon Falco amurensis (Raddle, 1863)
– Tapak Tamir, Abprez Thungwon Kimsing & Daniel Mize, Pp. 24967–24972

Breeding of the ‘Critically Endangered’ White-rumped Vulture Gyps bengalensis in the Shan Highlands, Myanmar
– Sai Sein Lin Oo, Nang Lao Kham, Marcela Suarez-Rubio & Swen C. Renner, Pp. 24973–24978

Nurturing orphaned Indian Grey Wolf at Machia Biological Park, Jodhpur, India
– Hemsingh Gehlot, Mahendra Gehlot, Tapan Adhikari, Gaurav & Prakash Suthar, Pp. 24979–24985

Short Communications

New records of forty-nine herbaceous plant species from lateritic plateaus for Ratnagiri District of Maharashtra, India

Recent record of Rodent - a part of culture and revolution in India
– Rajesh Chaudhary & Sohail Madan, Pp. 25013–25015

Sighting of Large Branded Swift Pelopidas sinensis in Delhi, India
– Sanath Chandra Bohra, Manmath Bharali, Puja Kalita & Rita Roy, Pp. 25010–25012

A record of the Hoary Palmer Unkana ambasa (Moore, [1858]) (Insecta: Lepidoptera: Hesperiidae) from Assam, India
– Kishor Deka, Sagarika Das & Bhaben Tanti, Pp. 25003–25005

Sighting of Large Branded Swift Pelopidas sinensis (Mabille, 1877) (Hesperiidae: Hesperiinae) in Delhi, India
– Rajesh Chaudhary & Sohail Madan, Pp. 25013–25015

Rodent - a part of culture and revolution in India
– Hiranmoy Chetia & Murali Krishna Chatakonda, Pp. 25016–25018