An inventory of geometrid moths (Lepidoptera: Geometroidea: Geometridae) of Kalakad-Mundanthurai Tiger Reserve, India

Geetha Iyer 1, Dieter Stüning 2 & Sanjay Sondhi 3

1 11/49, Teppakulam street, Suchindrum-629704, Kanyakumari District, Tamil Nadu, India.
2 Zoological Research Museum Alexander Koenig, Adenauerallee 160, 53113 Bonn, Germany.
3 Titli Trust, 49, Rajpur Road Enclave, Dhoran Khas, near IT Park, PO Gujrada, Dehradun, Uttarakhand 248013, India.

Abstract: The geometrid moths of Kalakad-Mundanthurai Tiger reserve were studied during the years 2012 to 2016. Since collection of specimens was not permitted, only field notes, accompanied by photo documentation was undertaken. Two-hundred-and-sixty geometrid moths identified to various hierarchical levels of taxa and one new genus for southern India, are reported.

Keywords: Agasthyamalai, biodiversity, Heterocera, KMTR, moth diversity, southern Western Ghats, Tamil Nadu.

Abbreviations: FW—Forewing | HW—Hindwing | KMTR—Kalakad-Mundanthurai Tiger Reserve, Tamil Nadu | KKWS—Kanyakumari Wildlife Sanctuary, Tamil Nadu | MoB—Moths of Borneo | UN—Underside | UP—Upperside | ZFMK—Zoological Research Museum Alexander Koenig, Bonn, Germany.

Editor: George Mathew, Alappuzha, Kerala, India.

Date of publication: 26 November 2021 (online & print)

Citation: Iyer, G., D. Stüning & S. Sondhi (2021). An inventory of geometrid moths (Lepidoptera: Geometroidea: Geometridae) of Kalakad-Mundanthurai Tiger Reserve, India. Journal of Threatened Taxa 13(13): 19887–19920. https://doi.org/10.11609/jott.7105.13.13.19887-19920

Copyright: © Iyer et al. 2021. 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: Self funded.

Competing interests: The authors declare no competing interests.

Author details: GEETHA IYER is an independent educational consultant and author who writes for and trains teachers to help bring India's biodiversity into biology and environmental science classes. She is particularly interested in the moths of the Southern Western Ghats which she has studied for many years at KMTR and KKWS. She has authored two books, authored and edited school text books, published scientific papers, and writes popular articles on moths and other insects. DIETER STÜNING is a German Geometridae specialist, who was Head of the Lepidoptera & Trichoptera Section of the Zoological Research Museum Alexander Koenig at Bonn for more than 30 years. Since retiring in 2014, he is working as a scientific associate, continuing to study Palaearctic and Asian Geometridae, especially the taxonomy, systematics and phylogeny of subfamily Ennominae. He has described numerous new taxa of species and genera and also co-authored the description of a new moth-family. SANJAY SONDHI is a Dehradun-based naturalist. An engineering graduate from IIT-Kanpur, in 2009 he set up TITLI TRUST (www.titlitrust.org), a nature conservation not-for-profit organisation, which is devoted to studying and protecting India’s lesser known flora and fauna. He has authored numerous books and technical papers on amphibians and reptiles, birds, butterflies and moths and other Indian wildlife.

Author contributions: GI—conceived and designed the study, surveyed and photographed the moths, prepared the species list, and wrote the manuscript. DS—supported species identifications with the help of literature and comparison with specimens of the ZFMK collection, and editing of the manuscript. SS—supported species identifications and editing of the manuscript during its various drafts. All three authors approve the final version.

Acknowledgements: This work would not have been possible without the permissions and assistance extended by forest personnel of different cadres. GI thanks the many Field directors, Deputy directors, foresters, and rangers of KMTR – past and present for permissions to survey moths and the guards, watchers and anti-poaching watchers who accompanied her on trails, and provided her with support and help. GI also thanks the former DFO Mr. Ritto Cytiac, rangers, forester and anti-poaching watchers of Kanyakumari Wildlife Sanctuary, and Mr Thomas Devasahayam of Maramalai for the assistance and help given. Thanks are due to ecologist Ms B. Smitha for her wide-ranging assistance during the surveys. We thank Rikio Sato from Japan who helped in identifying some of the geometrids of the tribe Boarmini. GI thanks Axel Haussmann and Pasi Sihvonen for sharing the relevant and most recent publications, as well as answering and clarifying the innumerable number of queries put to them. She thanks Ian Kitching, Jeremy D. Holloway Roger Clive Kendrick, Navneet Singh, Pritha Dey, Rahul Joshi, H. Sankararaman and Balakrishna Valappil for their help in clarifying doubts or sourcing papers and/or in helping to identify geometrids. GI thanks S. Thalavaipandi, researcher from ATREE, Bangalore, for sharing the images of geometrids from Upper Kothayar.
INTRODUCTION

Kalakad-Mundanthurai Tiger Reserve (KMTR) is located at the southern Western Ghats, in the Agasthyamalai range, approximately between 8.416N and 8.883N latitude and 77.166E and 77.583E longitude. It falls within Kanyakumari and Tirunelveli districts of the State of Tamil Nadu, India and is part of the Agasthyamalai Biosphere Reserve. With a core area of 895.39 km², KMTR was established as a tiger reserve in 1988 through the merger of Kalakad Wildlife Sanctuary, Mundanthurai Tiger Reserve, and parts of Veerapuli and Kilamalai reserve forests, from Kanyakumari district. The Nellai Wildlife Sanctuary, encompassing an area of 35.9 km², in the north and 201.36 km² of the Kanyakumari Wildlife Sanctuary towards the south form the buffer area of the reserve. The elevation ranges 100–1,880 m. Thus, a gradient of vegetation ranging from dry scrub to dense evergreen forest is found here. The reserve receives close to 3,000 mm of rainfall from both the south-west and north-east monsoons. It serves as a catchment area for no less than 14 rivers and streams. For this reason, it is sometimes referred to as a river sanctuary. The Agasthyamalai hills, which includes the core area of KMTR, are an important biogeographical ‘hot spot’ within the Western Ghats and a region of endemism in India (UNESCO 2016).

Being a tiger reserve, the biodiversity studies in this region have largely been focussed on mammals, herpetofauna, and plants for many years. Recent studies on invertebrates have been mostly on spiders or butterflies, and moths have not received any attention. This study is an attempt to enumerate the geometrid moths of this reserve. It is the first-of-its-kind study of moth diversity for this region, covering all habitats of the reserve, through seasons over multiple years.

Geometridae (Stephens, 1829) constitute the second largest family of moths in India, with at least 2,043 species listed so far (Kirti et al. 2019; Sondhi et al. 2020; Dey et al. 2021) from India. A large number of these slender moths, are mostly nocturnal, but day flying and crepuscular species are not uncommon. Some geometrids are strongly haired but most are examples of least-haired moths. In the forests of KMTR, we have observed them arrive in large numbers when the mist begins to set in. Protective colouration and camouflage were observed. Polymorphism was noticeable in many species. This paper outlines through photographic records, the diversity of geometrid moths arising out of a five-year survey in KMTR.

Geometrids have been reported from other parts of Western Ghats too: 77 species from Silent Valley National Park by Mathew & Rahamathulla (1995); six species by Bharmal (2015) from Amboli, Maharashtra and four species by Mishra et al. (2016) from Kodagu. From Kerala there are records of 47 species from Shendurney-Ponnudi by Sondhi et al. (2018). Elencezhian et al. (2014) reported 28 species from Maruthamalai hills and Goyal (2010) described 19 species for his PhD. The last two are the only recently published records from Tamil Nadu and even these studies were restricted to Madurai and Nilgiri districts.

A literature survey of the older Indian records in Moore (1884–7,1889) or Hampson (1891, 1893) finds no mention of moths from Kalakad or Mundanthurai. A few scattered records of geometrids from ‘Travancore State’ are available. The State of Travancore was dissolved soon after India attained independence and the places under its jurisdiction were distributed between the present States of Kerala and Tamil Nadu. Kanyakumari, from the erstwhile southern part of Travancore State, thus became a part of Tamil Nadu. Published records of geometrid moths from the southern part of the erstwhile Travancore State are not available. Hence it is safe to assume that there are no historical records of moths from this region.

Some moth species have been recorded from KMTR in recent years by other researchers. Ron Brechlin described a sphingid, *Ambulyx sinjaevi* (Brechlin 1998), and a saturniid, *Loepa schintlmeisteri* (Brechlin 2000); *Stauropus thiaucourti*, a notodontid moth, was reported by Schintlmeister (2003); a cossid *Phragmacossia brahmana*, by Yakovlev (2009) and three geometrid species, *Racotis keralaria*, *Ophthalmitis kalakadaria*, and *Hypomecis tamilenis*, were described by Sato (2004, 2014, 2016). All these species were recorded from Manjolai (8.250N and 77.433E), a very small area of a few sq. km. All of them were new to science. There are no other published records of geometrids from KMTR. Thus, most of the moths presented are previously unrecorded, several unidentified and still to be described or species that are range extensions. One of them is a new record for southern India. Hence the moth inventory in this paper is the first attempt to generate a comprehensive list of geometrid moths found in this Tiger Reserve.

MATERIALS AND METHODS

Study sites

The moths listed in this paper were extensively surveyed from within the core area of KMTR during the
years 2012 to 2015, covering most of the months except July and August, primarily due to lack of access during the monsoons. Moths were surveyed very briefly in the year 2016 and again, extensively, in the year 2019. The sites of study were Talayanai, Sengeltheri, Kuthiraivetti, Upper Kothayar, Mundanthurai, and Kannikatti. The list also includes geometrids from one of the buffer zones of KMTR, namely Kanyakumari Wildlife Sanctuary (KKWS), from sites located at Maramalai and Kalikesam (Table 1 & Figure 1–3. Locations and sites of study). Permission for collection was not available from the core or the buffer area of KMTR as the sites are within a legally protected area.

Some moths presented are not part of the planned survey, but were opportunistic observations during the years 2016, 2018, and early 2019. All sites being within the core regions of the Tiger Reserve, surveys were dependent on permissions from forest department, weather conditions, availability of accommodation, and finance. The entire study was self-funded by the first author.

Survey methods

Moths were surveyed using a light trap consisting of a 160W mercury vapour bulb hung above a white cotton sheet measuring 3 x 5 feet (0.9144 x 1.524 meters), stretched between either two posts, trees, window bars, or sometimes, nails on a wall. Wherever electricity was not available (Sengeltheri and Kannikatti), a kerosene or petrol-powered Honda generator was used. The white cloth screen was illuminated starting at 1800 h or 1830 h, depending upon sunset, until 0130 h. Where mains electricity was available, the MV bulb was kept on till 0400 h. Diurnal activity of moths was noted at all locations.

Digital photographs were taken using a Panasonic FZ 200 and a Panasonic FZ 35 with a Lumix lens. Field notes were recorded for morphological details and of features that could not be captured through photography.

Methods for identification

The Tamil Nadu Forest Department discourages collection of specimens, even for research. This is one of the reasons for the poor records of moths and other insects from this region. Despite providing photographic evidence for new range and species records, permission to collect voucher specimens was not granted. Consequently, field notes and digital photography were the only methods available for assessing the diversity. The notes, photographs, comparisons (of photos) with museum specimens from ZFMK, Bonn, published papers, discussions with experts and researchers, and historical records have been the methods used for identification.

Walker (1860–62), Moore (1879, 1884–87), Swinhoe (1890), Hampson (1891, 1893, 1895), Rothschild (1894), Warren (1894, 1897), Prout (1912, 1917, 1920–41), Inoue (1953, 1972), Barlow (1982), Holloway (1983–2011), Butler (1886, 1889), and Scoble et al. (1999) were the
prime sources of reference. Other than these sources, several research papers and books were also consulted. The second author referred extensively with the museum specimens at ZFMK, to arrive at identifications, and the third author used Moths of India website for the same. The classification in the paper, unless specified otherwise, follows that of Murillo-Ramos et al. (2019).

It is an established fact that without a specimen in hand, identification to the level of species is an extremely difficult task for many cryptic moth species. Hence, without specimens and therefore absence of genitalia information, it was not possible to identify all geometrids to the species level. Identifications, in such cases, have been limited to the level of subfamily, tribe or genus. For some individuals, where records or field data were insufficient, we have suggested provisional identifications. From our investigations, we believe that some of these could well be either new species to science or range extensions.

As this was the first comprehensive survey undertaken in this Tiger Reserve, most of the moths were first records for KMTR. They were also first records for the districts of Kanyakumari and Tirunelveli in the state of Tamil Nadu.

Findings from the study

Three-hundred-and-ninety geometrids belonging to five subfamilies were investigated. Only 260 are presented in this paper with identities at different levels. Six taxa were identified to the level of subfamily and six to the level of tribe. While 98 taxa were identified to genus level, 160 taxa, which included males, females as well as morphs, were identified to the level of species. Thirty-four taxa are reported with provisional identifications using Open Nomenclature qualifiers (Box 1). They have been identified to the nearest recognisable species for comparison, or to a possible species close to them for further study.

Overall, 98 genera and 108 species have been identified. Polymorphism was quite marked in species from subfamilies Ennominae, Larentiinae, and Sterrhinae. Other than Abraxas leucostola argyrosticta Hampson, 1893, Hypomecis tamiensis Sato, 2016, Luxiaria hypaphanes Hampson, 1891, Ophthalmitis kalakadaria Sato, 2014, and Racotis keralaria Sato, 2004, all the moths presented in this paper (Table 2) are new records for KMTR and Kanyakumari and Tirunelveli districts of Tamil Nadu, with Acanthovalva Krüger, 2001, a newly recorded genus for southern India.

Investigations have pointed to the possibility of some new species among the many tentatively identified or unidentified moth records. We hope this baseline survey report will assist in obtaining permission to collect and thus initiate a more detailed study of moths in this region.
Inventory of geometrid moths of Kalakad-Mundanthurai TR

Iyer et al.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 November 2021 | 13(13): 19887–19920

Taxon notes

Details of select genera/species are shared below. The taxon order followed is as given in The Forum Herbulot World List of Family Group Names in Geometridae-Forum Herbulot (2003, updated 2007).

Subfamily Sterrhinae Meyrick, 1892

Plates 1–2 (5–36)

The classification of moths of this subfamily (Table 3) follows the most recent revision by Sihvonen et al. (2020). Of the 34 moths observed, 31 individuals from seven tribes were identified either to the genera or species level. Three individuals could not be identified further. Sihvonen et al. (2020) mention in their paper that a large number of species of this cosmopolitan family, comprising of nearly 3,000 moth-species worldwide, fall under the genus *Idaea* Treitschke, 1825 or *Scopula* Schrank, 1802. This abundance was reflected in our survey too.

*Idaea* Treitschke, 1825

Plate 2 (23–30)

*Idaea* Treitschke, 1825 is a genus with hundreds of small and very similar species which are difficult to identify even with voucher specimens in hand. In their absence, we have relied on published records and museum specimens. We report only three individuals of *Idaea* (out of the 10 individuals), whose wing patterns were unique enough to be identified to species level. While researching to confirm *Idaea gemmaria* Hampson, 1896, (Plate 2(23)), we came across Holloway’s statement in Moths of Borneo (Holloway 1997) about the taxon “*I. gemmataria*”, Hampson (Sri Lanka). On contacting Dr Holloway (pers. comm., 21.ix.2020), he clarified that, “it was indeed an error arising at some stage between his reading the handwritten name in the museum collection and the final appearance of his text in print! The correct name of the species described by Hampson was indeed *I. gemmaria*”. This has helped confirm the identity of the species.

The next most common species were from the genus *Scopula* Schrank, 1802 (Plates 1–2 (15–19)). Out of five individuals observed, two have been identified to the species level.

The key given by Xue et al. (2018) for the pattern of ocellus in the wings, descriptions and comparison with specimens in the ZFMK collection, were used to identify *Problepsis apollinaria* Guenée, [1858] and *P. deliaria* Guenée, [1858] (Plate 1 (13–14)). All of the Sterrhinae listed are new records for KMTR.

Subfamily Larentiinae Duponchel, 1845

Plates 3–4 (37–60)

This is the second largest subfamily amongst Geometridae. Worldwide, 6,200 species (Õunap et al. 2016) have been described so far. We have recorded 24 moths from six tribes. Only nine of them could be identified to the species level. Fourteen larentiines reported belong to the tribe Eupitheciini Tutt, 1896. Of these, the genera *Collix* Guenée, [1858] and *Eois* Hübner, 1818 were the most represented. Three individuals from tribe Eupitheciini could not be identified even to the genus level. All the larentiine moths listed are new records for this region. We also believe that there are possibilities of new eupitheciine species from this region.

Subfamily Geometrinae Stephens, 1829

Plates 4–6 (61–101)

A large number of moths of this subfamily being green in colour, are often referred to as emerald moths. They were seen in large numbers at KMTR. However, the species diversity did not match individual abundance. According to Plotkin & Kawahara (2020), the current checklist of Geometrinae worldwide stands at 2,642 species. We recorded 41 different individuals from which 24 species from 23 genera were identified. Three moths remained unidentified while the remaining were identified to the level of genera or provisionally to the nearest species.

Subfamily Desmobathrinae Meyrick, 1886

Plates 1–2 (5–36)

Additional records for KMTR.

Subfamily Ennominae Duponchel, 1845

Plates 4–6 (61–101)

This is the second largest subfamily amongst Geometridae. Worldwide, 6,200 species (Õunap et al. 2016) have been described so far. We have recorded 24 moths from six tribes. Only nine of them could be identified to the species level. Fourteen larentiines reported belong to the tribe Eupitheciini Tutt, 1896. Of these, the genera *Collix* Guenée, [1858] and *Eois* Hübner, 1818 were the most represented. Three individuals from tribe Eupitheciini could not be identified even to the genus level. All the larentiine moths listed are new records for this region. We also believe that there are possibilities of new eupitheciine species from this region.

Subfamily Geometrinae Stephens, 1829

Plates 4–6 (61–101)

A large number of moths of this subfamily being green in colour, are often referred to as emerald moths. They were seen in large numbers at KMTR. However, the species diversity did not match individual abundance. According to Plotkin & Kawahara (2020), the current checklist of Geometrinae worldwide stands at 2,642 species. We recorded 41 different individuals from which 24 species from 23 genera were identified. Three moths remained unidentified while the remaining were identified to the level of genera or provisionally to the nearest species.

Tribe Comibaenini Inoue, 1961

Plate 4 (66–74)

*Comibaena* Hübner, [1823] 1816

Plate 4 (66–72)

We report four species and one individual referred for comparison to the nearest species. *Comibaena integrana* Hampson, 1893 and *Comibaena attenuata* Warren, 1896, are differentiated based on the patches

Table 2. Summary of subfamilies, genera and species presented.

| Subfamily      | Genera | Species with confirmed identity | Species with conditional identity | Species not identified |
|----------------|--------|---------------------------------|----------------------------------|------------------------|
| Sterrhinae     | 12     | 13                              | 5                                | 3                      |
| Larentiinae    | 13     | 9                               | 2                                | 3                      |
| Geometrinae    | 23     | 24                              | 7                                | 3                      |
| Desmobathrina  | 3      | 3                               | 0                                | 0                      |
| Ennominae      | 47     | 59                              | 20                               | 11                     |

19891
seen in the tornal region of forewing and apex of the hind wing. In *attenuata*, the forewing patch has an irregular projection anteriorly that is separated from the margin. Warren (1896), while describing *attenuata* under the older synonym *Probolosceles attenuata* Warren, 1896, has pointed out that some features of *attenuata* have been mistakenly attributed to the female of *integranota* by Hampson (1893).

**Protuliocnemis cf. biplagiata** (Moore, 1887)

Plate 4 (73)

*Protuliocnemis biplagiata* (Moore, [1887]) and *P. castalaria* (Oberthür, 1916), are similar in fasciae and genitalia. The number of spurs found in the hind tibia (Holloway 1996) is the only feature to distinguish the two species. Where as *P. biplagata* has four spurs in the hind tibia, *P. castalaria* has only two ((Prout 1933, Gross-Schmett. Erde 12: 88) in Holloway, 1996). *Protuliocnemis biplagiata* has been reported from Sri Lanka and, northern & northeastern of India and *P. castalaria* only from Khasi hills. This species of *Protuliocnemis* was frequently observed in both the core and the buffer zone of the reserve from the month of October to March. As the data of hind tibia spurs is not available and based on its presence in Sri Lanka, we report this individual provisionally as *P. cf. biplagiata*.

**Tribe Hemitheini Bruand, 1846**

Plate 5 (77–91)

We report 15 individuals belonging to 11 genera, of which six have been identified to the level of species; four are reported with provisional species identity and four are identified to the genus level. A few are detailed below.

**Pelagodes Holloway, 1996**

Plate 5 (83)

Moths of this genus were quite abundant in higher altitudes and found at all study sites except Talayani. The genus *Pelagodes* Holloway, 1996, was identified and differentiated from the closely resembling *Thalassodes* Guenée, [1858] based on the hindwing architecture as given by Han & Xue (2011). They report that the outer margin of the hindwing is strongly angled in *Thalassodes* but not so in *Pelagodes*. Species level identification of *Pelagodes* was not attempted in the absence of genitalia details. The presence of *Thalassodes* cannot be ruled out as several individuals remained unidentified. Lack of specimens in hand was a constraint for further investigation.

**Jodis Hübner, 1823**

Plate 5 (87–89)

Three species of *Jodis* were observed. One has been identified to species level. One is provisionally identified to species level while the third could not be identified beyond the level of genus.

**Jodis pallescens** (Hampson, 1891)

Plate 5 (88)

Hampson (1893) has described this taxon from Nilgiris as *Thalera pallescens* and the description matches the species reported here. Prout (1934) reported it from Sri Lanka and described *J. pallescens* as a distinct species due to the sharp contrast seen between the green and the white areas. This was quite evident in the moths we observed and the details match the field notes.

**Jodis nr. undularia** (Hampson, 1891)

Plate 5 (87)

Hampson (1893) described it from Nilgiris, and misidentified it as *Thalera caudularia*. It is, according to Prout (1934), widely distributed in India. A yellowish-green moth, it shows the features matching the description given by Hampson. The vertex of the head is white. The whitish antemedial and postmedial lines are dentate, excurred between veins 2 and 4, giving it, at first glance, a greyish-green appearance. The underside is white with shades of greyish-white. As Prout (1934) pointed, the tail of the hindwing is sharp. We, therefore, suggest the species identitly tentatively, to facilitate further exploration.

**Tribe Nemoriini Gumppenberg, 1887**

**Eucyclodes albisparsa** (Walker, 1861)

Plate 5 (92)

Ban et al. (2018) placed *Eucyclodes* in the tribe Nemoriini. However, its tribal position is reported as uncertain in the research paper by Murillo-Ramos et al. (2019). The paper also does not assign it to any tribe. We have retained the species in Tribe Nemoriini, after consulting Dr Hausmann (Hausmann, pers. comm. 01.vii.2020) who is one of the co-authors of the 2019 paper.

*Eucyclodes albisparsa* and *E. divapala* (Walker, 1861), are similar species, which fly in southern India. They are best separated by genitalic features. However, Barlow (1982) reports that the latter species found in southern India is more uniformly green and less contrasting than *divapala*. This matches the features in the individual observed by us. Hence, we report this moth as belonging to *Eucyclodes albisparsa* complex.
Subfamily Desmobarthrinae Meyrick, 1886
Plate 6 (102–105)

Four individuals from three genera are presented here. Derambila fragilis (Butler, 1881), Noreia ajaia Walker, 1859, Ozola micranioria Walker, 1862 and the fourth moth belonging to the genus Ozola Walker, [1861] could not be identified to species level.

Derambila Walker, [1863] 1862
Plate 6 (102)

Members of Derambila are small, slender, translucent white moths. Derambila saponaria (Guenée, [1858]) has been recorded from Travancore and Sri Lanka. Hampson (1891, 1893, 1907) records it as Rambara saponaria Guenée from Travancore. Rambara Moore, [1887] is currently treated as a junior synonym of Derambila (Scoble et al. 1999). Derambila fragilis (Butler, 1881), (Taiwan), described erroneously in the genus Zanclopteryx Herrich-Schäffer, [1855], is another similar species. Zanclopteryx is a genus with exclusively New World species. Prout (1921) notes that in fragilis, the antemedian lines are very few and mostly dissolved into spots. Holloway (1996), states that D. fragilis is also found in India and records that the wings are relatively slightly marked and lack the brown suffusion, seen in other species. In D. saponaria, the brown transverse markings are well expressed whereas in D. fragilis, they are present as dots. Based on the markings on the wings and the distribution given by Hampson & Moore, we report this species as Derambila fragilis.

Subfamily Ennominae Duponchel, 1845
Plates 6–13 (106–274)

With no anatomical details being available, members of the largest geometrid subfamily were the most challenging to identify from external morphological only. Along with historical records and published papers, the collections from ZFMK were most useful for identification. Polymorphism was quite vivid in several genera which added to the complexity. Explanations of our conclusions for select taxa are given below.

Tribe Abraxini Warren, 1893
Abraxas Leach, [1815]
Plates 6–7 (106–123)

Specimens of the genus Abraxas were found in abundant numbers in Upper Kothayar, Kuthiraiyetti, Sengeltheri, and Maramalai. Materials from Kalakad, Nilgiris, and Sri Lanka available in the collections at ZFMK were compared along with descriptions and figures published by Hampson (1891, 1893, 1907), Swinhoe (1890, 1891), Walker (1862), Warren (1894, 1898), and Prout (1925) for identification. Of the 15 individuals presented here, three are identified to the level of species (Plates 6–13 (106–109)). The rest of the unidentified individuals are in varying shades of grey and bluish-grey, with or without irregular yellow spots that ranged from many to none on the upperside. The underside of these specimens varied from being grey to grey with more or less irregular yellow spots and to one with a completely yellow underside with dark fasciae (Plate 7 (115)), the latter certainly a distinct species, the former probably variations of one species. All these species had yellow heads. The antennae were completely black or grey. The thorax showed varying degrees of greyness. Their legs were grey with yellow coxa. Large black spots on the upper side of the abdominal segment, and smaller ones on the sides and undersides were present. Based on these differences in patterns and colours on the upper and underside, the grey Abraxas moths and that with grey upper side and yellow underside have been categorised tentatively as different species. We cannot rule out the fact that some of them are probably just forms of two or more species. Hence collection is needed to investigate further and get greater clarity of this group of moths that were present during all seasons.

Another unidentified Abraxas was completely yellow on upper and underside, with grey postmedial fasciae and spots (Plate 7 (121–123)) which bore no resemblance to the two yellow Abraxas hitherto described from southern India, namely, A. lutearia Swinhoe, 1890 and A. germana Swinhoe, 1891. Both have been described from Nilgiri Hills, but were not spotted at KMTR during our surveys. The second author who is familiar with the southern Indian Abraxas species found that the grey and the yellow series of Abraxas we have presented does not resemble any existing species. We therefore report them as unidentified species of Abraxas that need further investigation.

About 20 species of the genus Abraxas have been described from southern India and Sri Lanka at the end of the 19th century and the beginning of the 20th century. Most of them are endemic to the Western Ghats and do not look (Plates 6–13 (110–120)) like typical Abraxas, as known from examples seen in the Himalaya or Chinese mountainous regions. Only A. leucostola Hampson, 1893, described from Sri Lanka and later described from southern India by Hampson (1907), as Abraxas argyrostricta (which is at present treated as subspecies of leucostola), resembles the typical Abraxas. A. fasciaria (Guérin-Méneville, 1843), A. poliostrata Hampson, 1907,
Table 3. Checklist of geometrids of Kalakad-Mundanthurai Tiger Reserve.

| S. Family/ Genus | Tribe/ Species | Author & Year: S. Family/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|------------------|---------------|------------------------------------------------|----------|--------------------------|
| Sterrhinae       | Cosymbiini    | Prout, 1911                                    |          |                          |
| 1                | Chrysocraspeda| sp.1, Swinhoe, 1893                            | Upper Kothayar | Mar 2014                  |
| 2                | Chrysocraspeda| sp.2, Swinhoe, 1893                            | Kannikatti, Kuthiraivetti | Feb 2013, Mar 2014        |
| 3                | Perisera      | insitiva                                        | (Prout, 1920) | Kuthiraivetti Dec 2012    |
| Cylopodini       |               |                                                 |          |                          |
| 4                | Organopoda    | sp.2, Hampson, 1893                            |          |                          |
| Lissoblemmini    |               |                                                 |          |                          |
| 5                | Lissoblemma   | lunuliferata                                    |          |                          |
| 6                | Craspediopsis | sp.2, Warren, 1895                             |          |                          |
| Rhodometrini     |               |                                                 |          |                          |
| 7                | Traminda      | aventaria                                        | (Guenné, 1858) | Kuthiraivetti Dec 2012    |
| 8                | Traminda      | mundissimo - 3 forms                            | (Walker, 1861) | Mundanthurai, Talayanai, Kuthiraivetti Mar 2012, Oct 2012, Feb 2015, Dec 2012 |
| Scopulini        |               |                                                 |          |                          |
| 9                | Problepsis    | deliaaria                                        | (Guenné, 1858) | Kuthiraivetti, Sengeltheri, Upper Kothayar, Maramalai Dec 2011, 2012, 2019, Oct 2012, June 2013, Feb 2012 |
| 10               | Problepsis    | appollinaria                                     | (Guenné, 1858) | Maramalai Feb 2012 |
| 11               | Scopula       | divisaria                                        | Walker, 1861 | Upper Kothayar Jun 2013 |
| 12               | Scopula       | fibulata                                         | (Guenné, 1858) | Kannikatti Feb 2013 |
| 13               | Scopula       | nr relictata                                     | (Walker, 1866) | Kuthiraivetti Mar 2014 |
| 14               | Scopula       | nr actuatoria                                    | (Walker, 1861) | Sengeltheri Feb 2015 |
| 15               | Scopula       | sp.6                                             | Schrank, 1802 | Upper Kothayar Mar 2014 |
| 16               | Somatina      | nr plynusaria                                    | (Walker, 1863) | Sengeltheri Oct 2012 |
| 17               | Somatina      | rosacea                                          | Swinhoe, 1894 | Kuthiraivetti Mar 2014 |
| 18               | Somatina or nr| nr plynusaria                                    | (Walker, 1863) | Sengeltheri Oct 2012 |
| 19               | Somatina or nr| nr plynusaria                                    |          |                          |
| 20               | Lophop heaps  | phoenicoptera                                    | (Hampson, 1896) | Kalikesam Jul 2014 |
| 21               | Lophop heaps  | purpurea                                         | Hampson, 1891 | Sengeltheri Feb 2015 |
| 22               | Idaea         | gemmario                                         | Hampson, 1896 | Maramalai Feb 2012 |
| 23               | Idaea         | nr gemmario                                      | Hampson, 1896 | Upper Kothayar Mar 2014 |
| 24               | Idaea         | vioaceae                                         | Hampson, 1891 | Maramalai Feb 2012 |
| 25               | Idaea         | sp.4                                             | Treitschke, 1825 | Sengeltheri, Upper Kothayar Oct 2012, Feb 2015, Mar 2014 |
| 26               | Idaea         | sp.5                                             | Treitschke, 1825 | Maramalai Feb 2012 |
| 27               | Idaea         | sp.6                                             | Treitschke, 1825 | Maramalai Feb 2012 |
| 28               | Idaea         | sp.7                                             | Treitschke, 1825 | Sengeltheri Feb 2015 |
| 29               | Idaea         | sp.8                                             | Treitschke, 1825 | Kuthiraivetti Mar 2014 |
| 30               | Timandra      | sp.                                              | Duponchel, 1829 | Upper Kothayar Jun 2013 |
| 31               | Unidentified  | Sterrhinae                                       | Meyrick, 1892 | Sengeltheri, Maramalai Feb 2015, Feb 2012 |
| Larentiinae      | Asthenini     |                                                 |          |                          |
| 32               | Acalatha      | pictaria                                         | (Moore, 1888) | Upper Kothayar Mar 2014 |
| 33               | Polynesa      | sunondava                                        | (Walker, 1861) | Kuthiraivetti Dec 2012, Jan 2019 |
| S. Family/ Genus | Tribe/ Species | Author & Year: S. Family/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|-----------------|---------------|-----------------------------------------------|----------|-------------------------|
| Cidariini       |               | Duponchel, 1845                               |          |                         |
| 33 Ecliptoperia | dissecta      | (Moore, [1887]) Upper Kothayar, Kuthiraivetti | Jun 2013, Jan 2019 |
| 34 Ecliptoperia | muscicolor    | (Moore, 1888) Upper Kothayar                  | Jun 2018  |
| 35 Chloroclystis| sp.           | Hübner, [1825] Sengeltheri                    | Feb 2015  |
|                 |               |                                              |          |                         |
|                 |               | Incertae sedis                               |          |                         |
| 36 Phystobasis  | annulata      | (Hampson, 1891) Kuthiraivetti                | Dec 2012 |
| 37 Bosara       | albitoralis   | (Prout, 1958) Kuthiraivetti                  | Dec 2012 |
| 38 Eupithecia   | sp.           | Curtis, 1825 Sengeltheri                     | Feb 2015  |
| 39 Collix       | sp.1          | Guenée, [1858] Marmalai                      | Feb 2012  |
| 40 Collix       | sp.2          | Guenée, [1858] Marmalai                      | Feb 2012  |
| 41 Collix       | sp.3          | Guenée, [1858] Marmalai                      | Feb 2012  |
| 42 Eois         | sp.4          | Hübner, 1818 Marmalai                        | Feb 2012, 2015 |
| 43 Eois         | sp.5          | Hübner, 1818 Upper Kothayar                 | Mar 2014  |
| 44 Eois         | cf. dissimilis| (Moore, 1887) Kuthiraivetti                 | Dec 2012  |
| 45 Eois         | lunulasa form ochraceae | (Moore, [1887]) Kuthiraivetti | Dec 2012  |
| 46 Gymnoscelis  | cf. admixtaria| (Walker, 1862) Kuthiraivetti                | Dec 2012  |
| 47 Zinidava     | rubridisca    | (Hampson, 1891) Upper Kothayar               | Oct 2018  |
|                 |               |                                              |          |                         |
|                 |               | Trichopterygini                              |          |                         |
| 48 Sauris       | sp.1          | Guenée, [1858] Kuthiraivetti                | Dec 2012 |
| 49 Sauris       | sp.2          | Guenée, [1858] Sengeltheri                  | Oct 2012  |
|                 |               |                                              |          |                         |
|                 |               | Xanthorhoini                                 |          |                         |
| 50 Xanthorhoe   | saturata      | Guenée, [1858] Kuthiraivetti                | Dec 2012  |
| 51 Unidentified Eupethiciini-3 |           | Duponchel, 1845 Kuthiraivetti               | Dec 2012, Mar 2014 |
|                 |               |                                              |          |                         |
|                 |               | Geometrinae Stephens, 1829                  |          |                         |
| 52 Agathia      | hemithearia   | Guenée, [1858] Kuthiraivetti, Upper Kothayar | Mar 2014, Jan 2019 |
| 53 Agathia      | lycenaaria    | (Kollar, 1844) Upper Kothayar                | Jul 2018  |
| 54 Agathia      | laetata       | (Fabricius, 1794) Kuthiraivetti              | Dec 2012  |
|                 |               |                                              |          |                         |
|                 |               | Archaeobalbini                               |          |                         |
| 55 Herochroma   | cf. cristata  | Warren, 1894 Maramalai                      | Feb 2012, Mar 2014 |
| 56 Lophophelma  | ruficosta     | Hampson, 1891 Kuthiraivetti, Sengeltheri    | Dec 2012, Mar 2014, Jan 2019, Feb 2015 |
|                 |               |                                              |          |                         |
|                 |               | Comibaenini                                  |          |                         |
| 57 Argyrocosma  | inductaria    | (Guenée, [1858]) Kuthiraivetti, Sengeltheri, Talayanai, Maramalai | Dec 2012, Feb 2015, Feb 2012 |
| 58 Chlorochromodes | sp.      | Warren, 1896 Talayanai                      | Feb 2015  |
| 59 Comibaena    | attenuata     | (Warren, 1896) Upper Kothayar               | Mar 2014  |
| 60 Comibaena    | cassidara     | Guenée, [1858]) Mundanthurai, Upper Kothayar, Maramalai | Mar 2012, Oct 2016, Feb 2012 |
| 61 Comibaena    | cf. striatara | Leech, 1897 Mundanthurai                    | Mar 2012  |
| 62 Comibaena    | integratorata | Hampson, 1893 Sengeltheri, Maramalai        | Feb 2015, Feb 2012 |
| 63 Comibaena    | fuscidorsata  | Prout, 1912 Upper Kothayar, Kuthiraivetti  | Mar 2016, Jan 2019 |
| 64 Protuliosnemis | cf. bilipliata | (Moore, [1887]) Kuthiraivetti, Upper Kothayar, Sengelheri, Maramalai | Dec 2012, Mar 2014, Oct 2012, Feb 2012 |
| S. Family/ Genus | Tribe/ Species | Author & Year: S. Family/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|------------------|---------------|------------------------------------------------|----------|--------------------------|
| 65 Protulioconemis | partita | (Walker, 1861) | Upper Kothayar | Jan 2019 |
| Dysphaninini | | Warren, 1895 | | |
| 66 Dysphania | percota | (Swinhoe, 1891) | Kalikesam | Jul 2014 |
| Geometrini | | Stephens, 1829 | | |
| 67 Cyclothea | disjuncta | (Walker, 1861) | Sengeltheri | Feb 2015 |
| Hemitheini | | Bruand, 1846 | | |
| 68 Comostola sp | sp. | Meyrick, 1888 | Sengeltheri, Kuthirai-vetti, Maramalai | Oct 2012, Jan 2019, Feb 2012 |
| 69 Episothalma | robustaria | (Guenée, [1858]) | Upper Kothayar | Dec 2011 |
| 70 Hemitea | tritonaria | (Walker, [1863]) | Upper Kothayar | Jul 2018 |
| 71 Hemitea | wuka | (Pagenstecher, 1886) | Kalikesam | Jul 2014 |
| 72 Idiochlorella | nr caudularia | (Guenée, [1858]) | Kuthirai-vetti, Sengeltheri | Mar 2014, Feb 2015 |
| 73 Orthoallassodes | hypocrites | (Prout, 1912) | Kuthirai-vetti, Upper Kothayar | Jan 2019 |
| 74 Pelagodes | sp. | Holloway, 1996 | All sites except Talayanai | Mar 2011, Dec 2012, Mar 2013, June 2014, Feb 2012/15, Jan 2019 |
| 75 Pentheochlorella | cf. uniformis | Hampson, 1891 | Kuthirai-vetti | Dec 2012 |
| 76 Spaniocentra | sp. | Prout, 1912 | Maramalai | Mar 2012 |
| 77 Berta | cf. chrysolineata | Walker, 1863 | Upper Kothayar | Oct 2018 |
| 78 Jodis | nr undularia | (Hampson, 1891) | Upper Kothayar | Mar 2014 |
| 79 Jodis | pallescens | (Hampson, 1891) | Upper Kothayar | Mar 2014 |
| 80 Jodis | sp.3 | Hübner, [1823] | Kuthirai-vetti | Jun 2013 |
| 81 Microlyxia | indecretata | (Walker, [1863]) | Talayanai | Feb 2015 |
| 82 Microlyxia | sp.2 | Warren, 1893 | Muntandhurai | Mar 2012 |
| 83 Eucyclodes | gavissima | (Walker, 1861) | Sengeltheri | Oct 2012 |
| 84 Eucyclodes | albisparsa complex | (Walker, 1861) | Sengeltheri | Oct 2012 |
| 85 Ornithospilina | | Ban & Han, 2018 | | |
| 86 Ornithospilina | lineata | (Moore, 1872) | Kuthirai-vetti | Jan 2019 |
| 87 Ornithospilina | submanstrans | (Walker, 1861) | Kuthirai-vetti | Dec 2012, Jan 2019 |
| Pseudoterpnini | | Warren, 1893 | | |
| 88 Pingasa | dispensata M, F | (Walker, 1866) | Kuthirai-vetti | Dec 2012 |
| 89 Pingasa | ruginaria | (Guenée, [1858]) | Upper Kothayar, Sengeltheri, Kuthirai-vetti, Maramalai | Mar 2014, Feb 2015, Dec 2012, Jan 2019, Feb 2012, Feb 2015 |
| 90 Unidentified Geometrinae-3 | | Leach, 1815 | Maramalai, Muntandhurai | Feb 2012, Mar 2012 |
| Desmobathrinina | | Meyrick,1886 | Desmobathrini | Meyrick, 1886 |
| 91 Noreia | ajoia M | (Walker, 1859) | Upper Kothayar | Jun 2013 |
| 92 Ozola | microiaria | Walker, 1862 | Kuthirai-vetti, Sengeltheri | Mar 2014, Feb 2015 |
| 93 Ozola | sp. | Walker, 1861 | Sengeltheri | Feb 2015 |
| 94 Derambila | fragilis | (Butler, 1881) | Sengeltheri | Feb 2015 |
| 95 Eumnominae | | Duponchel,1845 | Abraxini | Warren, 1894 |
| 96 Abraxas | leucostola argyrogyctica | Hampson, 1893 | Upper Kothayar, Kuthirai-vetti, Maramalai | Jan 2019, Dec 2012, Feb 2012 |
| 97 Abraxas | fasciaria | Guerin-Meneville, 1843 | Sengeltheri, Upper Kothayar, Kuthirai-vetti, | Oct. 2012, Jan 2019 |
| 98 Abraxas | Polystotrica M, F | Hampson, 1907 | Kuthirai-vetti | Dec. 2012 |
| S. Family/ Genus | Tribe/ Species | Author & Year: S. Family/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|------------------|---------------|-----------------------------------------------|----------|-------------------------|
| 98 | Abraxas | (grey)sp.4 | Leach, [1815] 1830 | Upper Kothayar, Kuthiraivetti, Sengeltheri | Dec 2012, Oct 2013, Feb 2015, Jan 2019 |
| 99 | Abraxas | (grey)sp.5 | Leach, [1815] 1830 | Upper Kothayar | Mar 2014 |
| 100 | Abraxas | (grey)sp.6 | Leach, [1815] 1830 | Upper Kothayar, Sengeltheri | Jan 2019, Feb 2012 |
| 101 | Abraxas | (grey)sp.7 | Leach, [1815] 1830 | Upper Kothayar | Jan 2019 |
| 102 | Abraxas | (grey)sp. 3 forms | Leach, [1815] 1830 | Upper Kothayar, Kuthiraivetti, Sengeltheri, Maramalai | Jan 2019, June 2013, Mar 2014, Feb 2015, Feb 2012 |
| 103 | Abraxas | (yellow)sp.8 | Leach, [1815] 1830 | Upper Kothayar, Sengeltheri | Mar 2014, Mar 2019, Feb 2015 |
| 104 | Baptini | | Forbes, 1948 | | |

| S. Family/ Genus | Tribe/ Species | Author & Year: S. Family/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|------------------|---------------|-----------------------------------------------|----------|-------------------------|
| 106 | Borbacha | cf. pardaria | Guenée, [1858] | Kuthiraivetti, Maramalai | Dec 2012, Feb 2012 |
| 107 | Synegia | imitaria | (Walker, 1861) | Upper Kothayar | Mar 2014 |
| 108 | Yashmakia | erythra | (Hampson, 1891) | Upper Kothayar | June 2018 |
| 109 | Yashmakia | conflagrata F | (Hampson, 1912) | Upper Kothayar | June 2018 |
| 110 | Lomographa | inamata | (Walker, [1861] 1860) | Kuthiraivetti, Maramalai | Dec 2012, Jan 2019, Feb 2012 |
| 111 | Platycerota | vittcostata | (Walker, [1863]) | Upper Kothayar | June 2013 |
| 112 | Alcis | niligrica | Hampson, 1891 | Kuthiraivetti, Upper Kothayar, Sengeltheri | Dec 2012, June 2013, Mar 2014, Oct 2012, Feb 2015 |
| 113 | Ambychia | cf. angeronaria | Guenée, [1858] | Maramalai, Upper Kothayar | Feb 2012, June 2018 |
| 114 | Amraica | recursaria | Walker, 1860 | Sengeltheri, Upper Kothayar | Feb 2015 |
| 115 | Catoria | cf. sublatovaria F | Guenée, [1858] | Kuthiraivetti, Upper Kothayar, Sengeltheri | Dec 2012, Feb 2015, Jan 2019 |
| 116 | Choradha | striaria | (Guenée, [1858]) | Upper Kothayar | Mar 2014 |
| 117 | Cleora | alienaria M 5 forms | Walker, 1860 | Kuthiraivetti, Upper Kothayar, Sengeltheri | Dec 2012, June 2013, Jan 2019, Feb 2012, 2015 |
| 118 | Cleora | alienaria F | (Walker, 1860) | Kuthiraivetti | Jan 2019 |
| 119 | Cleora | sp.3 | Curtis, 1825 | Kuthiraivetti | Jan 2019 |
| 120 | Cleora | injectaria or nr. | (Walker, 1860) | Kuthiraivetti | Dec 2012 |
| 121 | Ascotis | cf. imparata F | (Walker, 1860) | Kuthiraivetti | Dec 2012, Jan 2019 |
| 122 | Cusiala | boarmoides | Moore, [1887] | Talayanai, Sengeltheri | Oct 2012, Feb 2015 |
| 123 | Cusiala | raptaria | Walker, 1860 | Sengeltheri | Feb 2015 |
| 125 | Cusiala | raptaria form disterminata | Walker, 1860 | Mundanthurai | Mar 2012 |
| 126 | Cusiala | raptaria distem-nata-variant | Walker, 1860 | Kuthiraivetti, Talayanai | Dec 2012, Feb 2015 |
| 127 | Cusiala | raptaria distem-nata-variant | Walker, 1860 | Kuthiraivetti | Dec 2012 |
| 128 | Cusiala | raptaria form ruflfasciata | Walker, 1860 | Sengeltheri | Feb 2015 |
| 129 | Cusiala | raptaria form suisasas M | Walker, 1860 | Mundanthurai, Kuthiraivetti | Feb 2015, Dec 2012 |
| 130 | Cusiala | raptaria-6 forms | Walker, 1860 | Mundanthurai, Kuthiraivetti, Talayan, Sengeltheri | Mar 2012, Oct 2012, Dec 2012, Feb 2015, Jan 2019 |
| 131 | Ectropis | cf. dentlineata | (Moore, 1868) | Kuthiraivetti | Jan 2019 |
| 132 | Ectropis | bhurmitra | (Walker, 1860) | Maramalai | Feb 2012 |
| 133 | Dasyboarmia | cf. inouei | (Sato, 1987) | Sengeltheri, Kuthiraivetti | Feb 2015, March 2014 |
| 134 | Gasterocome | polyspathes | Prout, 1934 | Upper Kothayar, Sengeltheri, Maramalai | Mar 2014, Oct 2012, Feb 2015, Feb 2012 |
| 135 | Hypomecis | pallida 1M, 4F | (Hampson, 1891) | Upper Kothayar | Jun 2013 |
| S. Family/ Genus | Tribe/ Species | Author & Year: S. Family/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|------------------|----------------|-----------------------------------------------|----------|-------------------------|
| 136 Hypomecis    | trancissa      | (Walker, 1860)                                 | Maramalai | Feb 2012                |
| 137 Hypomecis    | tamilesensis   | Sato, 2016                                     | Mundanthurai, Talayanai | Mar 2012, Feb 2015 |
| 138 Hypomecis    | separatata     | (Walker, 1860)                                 | Maramalai | Feb 2012                |
| 139 Hyposidra    | talaca         | (Walker, 1860)                                 | Upper Kothayar, Kuthiravetti, Maramalai | Feb 2012, Dec 2012, Mar 2014 |
| 140 Hyposidra    | violescens M, F| Hampson, 1895                                  | Kuthiravetti, Maramalai | Dec 2012, Feb 2012 |
| 141 Hyposidra    | sp. 3          | Guèneé, [1858]                                  | Kuthiravetti | Jan 2019 |
| 142 Ophthalmitis | cf. herbidaria  | (Guèneé, [1858])                               | Sengeltheri | Oct 2012 |
| 143 Ophthalmitis | kolokadaria    | Sato, 2014                                     | Sengeltheri | Feb 2015 |
| 144 Psilacis     | cf. subtachracea M, F | (Hampson, 1902) | Kuthiravetti, Sengeltheri, Talayanai, Maramalai | Dec 2012, Jan 2019, Oct 2012, Feb 2015, Feb 2012 |
| 145 Psilacis     | sp.2           | Warren, 1893                                   | Sengeltheri | Feb 2015 |
| 146 Psilacis     | sp.3           | Warren, 1893                                   | Sengeltheri | Feb 2015 |
| 147 Psilacis     | sp.4           | Warren, 1893                                   | Maramalai | Feb 2012 |
| 148 Racots       | kerralaria     | Sato, 2004                                     | Kuthiravetti, Upper Kothayar, Sengeltheri, Maramalai | Dec 2012, Jan 2019, Feb 2015, Feb 2012 |
| 149 Ruttellerana | cf. cessavia   | (Walker, 1860)                                 | Kuthiravetti | Dec 2012 |
| 150 Ruttellerana | cf. pseudocessaria | Holloway, [1994] | Upper Kothayar | Jan 2019 |
| 151 Biston       | strigaria      | (Moore, 1879)                                  | Kuthiravetti, Sengeltheri, Maramalai | Dec 2012, Feb 2015, Feb 2012 |
| 152 unidentified | Boarmiini     | Duponchel, 1845                                | Kuthiravetti | June 2013 |
| 153 Astygisa     | sp.            | Walker, 1864                                   | Upper Kothayar | Mar 2014 |
| 154 Petelia      | medardaria M   | Herrich-Schaffer, [1856]                       | Maramalai, Upper Kothayar, Kuthiravetti | Feb 2012, Jun 2013, Jan 2019, Dec 2012, Mar 2014, Jan 2019 |
| 155 Petelia      | distract F     | (Walker, 1860)                                 | Kuthiravetti, Sengeltheri, Upper Kothayar | Dec 2012, Oct 2012, Feb 2015, Jan 2019 |
| 156 Petelia      | immaculata 2M, 2F | Hampson, 1893                                     | Kuthiravetti | Dec 2012, Mar 2014, Jan 2019 |
| 157 Petelia      | fasciata       | Moore, 1868                                    | Kuthiravetti | Dec 2012 |
| 158 Hyperynthia | lutea          | (Stoll, [1781])                                | Upper Kothayar | Mar 2014 |
| 159 Heterostegane| subtessellata M, F | (Walker, [1863])                  | All sites | Feb 2012, 2015, Mar 2012, 2014, June 2014, Jan 2019 |
| 160 Heterostegane| cf. tritocampsis M, F | (Prout, 1934) | Sengeltheri, Talayanai | Feb 2015 |
| 161 Heterostegane| sp.3           | Hampson, 1893                                  | Maramalai | Feb 2015 |
| 162 Zamarada     | cf. excisa     | Hampson, 1891                                  | Kuthiravetti, Sengeltheri, Maramalai | Dec 2012, Oct 2012, Feb 2012 |
| 163 Ourapteryx   | marginata      | (Hampson, 1891)                                | Kuthiravetti, Kannikatti, Upper Kothayar, Sengeltheri, Maramalai | Dec 2012, Feb 2013, Mar 2014, Oct 2015, Feb 2012, 2015 |
| 164 Ourapteryx   | peermaadiata-yellow and white | Thierry-Mieg, 1903 | Kuthiravetti-yellow Upper Kothayar Both | Mar 2014 |
| 165 Calliteaera  | postvittata    | (Walker, 1861)                                 | Upper Kothayar | Jun 2018 |
| 166 Luxiania     | emphatica      | Prout, 1925                                    | Kuthiravetti | Dec 2012 |
| 167 Luxiania     | hypaphanes M   | Hampson, 1891                                  | Sengeltheri, Kuthiravetti, Upper Kothayar | Oct 2012, Dec 2012, Jan 2019, Mar 2014 |
| S. Family/ Genus | Tribe/ Species | Author & Year/ Tribe/ Genus/ Species | Location | Month and Year of survey |
|------------------|---------------|-------------------------------------|----------|--------------------------|
| 168 Luxiaria     | phyllosaria    | (Walker, 1860)                      | Upper kothayar | Jan 2019                |
| 169 Luxiaria     | sp.4           | Walker, 1860                        | Kuthiraivetti | Jan 2019                |
| 170 Zeheba       | nr aureata 2M, 1F | Moore, [1887]                      | Sengeltheri,   | Oct 2012, Feb 2015      |
| 171 Zeheba       | cf. aureatoides | Holloway, [1994]                    | Sengeltheri, Kuthiraivetti | Feb 2015, Dec 2012    |
| 172 Gonodontini  | pallida        | (Butler, 1880)                      | Maramalai     | Feb 2012                |
| 173 Fascellina   | plagiata       | (Walker, 1866)                      | Upper Kothayar, Maramalai, | Feb 2012          |
| 174 Fascellina   | Chromatarias-5 forms, 1F | Walker, 1860 | Upper Kothayar, Maramalai, | Oct 2018          |
| 175 Achrosis     | incita- complex-2 forms | (Walker, 1862) | Kuthiraivetti, Upper Kothayar | Mar 2014, Jan 2018  |
| 176 Achrosis     | intexta        | (Swinhoe, 1891)                     | Kuthiraivetti | Mar 2014                |
| 177 Achrosis     | sp.4 4M        | Guenée, [1858]                      | All sites     | All survey years.       |
| 178 Achrosis     | sp.4 1F        | Guenée, [1858]                      | Kuthiraivetti, Sengeltheri | Dec 2012, Feb 2015  |
| 179 Achrosis     | sp. 4F         | Guenée, [1858]                      | Kuthiraivetti | Dec 2012                |
| 180 Celenna      | festivaria     | (Fabricius, 1794)                   | Kannikatti, Upper Kothayar | Feb 2013, Mar 2014  |
| 181 Celenna      | festivaria and form formosensis | (Fabricius, 1794) | Kuthiraivetti, Upper Kothayar | Mar 2014, Mar 2013, Mar 2014 |
| 182 Corymica     | deducta        | (Walker, 1866)                      | Upper Kothayar | Jun 2018                |
| 183 Corymica     | sp.            | Walker, 1860                        | Kannikatti    | Feb 2013                |
| 184 Hypochrosis  | hydraria- chlorazonaria complex-3 forms | (Guenée, [1858]) - (Walker, 1861) | Kuthiraivetti, Upper Kothayar, Sengeltheri, Maramalai | Dec 2012, Mar 2014, Feb 2015, Feb 2015 |
| 185 Omiza        | miliaria F-3 forms | Swinhoe, 1890 | Kuthiraivetti, Upper Kothayar, Sengeltheri, Maramalai | Dec 2012, Mar 2014, Oct 2012, Feb 2015, Feb 2012, Jan 2019 |
| 186 Omiza        | miliaria M-2 forms | Swinhoe, 1890 | Kuthiraivetti | Mar 2014                |

**Incertae sedis**

| 187 Eumelea      | ludovicata M   | Guenée, [1858]                      | Kuthiraivetti | Dec 2012                |
| 188 Eumelea      | sp.2           | Duncan [&Westwood], 1841            | Kuthiraivetti, Sengeltheri | Dec 2012, Feb 2015  |
| 189 Macariini    | sp.            | Krüger, 2001                        | Talayanai     | Feb 2015                |
| 190 Chiasmia     | eleonora       | (Cramer, [1780])                    | Kuthiraivetti, Upper Kothayar, Sengeltheri | Dec 2012, Mar 2014, Feb 2015, |
| 191 Chiasmia     | inchoata       | Walker, 1861                        | Maramalai, Kuthiraivetti | Feb 2012, Dec 2012, Feb 2015 |
| 192 Chiasmia     | myandaria      | (Walker, [1863])                    | Maramalai     | Feb 2012                |
| 193 Chiasmia     | nora           | (Walker, [1862])                    | Kuthiraivetti, Upper Kothayar, Sengeltheri | Dec 2012, Mar 2014, Feb 2015 |
| 194 Chiasmia     | ornataidata    | (Leech, 1897)                       | Maramalai     | Feb 2012                |
| 195 Chiasmia     | ozonaria       | (Walker, [1860])                    | Kuthiraivetti | Oct 2018                |
| 196 Chiasmia     | perfusaria     | (Walker, 1866)                      | Maramalai     | Feb 2012                |
| 197 Chiasmia     | triangulata    | (Hampson, 1891)                     | Maramalai     | Feb 2012                |
| 198 Chiasmia     | cf. normata.   | (Walker, 1861)                      | Talayanai     | Feb 2015                |
| 199 Chiasmia     | sp.11          | Hübner, [1823]                      | Maramalai     | Feb 2012                |
| 200 Chiasmia     | sp.12          | Hübner, [1823]                      | Kuthiraivetti | Dec 2012                |
| 201 Chiasmia     | sp.13          | Hübner, [1823]                      | Maramalai     | Feb 2012                |
| 202 Chiasmia     | sp.14          | Hübner, [1823]                      | Kuthiraivetti, Sengeltheri | Dec 2012, Feb 2015  |
| 203 Isturgia     | disputaria group | Krüger, 2001 | Maramalai | Feb 2012                |
and A. latizonata Hampson, 1907, being white with grey or black pattern, are less similar. All the other Abraxas species from southern India show rather untypical coloration, grey or brown or yellow, sometimes with shining surface. Moths of the genus Abraxas are known to be toxic and their conspicuous appearance is a very significant and successful signal to predators which therefore avoid them, hence their abundance in many habitats, and presence of more than a hundred species across Europe to Australia. Why do species of southern Indian Abraxas not exhibit the typical kind of mimicry but prefer a rather mimetic appearance is a point for future research?

**Tribe Boarmiini Duponchel, 1845**
Plate 7–10 (130–190)

**Cleora Curtis, 1825**
Plate 8 (138–146)

Individuals identified as *Cleora alienaria* (Walker, 1860), (Plates 8 (138–144)) were quite common in KMTR. They were especially abundant in higher altitudes where they were recorded during most months of the year, except during April and May. The species has conspicuous pattern elements and their identity was determined with the help of literature sources and comparison with specimens in the ZFMK collection. Males were seen to be polymorphic; we have recorded five different variants which made identification even more difficult. A further problem is the existence of a very similar species, *C. fraterna* (Moore, 1888), described from Sikkim. *Cleora alienaria* was described from Sri Lanka and has a generally more southern distribution, but *C. fraterna* may perhaps occur also in the south. Externally both are not distinguished with certainty without details of their genitalia, which are very different. As there is no existing record of *fraterna*’s presence in the south we report these as *Cleora alienaria*.

*Cleora acaciaria* (Boisduval, 1833), reported in Goyal’s PhD thesis (Goyal 2010; Pl. 36) from the Western Ghats is a misidentification of *C. alienaria*, as is evident from the comparison of genitalia figures depicted in the thesis and in Holloway, [1994] (Moths of Borneo, Part 11). The name *C. acaciaria* is valid today only for the species flying on Réunion Islands, extending perhaps to Mauritius.

*Cleora nr injectaria* (Walker 1860), (Plate 8 (145)), recorded during the surveys, could not be confirmed to be true injectaria from the available information including distribution ranges, though it looks very similar to the typical, dark grey form of *injectaria* that is known to fly in montane habitats, from where this particular specimen was photographed. It is tentatively identified to the nearest possible species as *C. nr injectaria* for further investigation. True *C. injectaria* is known to be a lowland species, occurring mostly at seashore-areas with mangrove and along riverines (Holloway 1994; Kendrick 2015).

Externally, *Cleora* sp. 3. (Plate 8 (146)) is a member of the Carecomotis-group (Fletcher, 1953), but it bears resemblance to several species of this group. Of these, *C. falculata* (Fletcher, 1953), and *C. onycha amplissima* (Fletcher 1953), were reported from first whilst Travancore. The holotype and paratype of *C. falculata* and the paratype of *C. onycha amplissima* are from this region. The study site from which *Cleora* sp. 3 was observed and photographed was earlier part of Travancore. A very similar species of *Cleora*, also of the Carecomotis-group, was recorded as *C. propulsaria* by Goyal from southern India in his thesis (Goyal 2010, Plate 37). On comparison of the genitalia Plates of *C. falculata*, *C. onycha amplissima* (Fletcher, 1953), and *C. propulsaria* (Holloway, [1994]) with that presented in his thesis, it is seen that the species reported by him is *falculata* and not *propulsaria*. *Cleora* sp. 3, therefore, could belong to any one of these three species. Without
genitalic information, this remains identified as another species of *Cleora*.

**Ascotis Hübner, 1825**

Plate 8 (147)

*Ascotis cf. imparata* (Walker, 1860) (Plate 8 (147), female) was a species difficult to identify. Pattern and coloration are extremely similar to *C. alienaria* (Walker, 1860), but this was ruled out since this individual had narrower wings and was larger in wingspan (>45 mm). In size, this wingspan compared well with that reported for *C. fraterna* (Moore, 1888). But without any discerning characters (males of *Ascotis* with simple antennae would be easy to distinguish from males of *Cleora* with strongly pectinated antennae) and with scarce evidence of the presence of *fraterna* in southern India we at first, provisionally identified it as a species near *alienaria*. After further comparative studies the 2nd author could identify it as a female of *A. imparata*, described from Nepal and “Hindostan”, although not yet recorded from southern India. We believe that the presence of *imparata* cannot be excluded and it is unlikely, that the South Indian individuals may be members of any other closely related species.

Examination of genitalia is needed to identify this moth which was observed frequently in KMTR.

**Cusiala Moore, 1887**

Plates 8–9 (148–160)

Thirteen individuals of *Cusiala* Moore are reported. There are two species of *Cusiala* that fly in India, *C. boarmoides* Moore, [1887] and *C. raptaria* Walker, 1860. Both are polymorphic but at KMTR the latter was observed to be more widely polymorphic. *Cusiala boarmoides*, the type species described from Sri Lanka, flies both in northern and southern India but *C. raptaria* is reported only from southern India (Hampson 1895). The only distinguishable external difference between the two species (Moore 1887; Hampson 1895) is the postmedial band of the hindwing. In *boarmoides*, it is angled beyond the cell instead of curved as in *raptaria*. In the absence of any other clearly identifiable characteristics based on external morphology, to differentiate *boarmoides* from the typical *raptaria* of southern India, we have presented one individual as *C. boarmoides* (Plate 8 (148)), and all others are designated *C. raptaria*.

Hampson (1895) determined the species *disterninata, ruffasciata* and *siaisasa* as forms of *C. raptaria*. Our elementary investigation suggests that these determinations, too, need investigation. In addition, the sexual polymorphism, that this genus displays, too, needs investigation. These three forms were not the only ones that we found in our study sites. There were variants in the form *disterninata*, a black variant form, and several other with variable wing markings were observed. Twelve *Cusiala raptaria* that includes the described and undescribed forms (Plate 8–9 (149–160)) are reported. The existence of a wide variety of previously undescribed forms among *C. raptaria* require a more thorough investigation of the genitalic features to understand this genus and its species, as well as its sexual variations. Several other variants seen have been omitted from this paper, for want of detailed descriptions. This further underscores the importance of permitting collection to correctly document the diversity and furthering the scientific knowledge.

**Hypomecis Hübner, 1821**

Plate 9 (164–171)

Four species of Hypomecis – *H. transcissa* (Walker, 1860), *H. separata* (Walker, 1860), *H. tamilensis* Sato, 2016 and *Hypomecis pallida* (Hampson, 1891), are reported in this paper. Dark and light forms of *H. separata* are reported from the buffer area of the reserve. *Hypomecis tamilensis* is a species that was described from KMTR by Sato (2016). *H. pallida* was quite abundant in our study sites. The females of this species are polymorphic (Plate 9 (164–167)) and were found more abundantly and frequently than males. The postmedial fasciae on their wings varied from shades of light and dark grey with brownish or blackish tinge.

*H. pallida* had been earlier described as a member of the genus *Narapa* Moore, 1887, which later was placed as a junior synonym under *Hypomecis* (Scoble 1999; Hausmann, pers. comm. 29.vi.2019). Preliminary studies of the type-species of *Narapa*, *N. adamata* Felder & Rogenhofer, 1875, from Sri Lanka, by the second author (2nd author, unpublished data), which included analysis of male genitalia indicate that *Narapa* should be treated as a distinct genus in future again.

Several individuals that bore close resemblance to *pallida*, but differing in size, wing shape and markings were observed in the study sites, especially at Kuthiraivetti and Upper Kothayar. We believe that collection and further investigation is likely to reveal new data.

**Tribe: Caberini Duponchel, 1845**

Plate 10 (191–200)

Ten individuals, belonging to three genera, namely *Astygisa* Walker, 1864, *Petelia* Herrich-Schäffer, 1855, and *Hyperythra* Guenée, [1858], are reported.
**Petelia Herrich-Schäffer, 1855**

Plate 10 (191–198)

Members of this genus were common in KMTR and were sighted during all surveys at all sites except Talayanai. Four species of *Petelia* – *Petelia medardaria* Herrich-Schäffer, [1856], *P. immaculata* Hampson, 1893, *P. distracta* (Walker,1860), and *P. fasciata* Moore, 1868, are reported in this paper. One individual could not be identified to species level. All four species are differentiated by the pattern of lines and spots on the wings.

Three almost straight, and almost parallel transverse lines in the forewing are typical to *medardaria* (Plate 10 (191)). Black apical patches are sometimes present in the forewings.

A curved medial line in the forewing, curved toward apex near costa and towards base near hind-margin is typical to *immaculata*. Females of *Petelia* species show wide variation, which the second author has noticed from the collections at ZFMK. This was evident in the two individuals of *immaculata* we have presented. The elements of black pattern near forewing apex which is typical of the females in *immaculata* (Hampson, 1893) was present in one and absent in another female (Plate 10 (196–197)). This pattern is lacking in males.

Identification of *P. distracta* (Plate 10 (192)), was difficult as the facies of *distracta* bears resemblance with that of *medardaria* female and *P. delostigma* Prout, 1932. The fasciae, however, have some discernable differences. The medial line in *delostigma* is curved more towards the tornus unlike in *distracta* in which it runs straight towards the inner margin. *Petelia delostigma* is larger than *distracta* and has not been reported from India. The black spots in *distracta* lie very close to the medial line almost touching it, whereas in the female of *medardaria* the spots lie well below the medial line, closer to the outer margin of the HW. Given these differences we conclude that the individual is *P. distracta*.

In *P. fasciata* (Plate 10 (193)), the antemedial and medial line of the forewing are diffused and rufous-brown with the postmedian band also being rufous-brown, but ill-defined and waved. Diffused transverse greyish fascies between the rufous bands on both wings, a grey centred blackish discal spot in the HW and a marginal row of black spots form the markings of this species.

The markings on the *Petelia* sp. 5 (Plate 10 (198)) bear similarity to *immaculata*, but the presence of additional patterns on the hindwings require a more thorough investigation, hence it remains unidentified at the species level.

**Tribe: Ennomini Duponchel, 1845**

**Ourapteryx Leach, 1814**

Plate 11 (207–209)

We report two species, the white *Ourapteryx marginata* (Hampson, 1891) (Plate 11 (207)), and the yellow *Ourapteryx peermaadiata* Thierry-Mieg, 1903 (Plate 11 (208)). The yellow *O. peermaadiata* was first described by Thierry-Mieg in 1903. Hampson (1907) described it again as *U. ebuleata palniensis* from Palani Hills, Tamil Nadu and Inoue (1993) redescribed *peermaadiata* placing *O. ebuleata palniensis* as a junior synonym of *peermaadiata*. This is the only yellow coloured *Ourapteryx* that flies in southern India. The third author who is researching *Ourapteryx* species of India (3rd author, unpublished data) has recorded a white morph of *O. peermaadiata* from southern India which has also been recorded in KMTR (Plate 11 (209)). Wing-shape and all pattern elements are exactly the same in both forms, but genitalia have not been compared yet.

Comparisons of genitalia presented by Inoue (1993) with that reported by Goyal in his PhD thesis (Goyal 2010, Plate 57) show that *O. peermaadiata* has been incorrectly described as *O devikulamensis* sp. n.

**Tribe Eutoeini Holloway, 1994**

Plate 11 (210–219)

**Zeheba Moore, [1887]**

Plate 11 (216–219)

Four individuals that we report are only tentatively identified. The second author has compared these individuals (Plate 11 (216–219)) to the material of an undescribed *Zeheba* from Sri Lanka in the ZFMK collection. Based on external morphology, these individuals from KMTR resemble the material at the museum.

Males and females of *Zeheba* are easily distinguished. While both have simple, unpectinated antennae, the hindwing margin is dentate in males, but is smooth, broader and angled in the middle (at vein M3) in females (Plate 11 (216)). *Zeheba marginata* that Moore (1884) describes and figures in Lepidoptera of Ceylon (Moore, 1884–7) is a female of the yet-to-be described *Zeheba* species from Sri Lanka. True *Z. marginata* was described from Java by Walker in 1886 and is likely to be extralimital to India. The female we report is very similar to the female described by Moore, erroneously as *Z. marginata*.

The presence of this undescribed species in southern
India is further confirmed from another erroneous record of *Zebeba marginata* in Goyal’s PhD thesis (Goyal 2011; pl. 1). The genitalia details of the male presented in the thesis are identical to the male genitalia of the undescribed Sri Lankan material in ZFMK collection, which the second author has dissected and studied (2nd author, unpublished data).

These individuals (Plate 11 (216–218)) also bear strong resemblance to *Z. aureata* Moore, (1887), a Himalayan species, but the genitalia of the *aureata* are quite distinctly different (2nd author, unpublished data). We report them tentatively as *Z. nr aureata* but they require a detailed investigation to confirm the species identity.

The individual in Plate 11 (219) is a male which is larger than the other three individuals, half-white (or pale-yellow), including the broader wing borders, and with almost-hyaline basal part of hindwing. Without genitalic details its identity cannot be determined with certainty, but likely belongs to *Z. aureotooides* Holloway, [1994], described from Borneo, but with a wider distribution to Sulawesi and Peninsular Malaysia (Holloway, [1994]; coll. ZFMK), Thailand, Myanmar (coll. ZFMK, unrecorded) and perhaps, as a new record, to southern India. Examination of specimens would be necessary to investigate further to prove this.

**Tribe Hypochrosini Guenée, 1858**

Plates 11–12 (221–246)

*Achrosis* Guenée, [1858]

Plates 11 (221–223); Plate 12 (226–230)

Several individuals of the genus *Achrosis* were observed, mostly in the wet evergreen or moist deciduous habitats. Of the seven individuals of this genus presented in this paper, *A. intexta* (Swinhoe, 1891) (Plate 11 (223)) is identified with certainty, because of its conspicuous pattern and coloration and as it is the only species of the *intexta*-group known from South India (type-locality: Kanara, southwestern India). Other species of the *intexta*-group are known from Peninsular Malaysia, Borneo and Sumatra (Holloway [1994], the Philippines (ZFMK, not yet recorded).

We report another two individuals (Plate 11 (221 & 222)) with pattern and coloration of *Achrosis incitata* (Walker, 1862) (type-locality: northern India, Darjeeling). Both of them differ considerably from each other and may be members of two different species. From southern India (Nilgiri Hills), Swinhoe (1891) described *Zomia miscella* as new to science which Hampson (1895) synonymized with “Prioniia” *incitata*, indicating that *incitata* flies throughout India. Swinhoe later opines that *miscella* is a southern form of *incitata*. A further species of this group was described from Sri Lanka as *Timandra? serpentinaria* (Walker, 1866), which certainly may also occur in the extreme south of India. Identification of two Individuals we recorded of the *incitata*-group is only possible by dissection of genitalia; hence further investigation is required.

Holloway (1994) described a new species close to *A. incitata* from Borneo and Sumatra and in the process reviewed what he calls the *incitata* complex. According to him almost all species of this complex are allopatric (except his new Bornean species which overlaps with the Sumatran species) and all are distinguished by differences in the male genitalia.

The two individuals we report as *A. incitata* (Plate 11 (221 & 222)) may be one among the three species of *incitata* complex that fly in southern India or Sri Lanka or they could be a new species of the *incitata* complex. Further investigation is required.

We also report one unattributed species, *Achrosis* sp. 4 (Plate 12 (226–230)). The ZFMK, too, has specimens of this species that do not match any described so far in their collection. More than one form of the male was observed but only a single female was spotted during the survey. Neither *Achrosis* sp. 4 nor the *incitata* complex resemble *Achrosis euchroes* (Prout, 1917), described from Nilgiris, which also does not find mention in the *incitata*-complex described by Holloway [1994], as it did not occur in Borneo.

*Celenna festivaria* (Fabricius, 1794)

Plates 11–12 (224–225)

Two forms of *Celenna festivaria* Fabricius were found flying from March to August. They were found only in two sites of the survey (Table 3). The typical form of *festivaria* where the green patches are separated in the forewing, was less frequently seen than the form where the green bands were fused completely (Plate 11 (224)) and formed a large green patch on the FW. Although this species is common in India, there has been no report of racial differences so far. This form with the large fused bands that is dominant in Taiwan was named *formosensis* by Inoue (1964) and treated as a subspecies of *festivaria*. Holloway (1994) reports that the genitalia of ssp. *formosensis* described by Inoue resemble those of the Indian nominal subspecies *C. festivaria festivaria* and he therefore confirms it as a subspecies.

*Celenna centbraria* Snellen, 1880, described from Sumatra, but also occurring in Borneo, is reported by Kirti et al. (2019) as found in the Andaman Islands.
The fused pattern on the forewing of *centraria* is quite different from the species we are reporting here. Holloway [1994] states and figures that the genitalia of *centraria* differ strongly from those of *festivaria*. Until further investigation is undertaken, we report both forms as *C. festivaria*.

**Fascellina chromataria** Walker, 1860

Plate 12 (234–238)

These moths were seen from the month of June onwards till November. Four males and one female recorded is presented here. Sexual dimorphism is well marked; the female was yellowish-brown with cream coloured antemedial and postmedial lines. The postmedial line had cream spots at regular intervals. The wing colour in males ranged from shades of greenish-brown, brown to black (Plate 12 (235–238)). The submarginal fascia was white in three forms, while in the fourth, the brown form, there was merely a white speck near the excavated tornal margin (Plate 12 (237)). Each of the differently coloured forms were seen in different months and did not fly together.

The hindwing of the underside of the males were chrome-yellow, as their name suggests. The basal parts of the forewing were yellow, red-brown around the postmedial line; the postmedial regions being a mix of brownish-red. A greyish angled line and a patch near the apex of FW was also observed. *Fascellina chromataria* was described from Sri Lanka, and it has been reported from the Shendurney Wildlife Sanctuary in Kerala (Sondhi et al. 2018). Forests of KMTR and Shendurney Wildlife Sanctuary are part of Agasthyamalai Biosphere Reserve. The female seen in KMTR (Plate 12 (234)) is similar to the female collected and identified from Shendurney and therefore is identified as *Fascellina chromataria*. As we also observed more than one form of *chromataria* males, we report this group of four males and one female as *Fascellina chromataria* complex. Examination of specimens are needed to determine whether the individuals of this complex are morphs, subspecies or different species.

**Hypochrosis hyadaria** (Guenée, [1858]) – *H. chlorozonaria* (Walker, 1861)

Plate 12 (239–241)

*Hypochrosis hyadaria* is treated at present as a single species with a large number of described subspecies (Holloway [1994]; Scoble et al. 1999), distributed allopatrically from India, over large areas of southeastern Asia and the Malayan archipelago. *Hypochrosis chlorozonaria* Walker, 1861, described from Sri Lanka, is treated as a related, but distinct species. It was later described again as *Numaria galbulata* (Felder & Rogenhofer, 1875) and *Marcala sulphurescens* (Moore, [1887]), from Sri Lanka. *Hypochrosis galbulata* and *H. sulphurescens* are just different forms of the same variable species, *chlorozonaria*. Unlike the description of *hyadaria* given by Hampson (1895), the facies described by Moore for these two forms of *chlorozonaria* match well with the facies of the individuals (Plate 12 (239–241)) we have recorded. Holloway (1994) states, “India through S.E. Asia”, as the geographical range for *hyadaria*.

Evidence of *hyadaria* flying in southern India comes from the surveys at Shendurney Wildlife Sanctuary by Yash Sondhi (Sondhi et al. 2018). It is possible that both the species—*hyadaria* and *chlorozonaria*—could be found flying together in this region. Investigations through examination of the genitalia of collected specimens alone can provide their correct identity. Therefore, we report these three individuals as forms of *Hypochrosis hyadaria* or *chlorozonaria*.

**Tribe Macariini Guenée, 1858**

Plate 12–13 (250–269)

The identities of various moths in this tribe were investigated by referring to Krüger’s (2001) extensive work on African species and a range of global macariine species, and the review of this tribe by Scoble & Krüger (2002). The details given in the works of Hampson (1891, 1895), Moore (1884–7), and Walker (1862) were also consulted. Some macariine genera can be identified based on wing colour, shape, and pattern (Scoble & Krüger 2002). However, genitalia structure is the most reliable feature for identification of moths from this tribe.

The macariine taxonomy is still in flux as several species from the Oriental region, including some from India, have not yet been described, as is evident from this paper. Nineteen macariine individuals have been observed and are classified here in three genera, namely, *Acanthovalva* Krüger, 2001, *Chiasmia* Hübner, [1823] 1816, and *Isturgia* Hübner, [1823] 1816.
from South Africa, extending, if verified, the range of this genus to the Oriental region. This is the first record of the genus *Acanthovalva* from southern India.

**Chiasmia Hübner, [1823] 1816**
Plate 12–13 (251–266)

Fourteen macariine species belonging to the genus *Chiasmia* Hübner are reported. Four of them could be identified only to genus level. One is presented with a provisional identification and nine of them are identified to species level using the various published records listed throughout in this paper.

We report here that the ZFMK has a group of four specimens named *C. ablataria* Swinhoe, collected from the Nilgiri Hills. Externally, they bear close resemblance to the unidentified *Chiasmia* sp. 13 (Plate 13 (265)). However, our research did not yield any more information, such as the year Swinhoe described this species, whether it is a synonym for a described taxon or any literature on it. The name is missing even from the list in Scoble et al. (1999.)

This, again, underscores the importance of collecting moths for an accurate description and identification.

**Isturgia Hübner, [1823] 1816**
Plate 13 (267–269)

**Isturgia disputaria** (Guenée, [1858])

The various species of *Isturgia* have been broadly placed under five groups by Krüger (2001). One of them is the *Isturgia disputaria* group. We report two taxa that belong to it. Both are tentatively identified, as details of genitalia are not available.

We have identified a female from Talayanai (Plate 13 (269)) as *Isturgia disputaria* Guenée. It is identified by the strong, black fasciae of the forewings. The description of the fasciae matches that given by Hampson (1895). Hampson (1895) also states that the southern Western Ghats forms appear generally paler and ochreous. Krüger (2001) mentions that the HW median line in *disputaria* may be faint or absent, while Hampson records the HW “with sinuous median line”. These lines are partly visible in our Plate, but minor variations in fascia could also be a geographical phenomenon, in our opinion.

The second taxon (Plate 13 (267–268)) we report as *Isturgia*—a male and a female observed at Maramalai (a higher elevation site in the buffer zone of the Reserve)—also belongs to the *I. disputaria* group. It bears some resemblance to the former taxon, but has much weaker transverse fasciae. It may be just a form or variation of the latter, but may also be related to or conspecific with *I. pulinda* (Walker, 1860), from Sri Lanka. A year later, Walker (1861) described another *Isturgia*, *I. deeraria*, from South Africa, which was subsequently reported by several authors ([Agenjo 1974: 4; Herbulot 1978: 161; Fletcher 1978a: 77; Wiltshire 1952: 172; 1980: 197; 1990: 135; Hermosa 1985: 28; Hausmann 1991: 138) in Krüger (2001) as a subspecies of *I. pulinda*. Krüger (2001), after examining the genitalia of the type-specimens, concluded that the African species *I. deeraria* was not conspecific with *I. pulinda*. Based on the fasciae we believe that this *Isturgia* from Maramalai may be related to *I. pulinda* or may even be a new species. The real identity can only be decided after the study of the genitalia of collected Individuals.

*Isturgia catalaunaria* Guenée, [1858] was also listed as a macariine species from India (Kirti et al. 2019). Krüger (2001) has recorded this to be a misidentification, as this is a species from southern Spain and southern Africa, so extralimital to India.

**CONCLUSION**

Investigating 390 moths through photographs and without specimens in hand to refer to, was a daunting task. In the absence of specimens, we have attempted to assign as precise species identities as deemed possible, but many uncertainties in species identities can only be clarified through collection and examination of specimens. We have also attempted to compile the many historical records that lay scattered among different resources, and contemporary published papers on Geometridae, for easy access to future researchers. Many geometrids are flower feeders, hence important pollinators of plants in forests. Their presence is likely to help forests flourish. As most geometrids are polyphagous, their varied larval host plants are also crucial, and require protection of their habitats in the Western Ghats, an area of high endemism. Given the diversity observed by the first author in these forests, we hope that these preliminary findings will stimulate further research on the geometrid moths of KMTR.

**REFERENCES**

**Anonymous 2021** - http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/asia-and-the-pacific/india/agasthyamala/ Last accessed 13 August 2021

**Ban, X., N. Jiang, R. Cheng, D. Xue & H. Han (2018).** Tribal classification and phylogeny of Geometrinae (Lepidoptera: Geometridae) inferred from seven gene regions. *Zoological Journal of the Linnean Society* 184(3): 653–672. https://doi.org/10.1093/zoolinnean/zly013

**Barlow, H.S. (1982).** An introduction to the moths of S.E. Asia. *Malayan Nature Society*, Kuala Lumpur, 305 pp., 51 pls.
Beccaloni, G., M. Scoble, I. Kittching, T. Simonson, G. Robinson, B. Pitkin, A. Hine & C. Lylay (Editors) (2003). The Global Lepidoptera Names Index (LepIndex). Last accessed 13 August 2021. https://www.nhm.ac.uk/our-science/data/lepidoptera/lepidex/

Beljaev, E.A. (2007). Taxonomic changes in the emerald moths (Lepidoptera: Geometridae, Geometrinae) of East Asia, with notes on the systematics and phylogeny of Hemitheria. Zootaxa 1584: 55–68

Brechlin, R. (1998). Neues indoaustralisches Schwärmerarten (Lepidoptera, Sphingidae). Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. 19(1): 23–42

Brechlin, R. (2000). Zwei neue Arten derGattung Loepa Moore, 1859 (Lepidoptera: Saturniidae). Nachrichten des Entomologischen Vereins Apollo, Frankfurt am Main, N.F. 21(3): 165–170.

Butler, A.G. (1881). Descriptions of new Genera and Species of Heterocerous Lepidoptera from Japan. The Transactions of the Entomological Society of London 1881: 1–25.

Butler, A.G. (1886). Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part VI, London, 89 pp., 19 pls.

Butler, A.G. (1889). Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part VII, London, 176 pp., 18 pls.

Choi, S.W. & S.S. Kim (2013). Six new records of Idea treitschki (Lepidoptera: Geometridae, Sterrhinae) from Korea. Entomological Research 43: 27–33.

Choi, S.W. (2012). Taxonomic review of the genus Asthenia Hübner (Lepidoptera: Geometridae) in Korea. Entomological Research 42: 151–157. https://doi.org/10.1111/j.1748-5967.2012.00450.x

Cotes, E.C. & C. Swinhoe (1887). A Catalogue of Moths of India. Pt. 1-Sphinges. The Trustees of the Indian Museum, Calcutta, 40 pp.

Cui, L., D. Xue & N. Jiang (2019). A review of Organopanopa Hampson, 1893 (Lepidoptera, Geometridae) from China, with description of three new species. Zootaxa 4651(3): 434–444. https://doi.org/10.11646/zootaxa.4651.3.2

Cui, L., D. Xue, N. Jiang (2019). A review of Timandra Duponchel, 1829 from China, with description of seven new species (Lepidoptera, Geometridae). ZooKeys 829: 43–74. https://doi.org/10.3897/zokeys.829.29708

Dey, P., V.P. Uniyal, A. Hausmann & D. Stüning (2021). Revision of the genus Prometopidia Hampson, 1902, with description of the new species P. joshtahmetensis sp. nov. from West-Himalaya and its subspecies P. j. yazaki ssp. nov. from Nepal (Lepidoptera: Geometridae, Ennominae). Zootaxa 4980(1): 28–44.

Elanchezhian, M., C. Gunasekaran & A.A. Deepa (2014). A study on moth diversity in three different habitats of Maruthamalai Hill, Western Ghats, South India. Global Journal for Research Analysis 3(12): 136–138.

Fletcher, D.S. (1953). A revision of the genus Carecomotis (Lepidoptera, Geometridae), Annals and Magazine of Natural History: Series XIII(6): 100–142. https://doi.org/10.1080/00222935308654403

Forum Herbulot (2003): The Forum Herbulot world list of family group names in Geometridae, <http://www.herbulot.de>, 11 pp., with updated version of 12.vl.2007 [A. Hausmann ed.]. Last accessed on 13 August 2021.

Govt. of Tamlilnadu, Forest department (2009). Monitoring Primates - A guide for Kalakad Mundanthurai Tiger Reserve, https://www.forests.tn.gov.in/pages/view/kalakad_mundanthurai_tr. Last accessed on 13 August 2021.

Goyal, T. (2010). Taxonomic studies on family Geometridae (Lepidoptera) from Western Ghats of India, PhD thesis. Department of Zoology, Punjab University, 279 pp., 101 pls. Last accessed on 17 November 2020. http://hdl.handle.net/10503/2894

Goyal, T., J.S. Kirti & A. Saxena (2018). Taxonomy of Genus Agathia Guenée (Lepidoptera: Geometridae), with description of a new species from Western Ghats, India. Indian Journal of Entomology 80(3): 951–959. https://doi.org/10.5958/0974-8172.2018.00144.X

Hampton, G.F. (1891). Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part VII, Taylor & Francis, London, 144 pp., 18 pls.

Hampton, G.F. (1893). Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part IX, Taylor & Francis, London, 182 pp., 21 pls.

Hampton, G.F. (1895). The Fauna of British India including Ceylon and Burma, Moths- Vol. 3. Taylor and Francis, London, 588 pp.

Hampton, G.F. (1896). The Fauna of British India including Ceylon and Burma, Moths- Vol. 4. Taylor and Francis, London, 632 pp.

Hampton, G.F. (1907). The Moths of India. Supplementary paper to the Volumes in “The Fauna of British India”, Series III, Part IX. Journal of the Bombay Natural History Society 18: 27–53.

Hampton, G.F. (1912). The Moths of India. Supplementary paper to the Volumes in “The Fauna of British India”. Series IV, Part IV. Journal of the Bombay Natural History Society 21(4): 1222–1272.

Han, H. & D. Xue (2011). Thalassodipes and related taxa of emerald moths in China (Geometridae, Geometrinae). Zootaxa 2019: 26–50.

Han, H., C.A. Galsworthy & D. Xue (2009). A survey of the genus Geometra Linnaeus (Lepidoptera, Geometridae, Geometrinae). Journal of Natural History 43 (13–14): 885–922. https://doi.org/10.1080/00222930802702477

Han, H., C.A. Galsworthy & D. Xue (2012). The Comibaenini of China (Geometridae, Geometrinae), with a review of the tribe. Zoological Journal of the Linnean Society 165: 723–772.

Holloway, J.D. (1993(4)). The moths of Borneo (Part 11); Family Geometridae: Subfamily Ennominae. Malayan Nature Journal 47: 1–309.

Holloway, J.D. (1996). The moths of Borneo (Part 9); Family Geometridae: Subfamilies Oenochrominae, Desmobathrininae, Geometridae. Malayan Nature Journal 49: 147–326.

Holloway, J.D. (1997). The moths of Borneo (Part 10); Subfamilies Sterrhinae, Larentiinae. Malayan Nature Journal 51: 1–242.

Inoue, H. (1953). Notes on some Japanese Larentiinae and Geometridae (Lepidoptera: Geometridae). Tinea 1: 1–18.

Inoue, H. (1964). Some new subspecies of the Geometridae from the Ryukyu Archipelago and Formosa (Lepidoptera). Kontyū 32(2): 335–340.

Inoue, H. (1993). Redescription of Ourapteryx peermaadiata Thierry-Mieg from South India (Lepidoptera: Geometridae, Ennominae). Lepidoptera Science 44(3): 117–119. https://doi.org/10.18984/lepid.44.3_117

Kendrick, R.C. (2002). Moths (Insecta: Lepidoptera) of Hong Kong. PhD Thesis. Department of Ecology and Biodiversity, Hong Kong University of Hong Kong. 623 pp., 9 pls. http://hdl.handle.net/10722/31688. Last accessed on 4 December 2020.

Kendrick, R.C. (2015). Polymorphism and populations: Cleora injector (Walker, 1860) (Lepidoptera: Geometridae) at Mai Po Nature Reserve, Hong Kong. PeerJ 7: e7386. https://doi.org/10.7717/peerj.7386
Özün, E., J. Vialdallep & A. Truver (2016). Phylogeny of the subfamily Larentiinae (Lepidoptera: Geometridae): integrating molecular data and traditional classifications. Systematic Entomology 21(4): 824–843. https://doi.org/10.1111/syen.12195

Plotkin, D. & A.Y. Kawahara (2020). Review of recent taxonomic changes to the emerald moths (Lepidoptera: Geometridae: Ennominae). Biodiversity Data Journal 8: e52190. https://doi.org/10.3897/BDJ.8.e52190

Prout, L.B. (1912). Lepidoptera, Heterocera. Family Geometridae, Subfamily Hemiteineae. Genera Insecto 129: 274 pp.

Prout, L.B. (1917). On new and insufficiently known Indo-Australian Geometridae. Novitates zoologicae 24: 293–317.

Prout, L.B. (1920–1941). The Indo Australian Geometridae. In: Seitz, A. (Ed.). The Macrolepidoptera of the World. Vol 12, Stuttgart Verlag des Seitz’schen Werkes (Alfred Kernen), 356 pp. 50 pls.

Prout, L.B. (1925). Geometrid descriptions and notes. Novitates Zoologicae 32: 31–69.

Prout, L.B. (1929). New species and sub-species of Geometridae. Novitates Zoologicae 35: 63–77.

Prout, L.B. (1929). On the Geometrid Genus Catoria Moore. Novitates Zoologicae 35: 132–141.

Prout, L. B. 1933. The Indoaustralian Geometridae, pp. 77–116. In: Seitz, A. (ed.) 1920-1934. The Macrolepidoptera of the World. Volume 12: 1-292.

Prout, L.B. (1934). Geometridae: Subfamilia Sterrhinae. Lepidopterorum Catalogus, part LX: 1–180. W. Junk, Berlin.

Sato, R. (1987). Taxonomic notes on Menophra delineata (Walker) (Geometridae: Ennominae) and its allies from Indo-Malayan region. Tinea 12 Supplement: 249–258.

Sato, R. (2004). Taxonomic notes on Racotis boarmiaria (Guenee) (Geometridae, Ennominae) and its allies from the Indo-Malayan region. Tinea 18(2): 130–139.

Sato, R. (2014). Six new species of the genus Ophthalmittis (Geometridae, Ennominae) from Southeast Asia and South India, with taxonomic notes on the related species. Tinea 22(5): 318–330.

Sato, R. (2016). Five new species of the genera Hypomecis Hübner, Ophthalmittis Fletcher and Phthanoessa Warren (Geometridae; Ennominae) from the Indo-Malayan region. Tinea 23(5): 241–248.

Schnitlmeister, A. (2003). Die Gattung Staurusp Germar, 1812 (Lepidoptera: Notodontidae). Nachrichten des Entomologischen Vereins Apollo, Frankfurt/Main, N.F. 24(3): 97–118.

Scoble, J.M. & M. Krüger (2004). A review of the genera of Macarini with a revised classification of the tribe (Geometridae; Ennominae). Zoological Journal of the Linnean Society 134: 257–315.

Scoble, M.J. (1999). Geometrid Moths of the World - A Catalogue (Lepidoptera: Geometridae), Vol. 1 & 2, pp. 5–482 & 485–1016. CSIRO Publishing, Collingwood.

Scoble, M.J. & A. Hausmann [updated 2007]. Online list of valid and available names of the Geometridae of the World. Last accessed on 10 Jan 2021. http://www.herbulot.de/globalspecieslist.htm

Sihvonen, R. (2005). Phylogeny and classification of the Scopulini moths (Lepidoptera: Geometridae, Sterrhinae). Zoological Journal of the Linnean Society 143: 473–530.

Sihvonen, P., L.S. Murillo-Ramos, G. Brehm, H. Staude & N. Wahlberg (2020). Molecular phylogeny of Sterrhinae moths (Lepidoptera: Geometridae): towards a global classification. Systematic Entomology 45: 606–634.

Sondhi, S., D. Nath, Y. Sondhi & K. Kunte (2020). A new species of Metallossaphia Warren, 1895 (Lepidoptera: Geometridae: Geometrinae) and notes on M. opalina (Warren, 1893) from eastern Himalaya, India. Zootaxa 4832(2): 289–297.

Sondhi, Y., S. Sondhi, S.R. Pathour & K. Kunte (2018). Moth diversity (Lepidoptera: Heterocera) of Shendurney and Ponnudi in Agastymalai Biosphere Reserve, Kerala, India, with notes on new records. Tropical Lepidoptera Research 28(2): 66–89. https://doi.org/10.5281/zenodo.2027709

Sondhi, Y., S. Sondhi, P. Roy & K. Kunte (Chief Editors) (2021). Moths of India, v. 2.63. Indian Foundation for Butterflies.

Stünning, D. & V.K. Waila (2009). The genus Astygisa Walker, 1864 in India, with description of a new species from western Himalaya (Lepidoptera: Geometridae, Ennominae). Tinea 21(1): 9–22.

Swinhoe, C. (1890). New species of moths from Southern India. Transactions of the Entomological Society of London 1891(1): 133–154, pl.8. https://doi.org/10.1111/j.1365-2311.1891.tb01644.x

Thierry-Mieg, P. (1903). Descriptions de Lepidopteres Nocturnes. Annales de la Société entomologique de Belgique 47: 382–385.

Vialdallep, J. (2011). A morphological review of tribes in Larentiinae (Lepidoptera: Geometridae). Zootaxa 3136(1): 1–44. https://doi.org/10.11646/zootaxa.3136.1.1

Walker, F. (1860). List of the specimens of Lepidopterous insects in the collection of the British Museum, London. Part XX: 1–276.

Walker, F. (1860). List of the specimens of Lepidopterous insects in the collection of the British Museum, London, Part XXI: 1–373.

Walker, F. (1861). List of the specimens of Lepidopterous insects in the collection of the British Museum, London. Part XXII–XXV: 1–826.

Walker, F. (1862). List of the specimens of Lepidopterous insects in the collection of the British Museum, London. Part XXV–XXVI: 1–538.

Warren, W. (1894). New Genera and Species of Geometridae. Novitates Zoologicae, 1: 366–534.

Warren, W. (1896). New Species of Drepanidae, Thyrididae, Uraniidae, Epiplemidae, and Geometridae in the Tring Museum. Novitates Zoologicae 3: 335–420.

Warren, W. (1897). New Genera and Species of Geometridae. Novitates Zoologicae 4: 12–179 & 195–306.

Xue, D., L. Cui & N. Jiang (2018). A review of Problerpsis Lederer, 1853 (Lepidoptera: Geometridae) from China, with description of two new species. Zootaxa 4392(1): 101–127. https://doi.org/10.11646/ zootaxa.4392.1.5

Xue, D., X. Wang & H. Han (2009). A revision of Episothalma Swinhoe, 1893, with descriptions of two new species and one new genus (Lepidoptera, Geometridae, Geometrinae). Zootaxa 2033: 12–25.

Yakovlev, R.V. (2009). New taxa of African and Asian Cossidiae (Lepidoptera). Euroasian Entomological Journal 8(3): 353–361.
Subfamily Sterrhinae: 5–36

Tribe Cosymbiini: 5–7

*5. Chrysocraspeda sp.1
6. Chrysocraspeda sp.2
7. Perixera insitiva

Tribe Cyllopodini: 8

*8. Organopoda sp.
9. Craspediopsis sp.
10. Lissoblemma lunuliferata

Tribe Rhodometrini: 11–12

11. Traminda aventaria 12. Traminda mundissima

Tribe Scopulini: 13–22

13. Problepsis apollinaria
14. Problepsis deliaria

15. Scopula fibulata
16. Scopula divisaria
17. Scopula nr actuaria

Plate 1. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Inventory of geometrid moths of Kalakad-Mundanthurai TR

18. *Scopula nr relictata*
19. *Scopula sp.*
20. *Somatina rosacea*
21. *Somatina nr plyrusaria*
22. *cf. Somatina*

Plate 2. Geometrids of Kalakad-Mundanthurai Tiger Reserve

Tribe: Sterrhini: 23–32

23. *Idaea gemmaria*
24. *Idaea nr gemmaria*
25. *Idaea violacea*
26. *Idaea sp.4*
27. *Idaea sp.5*
28. *Idaea sp.6*
29. *Idaea sp.7*
30. *Idaea sp.8*
31. *Lophophleps phoenicoptera*
32. *Lophophleps purpurea*

Tribe: Timandrini: 33

33. *Timandra sp.*

Unidentified Sterrhinae: 34–36

34.
35.
36.
Subfamily Larentiinae: 37–60

Tribe Asthenini: 37–38

37. Acolutha pictaria

38. Polynesia sunandova

Tribe Cidarini: 39–41

39. Ecliptopera dissecta
40. Ecliptopera musicolor
41. Chloroclystis sp.
42. Bosara albitornis

Tribe Eupitheciini: 42–53

43. Eupithecia sp.
44. Collis sp. 1
45. Collis sp. 2
46. Collis sp. 3

47. Eois cf. dissimilis
48. Eois lunulosa
49. Eois lunulosa form ochraceae
50. Eois sp. 3

51. Eois sp. 4
52. Gymnoscelis cf. admixtaria
53. Ziridava rubridisca

Tribe: Incertae sedis: 54

54. Physetobasis annulata

Tribe: Trichopterygini: 55–56

55. Sauris sp. 1
56. Sauris sp. 2

Tribe: Xanthorhoini: 57

57. Xanthorhoe saturata

Plate 3. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Unidentified Eupitheciini: 58–60

Subfamily Geometrinae: 61–101

Tribe Agathiini: 61–63

Tribe Archaeobalbini: 64–65

Tribe: Comibaenini: 66–74

Plate 4. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Plate 5. Geometrids of Kalakad-Mundanthurai Tiger Reserve

Tribe Dysphiini: 75

75. *Dysphania percuta*

Tribe Geometriini: 76

76. *Cyclothea disjuncta*

Tribe Hemitheini: 77–91

77. *Comastola sp.*

78. *Episothalma robustaria*

79. *Hemithia tritonaria*

80. *Hemithia wuka*

81. *idiochlora nr caudularia*

82. *Orothalassodes hypocrites*

83. *Pelagodes sp.*

84. *Pentheochiora cf. uniformis*

85. *Spaniocentra sp.*

86. *Berta cf. chrysolineata*

87. *Jodis nr undularia*

88. *Jodis pallescens*

89. *Jodis sp.*

90. *Microloxia indecretata*

91. *Microloxia sp.*

Tribe Nemoriini: 92–93

92. *Eucyclodes albiparsa*

93. *Eucyclodes gavissima*

94. *Ornithospilia lineata*

95. *Ornithospilia submonstrans*
Tribe Pseudoterpnini: 96–98

96. Pingasa riguraria
97. Pingasa dispensata ♂
98. Pingasa dispensata ♀

Unidentified Geometrinae: 99–101

99.
100.
101.

Subfamily Desmobathrinae: 102–105

102. Derambila fragilis
103. Nareia ajaia ♂
104. Ozola micriaria ♀
105. Ozola sp.

Subfamily Ennominae: 106–274

Tribe Abraxini: 106–123

106. Abraxas leucostola argyrosticta
107. Abraxas fasciana
108. Abraxas poliostrota ♂
109. Abraxas poliostrota ♀

110. Abraxas sp.4 → 111.(UN) 112. Abraxas sp.5 → 113.(UN) 114. Abraxas sp.6(UP)

Plate 6. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Plate 7. Geometrids of Kalakad-Mundanthurai Tiger Reserve

115. Abraxas sp.6 (UN) 116. (UP) 117. (UN) 118. Abraxas sp. /form 119. Abraxas sp./form

120. Abraxas sp./form 121. Abraxas sp. 8 (UP) 122. 123. (UN) sp.8

Tribe Baptini: 124–129

124. Borbacha cf. pardaria 125. Lomographa inamata 126. Platycerota vitticostata

127. Syneagia imitaria 128. Yashmakia erythra ♀ 129. Yashmakia confragrata ♀

Tribe Boarmiini: 130–190

130. Alcis nilgirica ♂ -UP 131. Alcis nilgirica ♀ -UN 132. Alcis nilgirica ♂ 133. Amblychia cf. angeronaria

134. Amroica recursaria 135. Catoxia cf. sublavaaria ♂ UP & 136. UN 137. Chorodna striaria
Plate 8. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Plate 9. Geometrids of Kalakad-Mundanthurai Tiger Reserve

157. Undescribed variants of Cusia la raptanía

161. Ectropis bhurmitra
162. Ectropis cf. dentilineata
163. Gasteracme polyspathes

164. ♀
165. ♂
166. ♀
167. ♀

Hypomecis pallida

168. Hypomecis separata
169. H. separata, dark form
170. Hypomecis tamlensis
171. Hypomecis transcissa

172. Hyposidra talaca
173. Hyposidra violescens ♀
174. H. violescens ♂
175. Hyposidra sp.

176. Dasyboarmia cf. inouei
177. Ophthalmitis cf. herbidaria
178. Ophthalmitis kalakadaria

179. Psilalcis cf. subtochracea ♀
180. Psilalcis cf. subtochracea ♂
181. Psilalcis sp. 2
Inventory of geometrid moths of Kalakad-Mundanthurai TR Iyer et al.

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 November 2021 | 13(13): 19887–19920

182. Psilalcis sp. 3 ♀
183. Psilalcis sp. 4 ♀
184. Racotis keralaria

185. Ruttellerana cf. cessaria
186. Ruttellerana cf. pseudocessaria
187. Biston strigaria

Unidentified Boarmlini: 188–190

188.
189.
190.

Tribe Caberini: 191–200

191. Petelia medardaria ♀
192. Petelia distracta ♀

193. Petelia fasciata
194. Petelia immaculata ♀
195. Petelia immaculata ♀
196. Petelia immaculata ♀

197. Petelia immaculata ♀
198. Petelia sp. 5
199. Astygisa sp.
200. Hyperythra lutea

Tribe Cassymini: 201–206

201. Heterostegane subtessellata ♀
202. Heterostegane subtessellata ♀
203. Heterostegane cf. tritocampsis ♀
204. Heterostegane cf. tritocampsis ♀
205. Heterostegane sp. 3

Plate 10. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Plate 11. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Inventory of geometrid moths of Kalakad-Mundanthurai TR

19919

Plate 12. Geometrids of Kalakad-Mundanthurai Tiger Reserve
Plate 13. Geometrids of Kalakad-Mundanthurai Tiger Reserve. © Images with * are contributions from Thalavaipandi. All others are those of the first author.
An inventory of geometrid moths (Lepidoptera: Geometroidea: Geometridae) of Kalakad-Mundanthurai Tiger Reserve, India
– Geetha Iyer, Dieter Stüning & Sanjay Sondhi, Pp. 19887–19920

Communications
Roadkills of Lowland Tapir Tapirus terrestris (Mammalia: Perissodactyla: Tapiridae) in one of its last refuges in the Atlantic Forest
– Aureo Banhos, Andressa Gatti, Marcelo Renan de Deus Santos, Leonardo Merçon, Ika Westermeyer, Natália Carneiro Ardente, Luis Francisco Oliveira Pereira Gonzaga, Lucas Mendes Barreto, Lucas Damásio, Tomas Lima Rocha, Vítor Roberto Schettino, Renata Valls, Helena Godoy Bergallo, Marcus Vinícius Freitas Silva, Athelson Stefanon Bittencourt, Danielle de Oliveira Moreira & Ana Carolina Srbek-Araujo, Pp. 19921–19929

Scientific contributions and learning experiences of citizen volunteers with a small cat project in Sanjiv Gandhi National Park, Mumbai, India
– Shomita Mukherjee, R. Nandini, P. V. Karunakaran & Nayan Khanolkar, Pp. 19930–19936

Seasonal food preferences and group activity pattern of Blackbuck Antilope cervicapra
– Shomita Mukherjee, R. Nandini, P. V. Karunakaran & Nayan Khanolkar, Pp. 19930–19936

Recovery of vulture population in roosting and scavenging areas of Bastar and Bijapur, Chhattisgarh, India
– Sushil Kumar Dutta, Muntaz Khan, P. R. S. Nagi, Santosh Durgam & Surabhi Dutta, Pp. 19956–19963

A geographical assessment of Chariganga and Arpara Beel (wetlands) of Nadia, West Bengal as a habitat of wetland birds
– Mehide Hasen Mandal, Arindam Roy & Giyasuddin Siddique, Pp. 19964–19975

Phenotypic plasticity in Barilius vogro (Hamilton, 1822) (Teleostei: Danionidae) from two geographically distinct river basins of Indian Himalaya
– Sumit Kumar, Sharali Sharma & Deepak Singh, Pp. 19976–19984

Taxonomic notes, a new species, and a key to Indian species of the click beetle genus Cryptolaus Ohira, 1967 (Coleoptera: Elateridae: Agrypninae)
– Harshad Parekar & Amol Patwardhan, Pp. 19985–19999

Niche overlap of benthic macrofauna in a tropical estuary: diurnal variation
– Márió Hencaluno de Oliveira, Lidiane Gomes de Lima, Caroline Stefani da Silva Lima, Jéssica de Oliveira Lima Gomes, Francisly Ferreira Paiva, Graziele de Barros, Carlinda Raily Medeiros & Joselene Molozzi, Pp. 20000–20001

Diversity of aquatic insects and biomonitoring of water quality in the upper Ganga River, a Ramsar site: a preliminary assessment
– Kritish De, Arkojyoti Sarkar, Kritika Singh, Virendra Pratap Uniyal, Jeyaraj Antony Johnson & Syed Ainul Hussain, Pp. 20011–20018

Patterns of forest cover loss in the terrestrial Key Biodiversity Areas in the Philippines: critical habitat conservation priorities
– Bernard Peter O. Daipan, Pp. 20019–20032

The woody flora of Shettihalli Wildlife Sanctuary, central Western Ghats of Karnataka, India - A checklist
– Kanda Navane Babu, Kuriyan Ayushi, Vinchy K. Wilson, Narayanan Ayyappan & Narayanaswamy Parthasarathy, Pp. 20033–20055

Reproductive biology of Ophiirhiza coudata C.E.C.Fisch. (Rubiaceae), an endemic and endangered creeping perennial herb of the Western Ghats, India
– Maria Theresa, Appukuttan Kamalabai Sreekala & Jayalakshmi Mohanlal, Pp. 20056–20066