



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.

# Journal of Threatened Taxa

Building evidence for conservation globally

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

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

## SHORT COMMUNICATION

### **OCCURRENCE OF *FULGORAECIA* (= *EPIRICANIA*) *MELANOLEUCA* (LEPIDOPTERA: EPIPYROPIAE) AS A PARASITOID OF SUGARCANE LOPHOPID PLANTHOPPER *PYRILLA PERPUSILLA* IN TAMIL NADU (INDIA) WITH BRIEF NOTES ON ITS LIFE STAGES**

H. Sankararaman, G. Naveenadevi & S. Manickavasagam

26 May 2020 | Vol. 12 | No. 8 | Pages: 15927–15931

DOI: 10.11609/jott.5033.12.8.15927-15931



For Focus, Scope, Aims, Policies, and Guidelines visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-0>

For Article Submission Guidelines, visit <https://threatenedtaxa.org/index.php/JoTT/about/submissions#onlineSubmissions>

For Policies against Scientific Misconduct, visit <https://threatenedtaxa.org/index.php/JoTT/about/editorialPolicies#custom-2>

For reprints, contact [<ravi@threatenedtaxa.org>](mailto:ravi@threatenedtaxa.org)

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.

Member



Publisher & Host







## Occurrence of *Fulgoraacia* (= *Epiricania*) *melanoleuca* (Lepidoptera: Epipyropidae) as a parasitoid of sugarcane lophopid planthopper *Pyrilla perpusilla* in Tamil Nadu (India) with brief notes on its life stages

H. Sankararaman<sup>1</sup> , G. Naveenadevi<sup>2</sup> & S. Manickavasagam<sup>3</sup>

<sup>1,2,3</sup>Parasitoid Taxonomy and Biocontrol laboratory, Department of Entomology, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu 608002, India.

<sup>1</sup>sankararaman05@gmail.com (corresponding author), <sup>2</sup>nethranavi96@gmail.com, <sup>3</sup>drmanicks2003@yahoo.co.in

**Abstract:** Seasonal incidence of sugarcane planthopper *Pyrilla perpusilla* Walker (Hemiptera: Lophopidae) and its natural enemies was investigated at Cuddalore District, Tamil Nadu during 2018. In this study, *Fulgoraacia melanoleuca*, a parasitoid of sugarcane planthopper *Pyrilla perpusilla* was observed in large numbers in the field. Brief notes on its biology, life stages, and extent of parasitism on the host were studied. Per cent parasitization in nymph and adult was 47.54 and 45.09, respectively, during the month of August. High resolution images of all life stages are provided to help in identification.

**Keywords:** Biology, *Fulgoraacia melanoleuca*, life stages, natural occurrence, *Pyrilla perpusilla*.

Epipyropidae is a small family of ectoparasitic insects belonging to the order Lepidoptera. Their larvae are parasitic on Auchenorrhyncha, especially Fulgoridae and Membracidae (Pierce 1995). The family comprises 40 species worldwide (Heppner 2008), among which *Fulgoraacia* (= *Epiricania*) *melanoleuca* (Fletcher, 1939) is economically very important as an ectoparasitoid of sugarcane lophopid planthopper *Pyrilla perpusilla*.

*Fulgoraacia melanoleuca* has been reported from India, Sri Lanka, Pakistan, and Bangladesh (Kumarasinghe

& Wratten 1996). It has played a major role in the management of the sugarcane *Pyrilla* epidemics (Gangwar et al. 2008). Although it has been recorded in India in 1939 (Fletcher 1939), its biocontrol potential was recognized only during the *Pyrilla* epidemics in Uttar Pradesh and Bihar (Banerjee 1973). In India, incidence of *Fulgoraacia* has been recorded in Maharashtra (Gholap & Chandele 1985), Gujarat (Pawar et al. 1988), Rajasthan (Joshi & Sharma 1989), Odisha (Patnaik et al. 1990), Haryana (Chhillar & Madan 1992; Ahlawat & Kumar 2015), Uttar Pradesh (Tripathi & Katiyar 1998), Punjab (Sanhedeep et al. 2003), Uttarakhand (Kumar et al. 2008) and Chhattisgarh (Patre 2016). In the southern states, *Fulgoraacia* was recorded in Karnataka (Ansari et al. 1989; Hugar et al. 2002) and Andhra Pradesh (Rajak & Varma 2001). It has been considered as a potential biocontrol agent against *Pyrilla* (Chhillar & Madan 1992; Pawar et al. 2002) and extensively used in management of *Pyrilla* (Pawar et al. 2002; Seneviratne & Kumarasinghe 2002; Rajak 2007; Pandey et al. 2008). *Fulgoraacia melanoleuca* has proved its merit in in situ parasitization

**Editor:** George Mathew, (Ex) Head, Forest Health Division, Kerala Forest Research Institute, Peechi, India.

**Date of publication:** 26 May 2020 (online & print)

**Citation:** Sankararaman, H., G. Naveenadevi & S. Manickavasagam (2020). Occurrence of *Fulgoraacia* (= *Epiricania*) *melanoleuca* (Lepidoptera: Epipyropidae) as a parasitoid of sugarcane lophopid planthopper *Pyrilla perpusilla* in Tamil Nadu (India) with brief notes on its life stages. *Journal of Threatened Taxa* 12(8): 15927–15931. <https://doi.org/10.11609/jott.5033.12.8.15927-15931>

**Copyright:** © Sankararaman et al. 2020. Creative Commons Attribution 4.0 International License. JoTT allows unrestricted use, reproduction, and distribution of this article in any medium by providing adequate credit to the author(s) and the source of publication.

**Funding:** DST PURSE II, Annamalai University.

**Competing interests:** The authors declare no competing interests.

**Acknowledgements:** The authors are thankful to Dr. M. Ayyamperumal, Central Integrated Pest Management Centre, Trichy and PG students 2018-19 for the help rendered in collection. The partial financial aid of Government of India, DST PURSE PHASE II (2018-2019) through Annamalai University is gratefully acknowledged.



due to high multiplication rate, comparatively shorter life cycle, survival under varied agro-climatic conditions, and good searching ability of its host by larvae (Rajak 2006, 2007). In this paper, we report the natural occurrence of this parasitoid from Cuddalore District of Tamil Nadu, India.

#### MATERIALS AND METHODS

During our regular field surveys for collection of parasitic insects from different ecosystems, *F. melanoleuca* was collected from sugarcane *Saccharum officinarum* at Andipalayam Village of Anna Gramam block (11.77N & 79.55E) of Cuddalore District, Tamil Nadu during July and August 2018. The number of egg masses, nymphs and adults of *P. perpusilla* was recorded and these life stages were collected every week and they

were kept separately in polythene bags, with the leaves changed as and when necessary and observations made on parasitoid emergence.

From the egg masses collected, parasitized and unparasitized eggs were segregated by their colour (unparasitized eggs being creamy white and parasitized ones dark brown to black) and per cent parasitism was worked out by using the following formula as described by Mishkat & Khalid (2007). Similarly, per cent parasitism of nymphs and adults was worked out. Parasitized nymph (Image 1B) and adults (Image 1C) were differentiated by presence of white cottony cushion on the back and pleural abdominal region of the host, respectively.

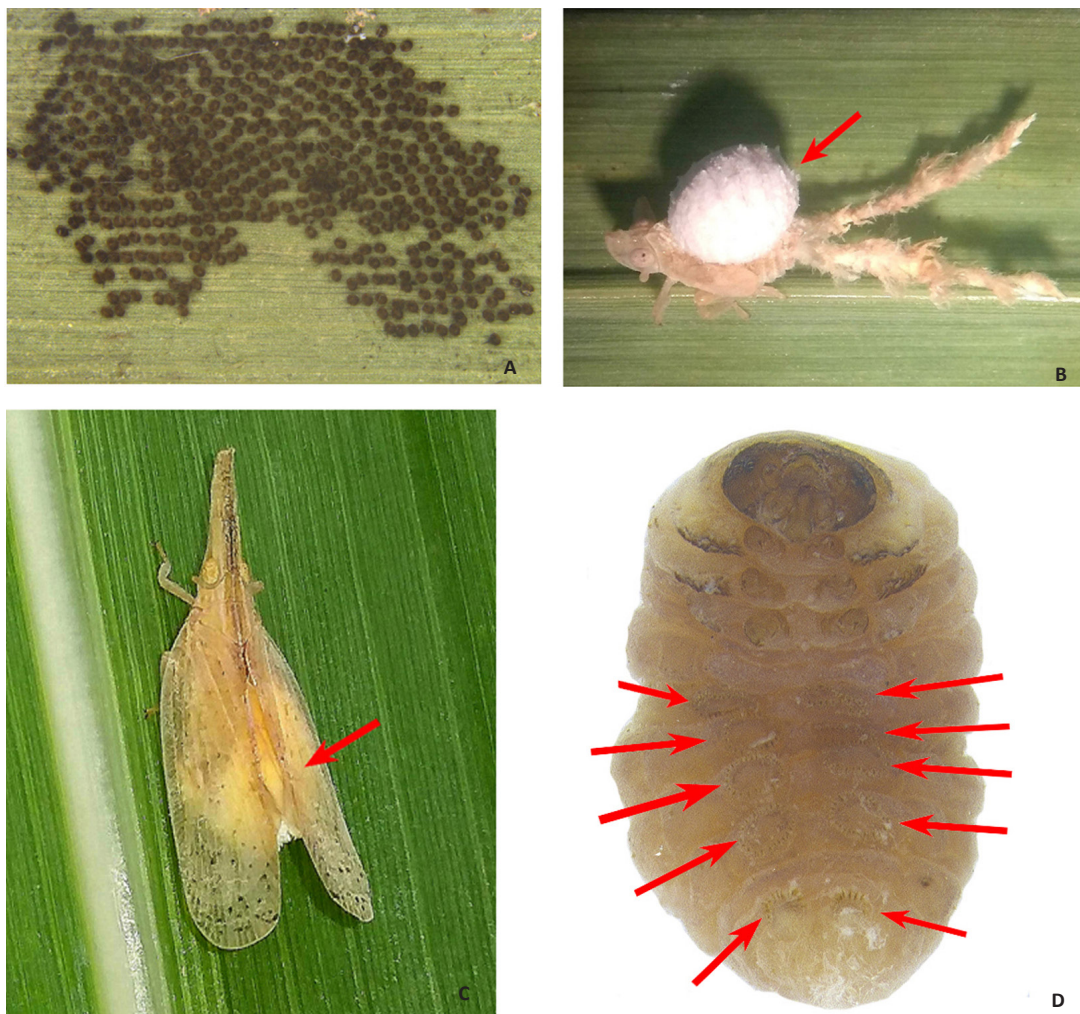


Image 1 A–D. Life stages of *Fulgoraecia melanoleuca*: A—Eggs on the leaves of sugarcane | B—larva developing on *Pyrilla perpusilla* nymph | C—larva developing on adult *Pyrilla perpusilla* | D—Prolegs showing crochets. © H. Sankararaman.



$$\text{Per cent egg/nymph/adult parasitism} = \frac{\text{No. of parasitized eggs/nymphs/adults}}{\text{Total no. of eggs/nymphs/adults}} \times 100$$

The various life stages of *F. melanoleuca* (Images 1 & 2) were also observed.

## RESULTS AND DISCUSSION

In our observations during July and August, all the three stages of *Pyrilla* recorded higher parasitization during August (34.40%, 47.54%, & 45.09%, respectively, Table 1) compared to July. As per earlier reports by Kumar et al. (2008), the accelerating phase of the *Pyrilla* starts from early July and the population continued to increase at a faster rate from the second fortnight onwards. Accordingly, parasitization also started from July and peaked during August.

### Life history of *Fulgoraacia* (= *Epiricania*) *melanoleuca*

**Eggs** (Image 1A): A trail of dark brown eggs with few silken threads. An adult female lays 240–450 eggs in a batch. The eggs are laid on the abaxial or adaxial surface of the leaf, closer to the midrib. On maturity, the eggs turn pale and larvae hatch out.

**Larva** (Images 1B, 1C, 1D): Only three instars are observed. Larvae are covered with whitish powdery coating (Image 1B). The first instar is an active wanderer, waits for the host (*P. perpusilla*) to approach and clings to the body of the host (Image 1B). Upon attaching to the abdomen of the host, it starts feeding on its haemolymph, externally (Image 1C). The larvae possess four pairs of abdominal pro-legs with one pair of anal claspers. Abdominal pro-legs have crochets (Image 1D) for helping in adhesion to host. The larva leaves the host before the pupation, and spins a cocoon on the leaf surface.

**Pupa** (Images 2A, 2B): The cocoons are milky white, elongated, convex anteriorly (Image 2A). Pupa is light

brown. Male pupa, short with genital scar in ninth abdominal segment. Female pupa larger (compared to male) with eighth and ninth abdominal segments fused and genital pore is present on the fused segment (Kumar et al. 2015). Anus in tenth abdominal segment of pupa in both the sexes.

**Adults** (Images 2C, 2D, 2E): Exhibit sexual dimorphism, differences in antennae, hindwing coloration and genitalia. Mouthparts reduced in both the sexes, haustellum absent.

**Male:** antennae bipectinate, 13-segmented, having long ciliated branches in each segment (Image 2E). Head with grey and thorax with black scales. Fore-wings generally with grey scales entirely, but few specimens with white scales up to discal cell, rest with grey scales. Hind-wings mainly with whitish scales except costal margin with grey scales (Image 2C).

**Female:** antenna short, bipectinate but with prominently short cilia. Head, thorax and wings unicolorous, covered by grey scales (Image 2D).

All the three stages of *Pyrilla* were parasitized. Eggs were parasitized by undetermined eulophids during July and August up to the tune of 34.40%. No other parasitoid was observed from any life stage of *Pyrilla* during the period of study. Per cent nymphal and adult parasitism by *F. melanoleuca* increased from July to August from 30.88 to 47.54 and 34.04 to 45.09, respectively (Table 1).

The natural parasitization of *Pyrilla* by *F. melanoleuca* has been reported from various states such as Punjab (Sanheedee et al. 2003), Uttarakhand (Kumar et al. 2008), Haryana (Ahlawat & Kumar 2015), Bihar (Chand et al. 2016), and in southern India from Karnataka (Hugar et al. 2002). Published records of natural occurrence of this parasitoid from the state of Tamil Nadu are scanty but for a mention in the tables of annual reports from Sugarcane Breeding Institute, Coimbatore (Anonymous 2016, 2017). Here we record its natural occurrence from Tamil Nadu with per cent parasitization as stated above, however, the per cent parasitization is reported to the

**Table 1. Natural parasitism of *Pyrilla perpusilla* in various life stages by its natural enemies.**

Life stages of <i>P. perpusilla</i> collected	July 2018			August 2018		
	TC	P	% parasitism	TC	P	% parasitism
Eggs	183	43	23.49	279	96	34.40
Nymph	68	21	30.88	61	29	47.54
Adult	47	16	34.04	51	23	45.09

TC—Total collected | P—Parasitized.



Image 2 A–E. Life stages of *Fulgoraecia melanoleuca*: A—Cocoon on sugarcane leaf | B—cocoon showing pupal exuviae | C—Male | D—Female | E—Male antennae showing long ciliated branches. © H. Sankararaman.

tune of 50.5 to 78.4 from Haryana (Ahlawat & Kumar 2015) and 61.4 from Bihar (Chand et al. 2016). Out of 39 parasitized adults collected in the month of July and August, 31 individuals were females and rest males, from which it is evident that *F. melanoleuca* prefers female *Pyrilla* than males. Similar reports of epipyropids parasitizing more of female hosts have been reported

on Lophopidae (Misra & Krishna 1986) and Flatidae (Supeno 2011; Swierczewski et al. 2016), however, the exact sex preferential parasitism of *F. melanoleuca* is not clear and further investigations in this line are required.





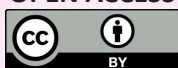
## REFERENCES

- Ahlawat, D.S. & D. Kumar (2015). Impact of Beneficial Arthropods on Sugarcane Insect Pests in Haryana. National Symposium on Integrated Pest Management for Sustainable Crop Protection. ICAR, New Delhi, 60pp.
- Anonymous (2016). Annual report 2015–16 (Entomology). Sugarcane Breeding Institute Coimbatore, Tamil Nadu. 12pp.
- Anonymous (2017). Annual report 2016–17 (Entomology). Sugarcane Breeding Institute Coimbatore, Tamil Nadu. 12pp.
- Ansari, M.A., A.D. Pawar, S.N. Ahmad & T. Nagaraja (1989). Sugarcane pyrrilla control by the use of *Epiricania melanoleuca* (Fletcher) in Karnataka. *Plant protection Bulletin* 41(1–2): 28–30.
- Banerjee, S.N. (1973). Integrated control of Sugarcane *Pyrilla* in India. *Pesticides: Annual* 73–74.
- Chand, P., A. Kumar, H. Chand & N. Kumar (2016). Bio-efficacy of some Insecticides against *Pyrilla perpusilla* Walker and its bioagent *Epiricania melanoleuca* on Sugarcane. *The Bioscan* 11(4): 2449–2452.
- Chhillar, B.S. & Y.P. Madan (1992). Biological control of sugarcane leafhopper, *Pyrilla perpusilla* Walker. *Indian Sugar* 42(9): 691–694.
- Fletcher, T.B. (1939). A new *Epipyrops* from India (Lepidoptera: Epipyropidae). *Bulletin of Entomological Research* 30: 293–294. <https://doi.org/10.1017/S0007485300004600>
- Gangwar, S.K., D.C. Srivastava, R.K. Tewari, M.R. Singh & D.C. Rajak (2008). Management of *Pyrilla perpusilla* Walker in sugarcane with ectoparasitoid *Epiricania melanoleuca* (Fletcher), during epidemics in sub-tropical India. *Sugar Tech* 10(2): 162–165.
- Gholap, M.S. & A.G. Chandele (1985). Incidence of sugarcane leaf hopper and parasitization by its natural enemies in Western Maharashtra. *Journal of Maharashtra Agricultural Universities* 10(2): 235–236.
- Heppner, J.B. (2008). Planthopper Parasite Moths (Lepidoptera: Epipyropidae), pp. 165–223. In: Capinera, J. L. (eds.). *Encyclopedia of Entomology*. Springer, Dordrecht, XLI+2580pp. [https://doi.org/10.1007/0-306-48380-7\\_3283](https://doi.org/10.1007/0-306-48380-7_3283)
- Hugar, P.S., V. Rachappa & H. Rajendra (2002). Population dynamics of sugarcane leaf hopper, *Pyrilla perpusilla* (Walker) and its natural enemies in Northern Karnataka. In: *Resources Management in Plant Protection during Twenty first century*, Hyderabad, 2: 26–29.
- Joshi, R.K. & S.K. Sharma (1989). Augmentation and conservation of *Epiricania melanoleuca* (Fletcher), for the population management of sugarcane leafhopper, *Pyrilla perpusilla* Walker, under arid conditions of Rajasthan. *Indian Sugar* 39(8): 625–628.
- Kumar, R., V. Mittal, P. Chutia & V.V. Ramamurthy (2015). Taxonomy of *Fulgoraacia melanoleuca* (Fletcher, 1939), (Lepidoptera: Epipyropidae) in India, a biological control agent of *Pyrilla perpusilla* (Walker) (Hemiptera: Lophopidae). *Zootaxa* 3974(3): 431–439. <https://doi.org/10.11646/zootaxa.3974.3.10>
- Kumar, S., M.A. Khan & K. Sharma (2008). Natural parasitization of sugarcane leafhopper, *Pyrilla perpusilla* (Walk.) in Uttarakhand. *Asian Journal of Bio Science* 3(2): 286–288.
- Kumarasinghe, N.C. & S.D. Wratten (1996). The sugarcane lophopid planthopper *Pyrilla perpusilla* (Homoptera: Lophopidae): a review of its biology, pest status and control. *Bulletin of Entomological Research* 86(5): 485–498. <https://doi.org/10.1017/S0007485300039286>
- Mishkat, U. & M. Khalid (2007). Population Dynamics of Sugarcane Plant hopper *Pyrilla perpusilla* Walker (Lophopidae: Homoptera) and its Natural Enemies at District Mandi Baha-ud-din (Punjab). *Pakistan Journal of Zoology* 39(3): 153–157.
- Misra, M.P. & S.S. Krishna (1986). Variation in sex ratio or age of sexes in mating pairs of *Epiricania melanoleuca* (F.) (Lepidoptera: Epipyropidae) affecting reproductive potential of the parasite. *Applied Entomology* 104: 208–210.
- Pandey, K.P., M.N. Pandey, V.K. Mishra, S. Singh, D.N. Singh & S.B. Singh (2008). Studies on the effect of eco-friendly bio-agent *Epiricania melanoleuca* for the control of Sugarcane *Pyrilla* (*Pyrilla perpusilla*) in eastern U.P. *Indian Agricultural Research Article* 23(2): 91–95.
- Patnaik, N.C., J.N. Mohanty, B.K. Mishra & M.K. Ghode (1990). Control of Sugarcane *Pyrilla* by *Epiricania melanoleuca* (Fletcher) (Epipyropidae: Lepidoptera) in Puri District of Orissa. *Journal of Biological Control* 4(1): 15–17. <https://doi.org/10.18311/jbc/1990/15328>
- Patre, R.S. (2016). Studies on the population dynamics of sugarcane leaf hopper (*Pyrilla perpusilla* Walker) and its natural enemies. M. Sc. Thesis. College of Agriculture, Indira Gandhi Vishwavidyalaya, Raipur, 85pp.
- Pawar, A.D., M.P. Misra & J. Singh (2002). Role of *Epiricania melanoleuca* Fletcher in biological control of sugarcane pyrrilla, *Pyrilla perpusilla* Walker outbreak in 1999 in Western Uttar Pradesh. *Journal of Biological Control* 16(1): 71–76.
- Pawar, A.D., R. Asre & B.I. Shukla (1988). Introduction and colonization of *Epiricania melanoleuca* (Fletcher) for the bio-control of sugarcane pyrrilla in Saurashtra region of Gujarat state. *Plant Protection Bulletin* 40(1): 1–4.
- Pierce, N.E. (1995). Predatory and Parasitic Lepidoptera: Carnivores living on Plants. *Journal of the Lepidopterists Society* 49: 412–453.
- Rajak, D.C. (2006). Evaluation of insecticides, botanicals and bioagents for the control of *Pyrilla perpusilla* and effect on related parasitoid, *Epiricania melanoleuca* in sugarcane. *Indian Journal of Plant Protection* 34(2): 245–247.
- Rajak, D.C. (2007). Colonization & redistribution of *Epiricania melanoleuca* Fletcher against *Pyrilla perpusilla* Walker. *Annals of Plant Protection Sciences* 15: 83–86.
- Rajak, D.C. & A. Varma (2001). Natural enemy complex of insect pest of sugarcane in the southern zone of Andhra Pradesh. *Indian Journal of Sugarcane Technology* 16(1): 114–116.
- Sanehdeep, K., K. Vijay & D.S. Brar (2003). Surveillance and monitoring of insect pests of sugarcane in Jalandhar and Kapurthala Districts of Punjab. *Insect Environment* 9(3): 117–118.
- Seneviratne, J.A.U.T. & N.C. Kumarasinghe (2002). Biological control of the sugarcane planthopper by the moth *Epiricania melanoleuca* (Fletcher) in Sri Lanka. *Sugar Tech* 4(2): 26–32.
- Supeno, B. (2011). Bioecology of parasitic moth (Lepidoptera: Epipyropidae) on cashew shootoppers, *Sanurus* spp. (Hemiptera: Flatidae) in Lombok island cashew plantation. Ph.D. Thesis. Institute Partanian Bogor, Bogor Agricultural University, 138pp. (In Indonesian with English abstract).
- Swierczewski, D., T. Bourgoin & A. Stroinski (2016). Revision of the Madagascan Genus *Paraflata* (Hemiptera: Fulgoromorpha: Flatidae), with Notes on Planthopper hosts Parasitized by Epipyropidae Moths. *Annales Zoologici* 66(1): 57–82. <https://doi.org/10.3161/00034541ANZ2016.66.1.005>
- Tripathi, G.M. & R.R. Katiyar (1998). Evaluation of some insecticides against sugarcane leaf hopper, *Pyrilla perpusilla* and its ectoparasitoid, *Epiricania melanoleuca*. *Indian Journal of Entomology* 60(4): 391–395.





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)

May 2020 | Vol. 12 | No. 8 | Pages: 15767–15966

Date of Publication: 26 May 2020 (Online & Print)

DOI: 10.11609/jott.2020.12.8.15767-15966

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

## Communications

### Mammalian fauna in an urban influenced zone of Chandaka-Dampara Wildlife Sanctuary in Odisha, India

– Subrat Debata & Kedar Kumar Swain, Pp. 15767–15775

### Species in peril: assessing the status of the trade in pangolins in Nepal

– Prayash Ghimire, Nirjala Raut, Pragya Khanal, Suman Acharya & Suraj Upadhyaya, Pp. 15776–15783

### Diversity and synanthropy of flies (Diptera: Calypttratae) from Ecuador, with new records for the country

– Karen Blacio, Jonathan Liria & Ana Soto-Vivas, Pp. 15784–15793

### Butterfly diversity in Gidakom Forest Management Unit, Thimphu, Bhutan

– Thal Prasad Koirala, Bal Krishna Koirala & Jaganath Koirala, Pp. 15794–15803

### Butterfly diversity in heterogeneous habitat of Bankura, West Bengal, India

– Kalyan Mukherjee & Ayan Mondal, Pp. 15804–15816

### A second report on butterflies (Lepidoptera) from Ladakh Union Territory and Lahaul, Himachal Pradesh, India

– Sanjay Sondhi, Balakrishnan Valappil & Vidya Venkatesh, Pp. 15817–15827

### Collecting parasitic Aculeata (Hymenoptera) from rice ecosystems of Tamil Nadu, India

– J. Alfred Daniel & K. Ramaraju, Pp. 15828–15834

### An annotated checklist of sea slug fauna of Gujarat coast, India

– Piyush Vadher, Hitesh Kardani & Imtiyaz Belem, Pp. 15835–15851

### Additional description of the Algae Hydroid *Thyroscyphus ramosus* (Hydrozoa: Leptothecata: Thyroscyphidae) from Palk Bay, India with insights into its ecology and genetic structure

– G. Arun, R. Rajaram & K. Kaleshkumar, Pp. 15852–15863

### Floristic composition and distribution pattern of herbaceous plant diversity in fallow lands of the central districts of Punjab, India

– Jashanpreet Kaur, Rajni Sharma & Pushp Sharma, Pp. 15864–15880

### Morphological and molecular phylogenetic studies on *Battarrea phalloides* (Agaricales): a new report to Indian mycobiota

– R. Kantharaja & M. Krishnappa, Pp. 15881–15888

### Diversity of polypores in Kerala Agricultural University main campus, Vellanikkara, Kerala, India

– M. Kiran, C.K. Adarsh, K. Vidyasagran & P.N. Ganesh, Pp. 15889–15904

## Short Communications

### On the evidence of the Irrawaddy Dolphin *Orcaella brevirostris* (Owen, 1866) (Mammalia: Cetartiodactyla: Delphinidae) in the Hooghly River, West Bengal, India

– Gargi Roy Chowdhury, Kanad Roy, Naman Goyal, Ashwin Warudkar, Rashid Hasnain Raza & Qamar Qureshi, Pp. 15905–15908

### Avifaunal diversity of Tilyar Lake, Rohtak, Haryana, India

– Jagjeet Singh, Sandeep Antil, Vivek Goyal & Vinay Malik, Pp. 15909–15915

### Life-history traits and courtship behaviour of four poorly known endemic bush frogs (Amphibia: Anura: Rhacophoridae) from the Western Ghats of India

– A.V. Abhijith & Shomen Mukherjee, Pp. 15916–15921

### A first record of *Camacinia harterti* Karsch, 1890 (Odonata: Libellulidae) from Arunachal Pradesh, India

– Arajush Payra, K.A. Subramanian, Kailash Chandra & Basudev Tripathy, Pp. 15922–15926

### Occurrence of *Fulgoraacia* (= *Epiricania*) *melanoleuca* (Lepidoptera: Epipyropidae) as a parasitoid of sugarcane loophopid planthopper

*Pyrilla perpusilla* in Tamil Nadu (India) with brief notes on its life stages  
– H. Sankararaman, G. Naveenadevi & S. Manickavasagam, Pp. 15927–15931

### A preliminary survey of soil nemafuna of Bhagwan Mahaveer Wildlife Sanctuary, Goa, India

– Kiran Gaude & I.K. Pai, Pp. 15932–15935

### Thirty-nine newly documented plant species of Great Nicobar, India

– Kanakasabapathi Pradheep, Kattukkunnel Joseph John, Iyyappan Jaisankar & Sudhir Pal Ahlawat, Pp. 15936–15944

## Notes

### An observation of homosexual fellatio in the Indian Flying Fox

*Pteropus medius* (Temminck, 1825) (Mammalia: Chiroptera: Pteropodidae)  
– K.S. Gopi Sundar & Swati Kittur, Pp. 15945–15946

### Diurnal observation of a Malayan Krait *Bungarus candidus* (Reptilia: Elapidae) feeding inside a building in Thailand

– Cameron Wesley Hodges, Anji D'souza & Sira Jintapirom, Pp. 15947–15950

### An additional record of the Tamdil Leaf-litter Frog *Leptobrachella tamdil* (Sengupta et al., 2010) (Amphibia: Megophryidae) from Dampa Tiger Reserve, Mizoram, India

– Vanlalsiammawii, Remruatpuii, V.L. Malsawmhriatuali, Lalmuansanga, Gospel Zothanmawia Hmar, Saisangpuia Sailo, Ht. Decemson, Lal Biakzuala & H.T. Lalremsanga, Pp. 15951–15954

### Records of dragonflies and damselflies (Insecta: Odonata) of Dipang Lake, with two new records to Nepal

– K.C. Sajjan & Juddha Bahadur Gurung, Pp. 15955–15961

### Henry's Rattan *Calamus henryanus* Becc. (Arecaceae), a new record to India

– Selim Mehmud & Himu Roy, Pp. 15962–15966

Member



Publisher & Host

