

ISSN 0974-7907 (Online)  
ISSN 0974-7893 (Print)

26 October 2019 (Online & Print)  
Vol. 11 | No. 13 | 14631–14786

10.11609/jott.2019.11.13.14631-14786  
[www.threatenedtaxa.org](http://www.threatenedtaxa.org)



**Journal of Threatened Taxa**



**PLATINUM  
OPEN  
ACCESS**

*Building evidence for conservation globally*





ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher  
**Wildlife Information Liaison Development Society**  
www.wild.zooreach.org

Host  
**Zoo Outreach Organization**  
www.zooreach.org

No. 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti,  
Coimbatore, Tamil Nadu 641035, India

Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)

Email: [sanjay@threatenedtaxa.org](mailto:sanjay@threatenedtaxa.org)

#### EDITORS

##### Founder & Chief Editor

**Dr. Sanjay Molur**

Wildlife Information Liaison Development (WILD) Society & Zoo Outreach Organization (ZOO), 12 Thiruvannamalai Nagar, Saravanampatti, Coimbatore, Tamil Nadu 641035, India

##### Deputy Chief Editor

**Dr. Neelesh Dahanukar**

Indian Institute of Science Education and Research (IISER), Pune, Maharashtra, India

##### Managing Editor

**Mr. B. Ravichandran**, WILD/ZOO, Coimbatore, India

##### Associate Editors

**Dr. B.A. Daniel**, ZOO/WILD, Coimbatore, Tamil Nadu 641035, India

**Dr. Mandar Paingankar**, Department of Zoology, Government Science College Gadchiroli, Chamorshi Road, Gadchiroli, Maharashtra 442605, India

**Dr. Ulrike Streicher**, Wildlife Veterinarian, Eugene, Oregon, USA

**Ms. Priyanka Iyer**, ZOO/WILD, Coimbatore, Tamil Nadu 641035, India

##### Editorial Board

**Ms. Sally Walker**

Founder/Secretary, ZOO, Coimbatore, India

**Dr. Robert Lacy**

Department of Conservation Biology, Chicago Zoological Society (also known as the Brookfield Zoo), Brookfield, Illinois 60513 USA; and Committee on Evolutionary Biology, University of Chicago

**Dr. Russel Mittermeier**

Executive Vice Chair, Conservation International, Arlington, Virginia 22202, USA

**Prof. Mewa Singh Ph.D., FASc, 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

**Dr. Ulrike Streicher, DVM**

Wildlife Veterinarian / Wildlife Management Consultant, 1185 East 39th Place, Eugene, OR 97405, USA

**Stephen D. Nash**

Scientific Illustrator, Conservation International, Dept. of Anatomical Sciences, Health Sciences Center, T-8, Room 045, Stony Brook University, Stony Brook, NY 11794-8081, USA

**Dr. Fred Pluthero**

Toronto, Canada

**Dr. Martin Fisher**

Senior Associate Professor, Battcock Centre for Experimental Astrophysics, Cavendish Laboratory, JJ Thomson Avenue, Cambridge CB3 0HE, UK

**Dr. Ulf Gärdenfors**

Professor, Swedish Species Information Center, SLU, Uppsala, Sweden

**Dr. John Fellowes**

Honorary Assistant Professor, The Kadoorie Institute, 8/F, T.T. Tsui Building, The University of Hong Kong, Pokfulam Road, Hong Kong

**Dr. Philip S. Miller**

Senior Program Officer, Conservation Breeding Specialist Group (SSC/IUCN), 12101 Johnny Cake Ridge Road, Apple Valley, MN 55124, USA

**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

#### English Editors

**Mrs. Mira Bhojwani**, Pune, India

**Dr. Fred Pluthero**, Toronto, Canada

**Mr. P. Ilangovan**, Chennai, India

#### Web Design

**Mrs. Latha G. Ravikumar**, ZOO/WILD, Coimbatore, India

#### Typesetting

**Mr. Arul Jagadish**, ZOO, Coimbatore, India

**Mrs. Radhika**, ZOO, Coimbatore, India

**Mrs. Geetha**, ZOO, Coimbatore, India

**Mr. Ravindran**, ZOO, Coimbatore, India

#### Fundraising/Communications

**Mrs. Payal B. Molur**, Coimbatore, India

#### Editors/Reviewers

##### Subject Editors 2016-2018

##### Fungi

**Dr. B. Shivaraju**, Bengaluru, Karnataka, India

**Prof. Richard Kiprono Mibey**, Vice Chancellor, Moi University, Eldoret, Kenya

**Dr. R.K. Verma**, Tropical Forest Research Institute, Jabalpur, India

**Dr. V.B. Hosagoudar**, Bilagi, Bagalkot, India

**Dr. Vatsavaya S. Raju**, Kakatiya University, Warangal, Andhra Pradesh, India

**Dr. D.J. Bhat**, Retd. Professor, Goa University, Goa, India

##### Plants

**Dr. G.P. Sinha**, Botanical Survey of India, Allahabad, India

**Dr. N.P. Balakrishnan**, Ret. Joint Director, BSI, Coimbatore, India

**Dr. Shonil Bhagwat**, Open University and University of Oxford, UK

**Prof. D.J. Bhat**, Retd. Professor, Goa University, Goa, India

**Dr. Ferdinando Boero**, Università del Salento, Lecce, Italy

**Dr. Dale R. Calder**, Royal Ontario Museum, Toronto, Ontario, Canada

**Dr. Cleofas Cervancia**, Univ. of Philippines Los Baños College Laguna, Philippines

**Dr. F.B. Vincent Florens**, University of Mauritius, Mauritius

**Dr. Merlin Franco**, Curtin University, Malaysia

**Dr. V. Irudayaraj**, St. Xavier's College, Palayamkottai, Tamil Nadu, India

**Dr. B.S. Kholia**, Botanical Survey of India, Gangtok, Sikkim, India

**Dr. Pankaj Kumar**, Kadoorie Farm and Botanic Garden Corporation, Hong Kong S.A.R., China

**Dr. V. Sampath Kumar**, Botanical Survey of India, Howrah, West Bengal, India

**Dr. A.J. Solomon Raju**, Andhra University, Visakhapatnam, India

**Dr. Vijayasankar Raman**, University of Mississippi, USA

**Dr. B. Ravi Prasad Rao**, Sri Krishnadevaraya University, Anantpur, India

**Dr. K. Ravikumar**, FRLHT, Bengaluru, Karnataka, India

**Dr. Aparna Watve**, Pune, Maharashtra, India

**Dr. Qiang Liu**, Xishuangbanna Tropical Botanical Garden, Yunnan, China

**Dr. Noor Azhar Mohamed Shazili**, Universiti Malaysia Terengganu, Kuala Terengganu, Malaysia

**Dr. M.K. Vasudeva Rao**, Shiv Ranjani Housing Society, Pune, Maharashtra, India

**Prof. A.J. Solomon Raju**, Andhra University, Visakhapatnam, India

**Dr. Mandar Datar**, Agharkar Research Institute, Pune, Maharashtra, India

**Dr. M.K. Janarthanam**, Goa University, Goa, India

**Dr. K. Karthigeyan**, Botanical Survey of India, India

**Dr. Errol Vela**, University of Montpellier, Montpellier, France

**Dr. P. Lakshminarasimhan**, Botanical Survey of India, Howrah, India

**Dr. Larry R. Noblick**, Montgomery Botanical Center, Miami, USA

**Dr. K. Haridasan**, Pallavur, Palakkad District, Kerala, India

**Dr. Analinda Manila-Fajard**, University of the Philippines Los Baños, Laguna, Philippines

**Dr. P.A. Sinu**, Central University of Kerala, Kasaragod, Kerala, India

#### Invertebrates

**Dr. R.K. Avasthi**, Rohtak University, Haryana, India

**Dr. D.B. Bastawade**, Maharashtra, India

**Dr. Partha Pratim Bhattacharjee**, Tripura University, Suryamaniganar, India

continued on the back inside cover

Cover: Parasitic Hymenoptera: front—*Stilbum cyanarum* collected from Thirupathisaram, Kanyakumari District (© J. Alfred Daniel) | back—*Callipteroma sexguttata* collected from Paddy Breeding Station, Coimbatore District (© J. Alfred Daniel).



PLATINUM  
OPEN ACCESS



The Journal of Threatened Taxa (JoTT) is dedicated to building evidence for conservation globally by publishing peer-reviewed articles online every month at a reasonably rapid rate at [www.threatenedtaxa.org](http://www.threatenedtaxa.org). All articles published in JoTT are registered under [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/) unless otherwise mentioned. JoTT allows unrestricted use, reproduction, and distribution of articles in any medium by providing adequate credit to the author(s) and the source of publication.

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

October 2019 | Vol. 11 | No. 13 | Pages: 14631–14786

Date of Publication: 26 October 2019 (Online & Print)

DOI: 10.11609/jott.2019.11.13.14631-14786

[www.threatenedtaxa.org](http://www.threatenedtaxa.org)

#### Communications

##### Camera trap survey of mammals in Cleopatra's Needle Critical Habitat in Puerto Princesa City, Palawan, Philippines

– Paris N. Marler, Solomon Calago, Mélanie Ragon & Lyca Sandra G. Castro, Pp. 14631–14642

##### Habitat suitability modeling of Asian Elephant *Elephas maximus* (Mammalia: Proboscidea: Elephantidae) in Parsa National Park, Nepal and its buffer zone

– Puja Sharma, Hari Adhikari, Shankar Tripathi, Ashok Kumar Ram & Rajeev Bhattarai, Pp. 14643–14654

##### Current population status of the endangered Hog Deer *Axis porcinus* (Mammalia: Cetartiodactyla: Cervidae) in the Terai grasslands: a study following political unrest in Manas National Park, India

– Alolika Sinha, Bibhuti Prasad Lahkar & Syed Ainul Hussain, Pp. 14655–14662

##### A food spectrum analysis of three bufonid species (Anura: Bufonidae) from Uttarakhand region of the western Himalaya, India

– Vivekanand Bahuguna, Ashish Kumar Chowdhary, Shurveer Singh, Gaurav Bhatt, Siddhant Bhardwaj, Nikita Lohani & Satyanand Bahuguna, Pp. 14663–14671

##### Moulting pattern and mortality during the final emergence of the Coromandel Marsh Dart Damselfly *Ceragrion coromandelianum* (Zygoptera: Coenagrionidae) in central India

– Nilesh R. Thakkar, Payal R. Verma & Raymond J. Andrew, Pp. 14672–14680

##### Diversity of parasitic Hymenoptera in three rice-growing tracts of Tamil Nadu, India

– Johnson Alfred Daniel & Kunchithapatham Ramaraju, Pp. 14681–14690

##### Mapping octocoral (Anthozoa: Octocorallia) research in Asia, with particular reference to the Indian subcontinent: trends, challenges, and opportunities

– Ghosh Ramvilas, Kannan Shalu, Rajeev Raghavan & Kutty Ranjeet, Pp. 14691–14721

##### SEM study of planktonic chlorophytes from the aquatic habitat of the Indian Sundarbans and their conservation status

– Gour Gopal Satpati & Ruma Pal, Pp. 14722–14744

##### Is cultivation of *Saussurea costus* (Asterales: Asteraceae) sustaining its conservation?

– Chandra Prakash Kuniyal, Joel Thomas Heinen, Bir Singh Negi & Jagdish Chandra Kaim, Pp. 14745–14752

#### Short Communications

##### A first photographic record of a Yellow-bellied Weasel *Mustela kathiah* Hodgson, 1835 (Mammalia: Carnivora: Mustelidae) from western Nepal

– Badri Baral, Anju Pokharel, Dipak Raj Basnet, Ganesh Bahadur Magar & Karan Bahadur Shah, Pp. 14753–14756

##### Mammal diversity in a montane forest in central Bhutan

– Tashi Dhendup, Kinga Thinley & Ugyen Tenzin, Pp. 14757–14763

#### Notes

##### First record of Otter Civet *Cynogale bennettii* (Mammalia: Carnivora: Viverridae) kept as a pet in Indonesia, representing a possible new threat to the species

– Jamie Francis Bernard Bouhuys, Pp. 14764–14766

##### An observation of the White-bellied Sea Eagle *Haliaeetus leucogaster* preying on Saltwater Crocodile hatchlings *Crocodylus porosus* in Bhitarkanika Wildlife Sanctuary, India

– Nimain Charan Palei, Bhakta Padarbinda Rath & Bimal Prasanna Acharya, Pp. 14767–14769

##### Elusive, rare and soft: a new site record of Leith's Softshell Turtle *Nilssonina leithii* (Reptilia: Testudines: Trionychidae) from Bhadra Tiger Reserve, Karnataka, India

– H.S. Sathya Chandra Sagar, M. Mrunmayee, I.N. Chethan, Manish Kumar & D.V. Girish, Pp. 14770–14772

##### A new distribution record of the Pentagonal Sea Urchin Crab *Echinoecus pentagonus* (A. Milne-Edwards, 1879) (Decapoda: Brachyura: Pilumnidae) from the Andaman Islands, India

– Balakrishna Meher & Ganesh Thiruchitrambalam, Pp. 14773–14776

##### First records of the ghost moth genus *Palpifer* Hampson, [1893] (Lepidoptera: Hepialidae) from the Indian subcontinent south of the Himalaya

– Siyad A. Karim & John R. Grehan, Pp. 14777–14779

##### First record of longhorn beetle *Calothyrsa margaritifera* (Cerambycidae: Lamiinae: Phrynetini) from western India

– Vishwas Deshpande & Hemant V. Ghate, Pp. 14780–14783

##### Extended distribution of *Ceropegia mahabalei* Hemadri & Ansari (Apocynaceae) to the state of Gujarat, India

– Mukta Rajaram Bhamare, Hemantkumar Atmaram Thakur & Sharad Suresh Kambale, Pp. 14784–14786

#### Partner



#### Member



#### Publisher & Host





ISSN : 0972-0030

eISSN : 0976-1780

R.N.I. No. 66602/08

## JOURNAL OF EXPERIMENTAL ZOOLOGY, INDIA

VOLUME 23	NUMBER 1	JANUARY 2020
-----------	----------	--------------

### CONTENTS

- CRISPR-Cas9 : A promising genome editing tool  
Nikhil K. C., D. R. Pruthviraj, Ganesh N. Adero and K. P. Harish Kumar 1
- Fish meal and fish oil replacement for aqua feed formulation by using alternative sources : A review  
A. R. Hodar, R. J. Vasava, D. R. Mahavadiya and N. H. Joshi 13
- An independent behavioral evolution in diverse group of animals for protecting their progeny  
A. K. Singh 23
- Toxicity of arsenic in the fish  
Madhuri Sharma 31
- Optimisation of Hydrilla plant in the rearing environment of lambrapami barb (Dawkinsia lambrapami) juveniles  
Sunil Kumar S. Ail, Bijayanad Seth, Uma Buddha, Rosalin Mohapatra, Mukesh Kumar Bairwa and Saroj Kumar Swain 35
- Histopathological changes in liver and kidney of freshwater fish, Rasbora daniconius exposed to sub-lethal concentration paper mill effluent  
T. S. Pathan 41
- Taxonomic notes on Puntius zohla (Hamilton, 1822)  
Mathews Plamoottil and Debarghya Maji 47
- Effect of some IPM modules on the foliage feeders infesting brinjal, Solanum melongena  
U. S. Nayak, L. K. Rath and G. Shial 53
- Dominance of male sex and non-synchronisation in gonadal maturity of rainbow trout  
Vishal Datta, H. C. S. Bisht, N. N. Pandey, Dinesh Mohan, Preetam Kala, Bipin Kumar Vishwakarma and Sheetal Sharma 57
- Nutritional evaluation of fermented sweet potato leaf meal as a replacer of deoiled Rice Bran in the diet of Labeo rohita fingerlings  
Manish Jayant, Narottam Prasad Sahu, Ashutosh Dhamendra Deo, Subodh Gupta, Chetan Kumar Garg and Rajendran Kooloth Valappil 61
- Effect of selection pressure of novel insecticide on brown plant hopper, Nilaparvata lugens (Stål.) infesting rice  
Krandeep Kaur Doosi, K. S. Suri and A. K. Chandi 71
- Effect of different oils on development of stored mite, Tyrophagus putrescentiae Schrank on stored groundnut  
Chauhan Rinkikumari and Abhishek Shukla 77
- Organic substrate-based production of vermicompost employing red wigglers, Eisenia fetida (Sav.) : Potential to agri-farming and aquaculture in agro-climatic condition of Punjab, India  
Amit Mandal, Sachin Onkar Khairnar, Bhanu Prakash Ch., Sandeep Sharma and Vijay Kumar Reddy Surasani 87
- Acute toxicity bioassay in sodium fluoride exposed amur carp (Cyprinus carpio haematopterus) fry  
Rajinder Kaur, Amita Saxena and Munish Batra 95
- Effect of brown seaweed extract coating and vacuum packaging on reef cod fish (Epinephelus diacanthus) fillet quality and shelf life during refrigerated storage  
Sumit Kumar Verma, S. M. Zotari, Neeraj Pathak, Sushri Subhasini Behera and Tarat Pravinkumar 101
- Use of DNA barcoding in the investigation of disputable meristic features for Hypselobarbus jerdoni (Day, 1870) fingerlings  
Shamima Naeem, Negeppa Basavaraja, Malathi Shekar, Md. Abdullah Al-Mamun, Sanjay Singh Rathore, Purandara Ballayya Abhiman and Kevin Dsouza Ronald 113

contd. inside

Owner, Printer, Publisher and Editor : Dr. P. R. Yadav, Published from 609/8, South Civil Lines, Muzaffarnagar, Ph. : 0131 - 2623278, Printed at Quick Prints, 203/39, Sadar Bazar, Muzaffarnagar-251001, India.



Online version : www.connectjournals.com/jez

ISSN : 0972-0030

eISSN : 0976-1780

VOLUME 23  
NUMBER 1  
JANUARY 2020

# JOURNAL OF EXPERIMENTAL ZOOLOGY INDIA



P. R. Yadav, Ph.D

Chief Editor

Phone 0131 - 2623278, Mobile : 09412867987

email : yadavpry@rediffmail.com

*Details of cover page picture*



*Aethriamanta brevipennis* (Female), Common Name: Scarlet Marsh Hawk,  
Order : Odonata, Family : Libellulidae,  
Place : Kanyakumari District, Tamilnadu, India;  
Copyright: © J. Alfred Daniel

---

---

*This journal is indexed/abstracted by :*



*Web of Science* : BIOSIS Previews,  
Biological Abstract, Zoological Records

**EBSCO**





**AEN 202 MANAGEMENT OF BENEFICIAL AND  
HARMFUL INSECTS (2+1)  
(2017 Syllabus)**

**PRACTICAL MANUAL CUM RECORD**



**Tamil Nadu State Butterfly**

**TAMIL YEOMAN**

**தமிழ் மறவன்**

***Cirrochroa thais***

**(Nymphalidae : Lepidoptera)**

**AEN 202 MANAGEMENT OF BENEFICIAL AND HARMFUL INSECTS (2+1)**



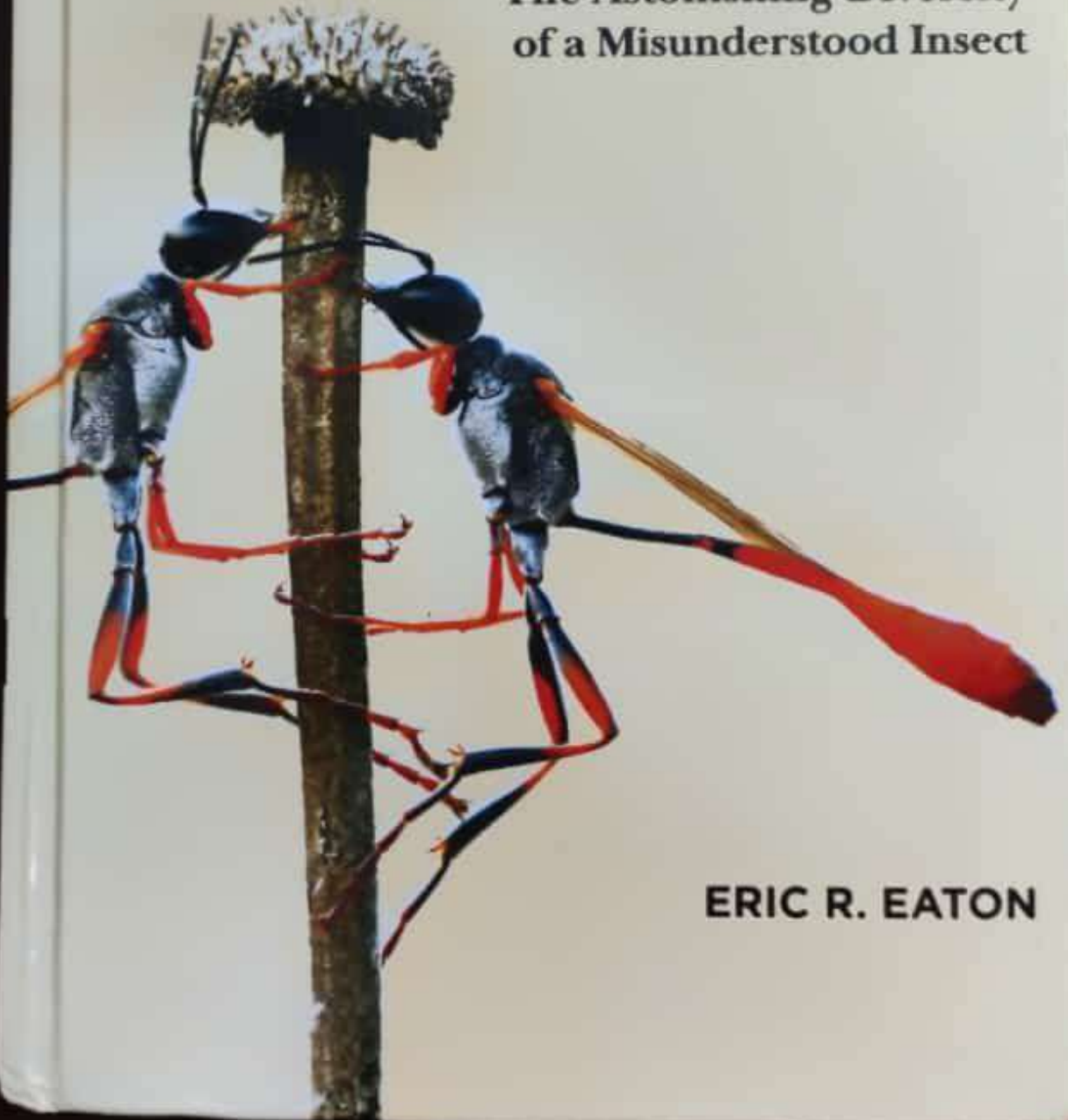
**DEPARTMENT OF AGRICULTURAL ENTOMOLOGY  
CENTRE FOR PLANT PROTECTION STUDIES  
TAMIL NADU AGRICULTURAL UNIVERSITY  
COIMBATORE - 641 003**

**2020**



# Wasps

The Astonishing Diversity  
of a Misunderstood Insect



ERIC R. EATON



# Wasps

**The Astonishing Diversity  
of a Misunderstood Insect**

**ERIC R. EATON**

PRINCETON UNIVERSITY PRESS  
PRINCETON AND OXFORD





Entomologists, the scientists who study insects, define "wasps" more broadly than the rest of us. We assume the term to mean social wasps like yellowjackets, hornets, and paper wasps. This accidental tunnel vision excludes an astonishing array of other wasps more colorful, larger, or smaller, and several orders of magnitude more fascinating and beneficial than the few species that plague picnics or barbecues. We cover when confronted by the smallest of spiders, but a female tarantula hawk wasp hunts down the largest of arachnids. We cannot recall where we parked our vehicle, but a sand wasp can locate her hidden burrow in a dune. Wasps own some of the most sophisticated senses we can only dream of. Most can fly. There is much to admire, if not envy.

Each chapter in this book explores attributes of wasps that set them apart from all other animals. Their anatomies and life cycles share similarities with other insects, but the diversity and efficiency of their lifestyles and behaviors are unsurpassed. Wasps have influenced the evolution of flowers, caused unrelated insects to evolve a nearly identical resemblance to them, and exerted pressure on host and prey insects to evolve new survival strategies. Wasps weaponized their egg-laying organs. Some species have evolved symbiotic relationships with fungi, or viruses, and bent them to their advantage. Many species are allies of man in pest control, medicine, and forensics. Wasps are the epitome of the warrior spirit, female empowerment, and relentless dedication to survival. Wasps excel as opportunists and exploiters.

**Larger Than Life**  
The face of a cicada wasp (*Stibum*) is dominated by compound eyes, antennae, spiracles, and mandibles.  
*Stibum* is a highly microscopic wasp found in Europe, Asia, and North America (right). It is a parasite of the eggs of leafhoppers and delphacid planthoppers.

Wasps have achieved their success through evolutionary adaptations over time, evolving subtle changes to their physical bodies and genetic heritage. We, on the other hand, are capable of rapid social and economic adaptations by exercising conscious choice in our habits as producers and consumers. One could argue that our male-dominated societies are more ruthless and destructive than any matriarchal "murder hornet" colony. This is a crucial period in the history of humanity and the natural history of the planet. Will we choose wasps to be a part of it?

Scientists argue that despite anecdotal evidence from Germany, Australia, Canada, Puerto Rico, and a few other locations, there is not quantitative nor qualitative data to support the assertion of an "insect apocalypse." There is, however, widespread agreement that we know enough to act now to prevent further erosion of insect abundance and diversity. What we cannot live without is obvious. Our psyche suffers when deprived of biodiversity, and our physical lives become threatened when ecosystem services like pollination, natural pest control, seed dispersal, and organic decomposition are compromised. There is no alternative but to preserve and protect all remaining extant species, wasps included.

