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A new species of *Cigaritis* Donzel, 1847 (Lycaenidae, Aphnaeinae) from the southern Western Ghats of Peninsular India

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ABSTRACT: A new species *Cigaritis meghamalaiensis* **sp. nov.** (Lycaenidae, Aphnaeinae) is described from the Meghamalai Hills of the Periyar landscape of the southern Western Ghats. Images of adults and illustrations of male genitalia are presented. Information on myrmecophilous immature stages is provided and its ecology is discussed. The new species is very distinct from all the known *Cigaritis* species in WG, and is diagnosed based on the following combination of characters–upper side of both wings marked extensively blue in males; discal and post-discal bands on forewing underside conjoined and lying parallel from their origin at the costa; post-basal band in hindwing underside continuous and not broken into three smaller bands and this post-basal band ends at vein1b, is not continued along it to reach discal band. The discal and post-discal bands on the underside of the forewing is conjoined and lying parallel from their origin at the costa which is a unique feature that distinguishes the new species from all other *Cigaritis* species occurring in Peninsular India and Sri Lanka. A key to all known species of *Cigaritis* from the Western Ghats is provided. © 2023 Association for Advancement of Entomology

KEYWORDS: Meghamalai Tiger Reserve, myrmecophily, new taxon, silverline, butterfly, crematogastor

INTRODUCTION

The Silverlines are strong-winged lycaenids in the subfamily Aphnaeinae Distant, 1884. Evans (1932) treated Indian taxa of Aphnaeinae Distant, 1884 under *Aphnaeus* Hübner, [1819] in synonymy with *Spindasis* Wallengren, 1857 and considered

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Cigaritis Donzel 1847 as a senior synonym of *Apharitis* Riley 1925. Evans (1932) treated, species with prominent hindwing lobe and the tails at veins 1b and 2 nearly equal under *Spindasis* Wallengren, 1857 (=*Aphnaeus* Hübner, [1819]); and those species with ill-developed hindwing lobe and tail at v2 half as long as in vein 1 were treated under *Apharitis* Riley 1925 (=*Cigaritis* Donzel, 1847). Thus, the Western Ghats taxa were kept under the genera *Spindasis* and *Apharitis* by him. However, Heath (1997) synonymised *Apharitis* with *Spindasis*. The genus *Spindasis* was later synonymized with the genus *Cigaritis* Donzel, 1847, and *Aphnaeus* Hübner, [1819] was restricted to African taxa by Heath *et al*. (2002). Heath (1997), Heath *et al.* (2002), Heath and Pringle (2011), and later Boyle *et al.* (2015), using molecular data synonymized *Spindasis* with *Cigaritis*–the senior synonym. There are seven species of *Cigaritis* in the Western Ghats namely *C. vulcanus* (Fabricius, 1775)*, C. schistacea* (Moore, [1881])*, C. ictis ictis* (Hewitson, 1865)*, C. elima elima* (Moore, 1877)*, C. lohita lazularia* (Moore, 1881), *C. lilacinus* (Moore, 1884), and *C. abnormis* (Moore, [1884]). Of these, except *C. lilacinus* all others have been reported from the southern Western Ghats (Unpublished data – Sadasivan *et al.*). A distinct *Cigaritis* species in the high elevations of Periyar Tiger Reserve, Idukki district, Kerala in 2018, and its myrmecophilous immature stages was observed. On further exploration in 2021, this species was found to be common in Meghamalai (Megamalai) of Tamil Nadu and adjoining Periyar Tiger Reserve of Kerala (Fig.1). This *Cigaritis* species was found to be new to science and is described here.

MATERIALS AND METHODS

The taxonomy of *Cigaritis* follows Evans (1932), Heath (1997), Heath *et al.* (2002), Heath and Pringle (2011) and Boyle *et al.* (2015). Identification of species follows Evans (1932), Wynter-Blyth (1957), and van der Poorten and van der Poorten (2018). Photographs of the specimens were taken with a Canon EOS 70D DSLR fitted with a 180mm macro lens and MPE 65 f 2.8 1–5x lens. The genitalia were studied by soaking overnight in KOH, then dissected under a stereo-zoom microscope (HEADZ Model HD81) and preserved in glycerol. Illustrations were drawn by the senior author using the stereo-zoom microscope. The length of the forewing (FW) is measured as the longest straight-line distance from the wing base to the wing tip following Van Hook *et al.* (2012). Terminology for the wing pattern follows Evans (1932) and genitalia descriptions follow Corbet & Pendlebury (1992). The holotype and paratypes will be deposited in the insect collection of the Zoological Survey of India (ZSI), Western Ghat Regional Centre (WGRC), Kozhikode, Kerala, and Bombay Natural History Society (BNHS), Mumbai.

Abbreviations

BNHS	Bombay Natural History Society
PTR	Periyar Tiger Reserve, Kerala
SMTR	Srivilliputhur-Meghamalai Tiger Reserve
TNHS	Travancore Nature History Society
UpF	Upperside of forewing
UnF	Underside of forewing
UpH	Upperside of hindwing
UnH	Underside of hindwing
WG	Western Ghats
WLS	Wildlife Sanctuary
ZSI	Zoological Survey of India, Kozhikode

RESULTS AND DISCUSSION

Systematics

Family Lycaenidae Leach, 1815

Subfamily Aphnaeinae Distant, 1884

Genus *Cigaritis* Donzel, 1847

Cigaritis meghamalaiensis Sadasivan & Naicker **sp. nov.** LSID urn:lsid:zoobank.org:act:A8D4F48B-46E6-4692-81D4-0D8F2EE4DA03

Holotype (Figs. 2A–B): TLRG 1001; Kardana Estate, Meghamalai, Theni District, Tamil Nadu

State, India; Col. SRK; 15.vi.2021, 1400m ASL, from a private estate; dry pinned specimen; will be deposited in the insect collections of ZSI, WGRC, Kozhikode Kerala, India.

Paratypes (1 male and 2 females) (Figs. 2C–G): ♂: TLRG 1002; bearing the same data as the holotype; dry pinned specimen; will be deposited in the insect collections of BNHS, Mumbai, Maharashtra, India. ♀ TLRG 1003 and ♀ TLRG 1004 bearing the same data as the holotype; dry pinned specimens, will be deposited in the insect collections of ZSI, WGRC, Kozhikode, Kerala, India and BNHS, Mumbai, Maharashtra, India, respectively.

Other materials (observed, not collected): 2 ♀♀, 26. xii. 2016, Eravangalar, PTR, Kerala, 1400m ASL (KS & JJ); 21 ♂♂, and 14 ♀♀, 16.iv.2021, Kardana Estate, Chinnamanur Range, Theni District, Tamil Nadu, 1420m ASL (SRK); 6 ♂♂ and 4 ♀♀, 21.iv.2023, KSR Estate, Meghamalai Range, Theni District, Tamil Nadu, 1320m ASL (SRK).

Description of the Holotype (♂ TLRG 1001)

Head. Antennae dark brownish-black, inferolateral striations grey, and tip distinctly marked in pale orange-white; palpi dorsally blackish and covered with small thick whitish hairs ventrally; eyes grey with black speckling in life.

Thorax. dark grey bearing long pale greyish white hairs; legs very pale pinkish white, distally speckled in brown.

Forewing. Measures 16mm, costal margin and termen straight, apex minimally obtuse. Upperside with ground color velvety black, marked extensively with blue. Most of the spaces 1b and 2, three-fourths of space 3 from base, and just over half of space 4 are marked in metallic blue; a little over basal third of space 4 blue, rest of it black with a small blue spot at its middle; origin of space 5 blue; inferior half of cell blue. Entire costa marked broadly in black, this black border thickest at apex, then tapers on termen towards tornus; dorsum wholly marked in blue. Underside with ground color pale pinkish–brown, marked with a band at base of wing, and other long bands which are darker than ground color as follows–post-basal, discal, post-discal, sub-apical, submarginal bands pinkish–orange, centrally marked with silver scales, bordered with black; all long bands start at costa; post-basal band ends at origin of v2; discal band short, ends at origin of v3;

Fig. 1 Distribution of *Cigaritis meghamalaiensis* **sp. nov.** in Meghamalais of Periyar Landscape

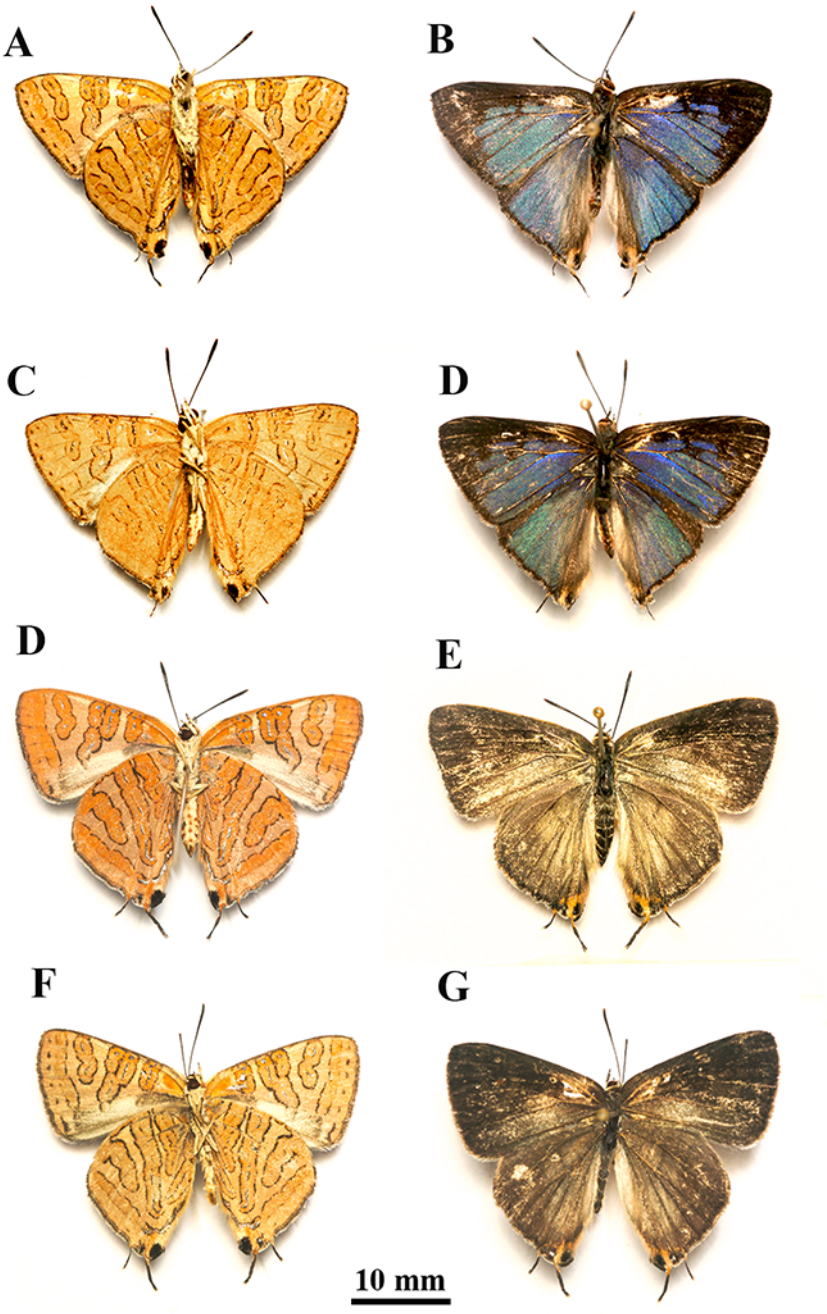

Fig. 2 *Cigaritis meghamalaiensis* **sp. nov.** Images of the types and paratypes. A and B – TLRG 1001 Holotype male, A – dorsal and B ventral views; C and D –TLRG 1002, Paratype male, C – dorsal and D – ventral view; D and E – paratype female TLRG 1003, D – dorsal view and E – ventral view; F and G – paratype female TLRG 1004, F – dorsal view and G –ventral view. All images © Kalesh Sadasivan

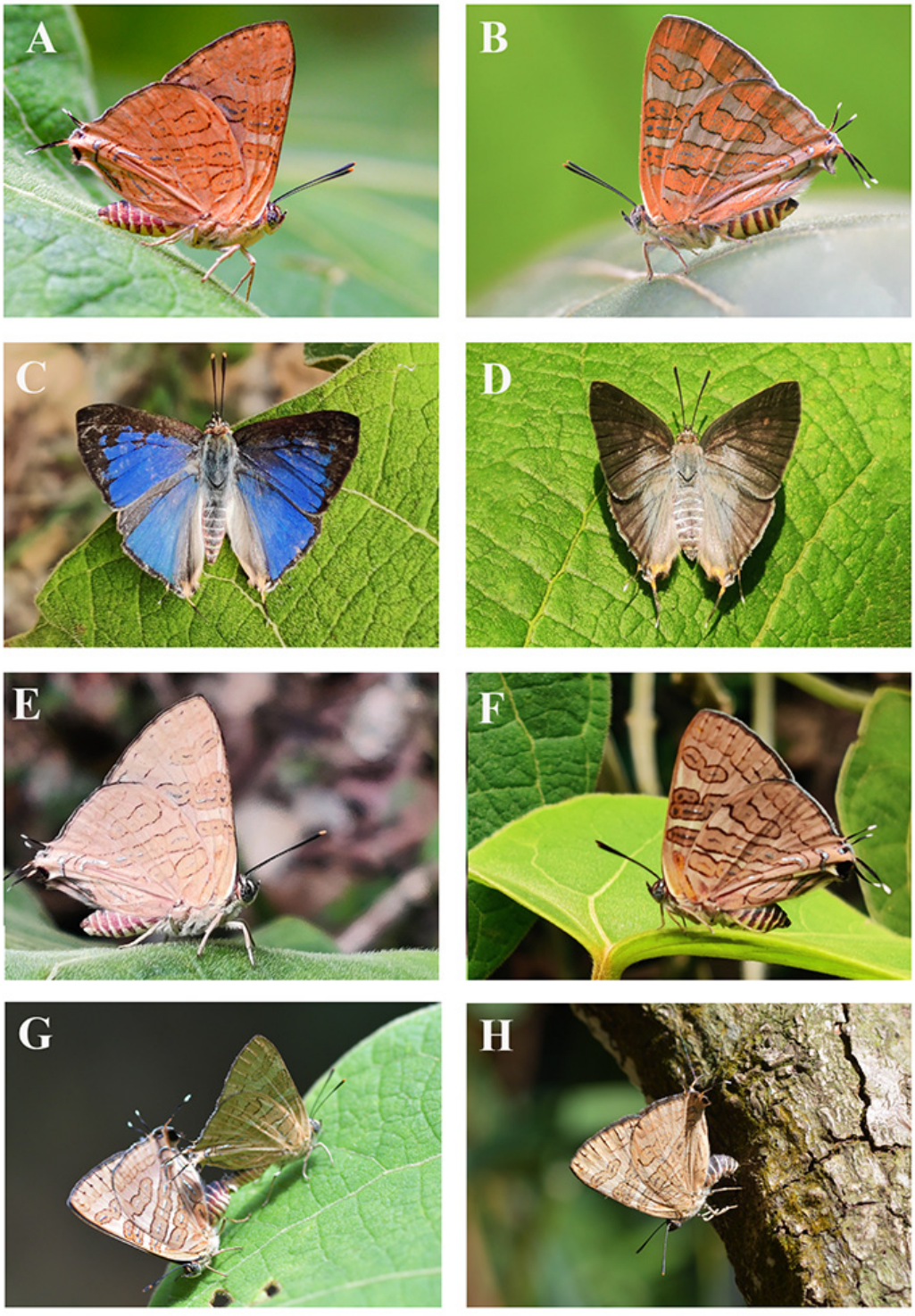

Fig. 3 *Cigaritis meghamalaiensis* **sp. nov.** Field images of males, females and seasonal forms. A–male. Typical color; B–female, typical color; C–male upperside; D–female upperside; E–dry season male underside; F–dry season female underside; G–mating; H–oviposition. All images © Ramasamy Naicker

Fig. 4 *Cigaritis meghamalaiensis* **sp. nov.** Early stages, larval pens, and attending ants. A–freshly laid egg © Kalesh Sadasivan; B–larvae being attended by *Crematogaster* ants inside the larval pen © Kalesh Sadasivan; C–intermediate instar larvae and its attending ant © Kalesh Sadasivan; D–larval pen under the bark of a shola tree opened to reveal the walls (white arrows), and two larvae inside it marked 1 and 2 (blue arrows) © Jebin Jose

post-discal band consists of two conjoined bands, meeting at base of space 4; lower band turns basally and crosses into middle of space 1b; subapical band curved inwards ending at middle of space 3; submarginal band with its outer black border ill-defined, ends at v1b; a submarginal series of blackish-brown streaks on each space along termen; cilia brownish-black.

Hindwing. Upperside with ground color grey, whole of spaces 1c, 2, 3, 4, and cell marked in blue; origin of space 5 bears a small blue patch along vein 4; space Ib pale grey; costa broadly dark grey, termen narrowly marked in dark greyish black, dorsum pale greyish white with long pale grey hairs; whole of cell bears long bluish hairs; tornus pale orange white; tornal spot black; tails black, basal quarter pale orange-white, extreme tip white. Underside ground color as in forewing but slightly more orangish; short basal, longer–post-basal, discal, sub-apical and submarginal bands; longer bands originate at costa, run towards tornus; post-basal band continuous, not broken in three spots; discal band just crosses v1b, but does not reach tornus; post-basal and post-discal bands do not meet each other; sub-apical band crosses v3 at its middle; submarginal band just reaches 1b; all bands except the submarginal band bears central silver scales; silver scaling is sparse generally but well defined as a curvilinear streak running from end of submarginal band to middle of dorsal margin; tornal spots black, medial most spot almost twice as large as lateral.

Abdomen. Dorsally dark greyish-violet to violet-black, anterolaterally all segments bearing a cinnabar-red transverse streak that tapers towards ventrum, rest of segment yellowish-white; ventrally clothed in pale dirt white hairs.

Male genitalia (Fig. 6). Tegumen broad; uncus in lateral view broad, truncated, and flattened distally, appearing as a blunt tip tooth; dorsally tegumen and uncus appearing horseshoe shaped with a u-shaped gap separating the halves; uncus tip flattened and appearing spatulated in dorsal view; subuncal process shorter than uncus, thin, and directed towards opposite side and tips pointing posterolaterally; vinculum moderately thick, with a shallow concavity cephalad; saccus thicker than vinculum; caudal plate of saccus absent; valva with a middorsal auricular process; dorsal process of valva long triangular, curved inferomedially and its tip directed posteroinferiorly, with respect to rest of valva; aedeagus as in fig. 6D, with its tip bearing a sectorized triangular plate, edges of which is toothed.

Description of female (Figs. 2D–G; 3B, D, F, H; 5D): A rounded greyish form of male without azure-blue upper sides. Wing span 35–38mm.

Head and *Thorax.* As in males.

Forewing. Measures 17mm, colour dark brownish-black with pale greyish-blue scaling in basal two-thirds of space 1 and base of space 2; termen rounded, apex rounded in comparison to males; cilia greyish-brown. All bands and marking as in male but sub-apical band more angulated towards termen in females in comparison to males.

Hindwing. A paler shade of forewing, greyish-brown, discal area clothed heavily in long bluish-grey hairs; tornal region yellowish-orange bearing a large medial black tornal spot and a smaller one laterally between tails; tails colored as in males. Cilia grey.

Abdomen. As in males with reddish lateral markings less prominent, speckled in black scales.

Variation: Not much variation was observed in the adults, except for the extent of silver scaling inside the bands and the lesser extent of reddish-orange hue on the underside in DSF individuals. Male genitalia is consistent. Forewing length was slightly variable to some extent, in males 15–17mm and females 16–18mm. On dry preservation, the blue shade on wings developed a greenish tinge.

Etymology: The new species is named after the Meghamalai region where it was discovered. Meghamalai means ‘cloud mountain’, reflecting the montane habitat of this very local species, which is restricted to the sub-tropical evergreen ‘sholas’ or cloud forests of the Periyar landscape. We suggest the common name ‘Cloud-forest Silverline’.

Ecology: Flight period observed was from

December to June. The butterfly, unlike its congeners, is very uninclined to fly and often falls easy prey to predators like *Monilesaurus acanthocephalus* Pal, Vijayakumar, Shanker, Jayarajan & Deepak, 2018 (Squamata, Agamidae). The butterfly is restricted to the sub-tropical evergreen forests and keeps to the forest edges where they perform mating and basking. The females were observed flying around trees occupied by *Crematogaster* ants. Another species that flies in the same elevation is *Cigaritis lohita.* The adults of *C. lohita* are not uncommon on the southern WG and their larvae have been observed on various plant families like Cannabaceae, Euphorbiaceae, Loranthaceae, Mimosaceae, and Myrsinaceae. However, the locally preferred species is *Maesa indica* (Roxb.) A. DC. (Myrsinaceae), and the larvae were seen attended by *Crematogaster rothneyi civa* Forel, 1902.

Immature stages and myrmecophily: Mating was noted in April (Fig. 3G), and oviposition was noted in mid-April and late December. Females lay eggs (Fig. 4A) on dry bark of trees such as *Neolitsea* (Benth. & Hook. f.) Merr. (Lauraceae) inside the shola and shrubs like *Clerodendrum infortunatum* L. on shola edges (Figs. 3H; 5D), invariably in the presence of the ant *Crematogaster wroughtonii* Forel, 1902 and their nests (Figs. 4 B–D). Oviposition was observed between 11.00 a.m. and 1.30 p.m. Eggs are laid on stems inside ant nests, dark crevices on tree trunks and fallen branches with moss and lichen. The females preferred trees and shrubs whose stem diameter was less than 20 cm, and eggs were laid at heights of 1 meter or less from the ground well away from any foliage. Immature stages were observed inside *Crematogaster* ant larval pens (Fig. 4D), under the bark of *Neolitsea cassia* (L.), Kosterm., a shola tree at Eravangalar in Periyar (1400m ASL). Each larval pen contained 3–4 larvae in various stages of development (Fig. 4D). We observed that the larvae scrape and eat the soft bark of the tree and are sheltered under the hard bark in small pens created by *Crematogaster* ants, possibly with the droppings of the caterpillars and vegetable matter (Fig. 4D). These larval pens were in the main trunk of the tree at a height of 1.5–2m from the ground, very far away from any leaves of the tree. The ant nests were very far away from these larval pens, and thus the possibility of feeding by trophallaxis is suggested rather than the larvae being parasitic or predatory on these ant and their broods.

Of the seven species of *Cigaritis* known from the Western Ghats, six are reported on the southern Western Ghats namely *C. vulcanus*, *C. schistacea*, *C. ictis ictis, C. elima elima, C. lohita lazularia*, and *C. abnormis*. Of these, as per our field observation, *C. vulcanus* is a ubiquitous species seen in all elevations from sea coasts to 1200m, *C. schistacea* is an uncommon midland species (200–1200m), while *C. ictis* and *C. elima* are distributed below 800m, especially on the drier eastern slopes and *C. lohita* is a species which is found from the seacoast to about 1800m on the WG. *Crematogaster abnormis* is reported to occur on the lower eastern slopes of Coorg, Wayanad, Nilgiri, and Anamalai landscapes below 800m. Only *C. lohita* was shares the elevational habitat of the new species. The *'unidentified' Cigaritis* sp. mentioned in Sujitha *et al.* (2023) is described here as new to science and the myrmecophilous association with *Crematogaster wroughtonii* is confirmed. The new species is very distinct from all the known *Cigaritis* species in WG, and is diagnosed based on the following combination of characters–upper side of both wings marked extensively in blue; discal and post-discal bands on forewing underside conjoined and lying parallel from their origin at the costa; post-basal band in hindwing underside continuous and not broken into three smaller bands and this post-basal band ends at vein1b, is not continued along it to reach discal band. The presence of extensive blue coloration on Fw readily separates this new species from *C. elima elima*, *C. ictis ictis*, *C. schistacea*, and *C. vulcanus*, all of which have some form of orange stripes on the forewing. In addition, the unbroken post-basal band UnH distinguishes the new species from *C. elima elima*, *C. ictis ictis* as well as *C. abnormis,* and *C. lilacinus*. The hindwing underside post-basal band ends at vein1b, not continuing along it to reach the discal band separates the new taxon from *C. lohita.*

The discal and post-discal bands UnF conjoined and

Fig. 5 *Cigaritis meghamalaiensis* **sp. nov.,** habitat and host plants. A–Sub-tropical Evergreen forests of Meghamalais (1400m ASL) © Ramasamy Naicker; B–*Neolitsea cassia* (L.), Kosterm., a host tree © Kalesh Sadasivan; C–typical climate inside the misty cloud forests © Jebin Jose; D–female ovipositing inside *Crematogaster* nest on *Clerodendrum infortunatum* L. © Ramasamy Naicker

lying parallel from their origin at the costa is a unique feature that distinguishes *C. meghamalaiensis* **sp. nov.** from all known species of *Cigaritis* in Peninsular India and Sri Lanka. The discovery of a new species of *Cigaritis* from the southern Western Ghats reiterates the possibility of discovering new species which may have sought refuge in the montane sholas and cloud forests, which are under severe anthropogenic stress. The nature of myrmecophilous interaction needs to be studied in detail, and the possibility of finding this new species must be kept in consideration wherever the attending host ant *C. wroughtonii* occurs in the Western Ghats.

Key to *Cigaritis* Donzel, 1847 of Western Ghats Modified from Wynter-Blyth (1957), based on the males

1. UnH the second band from the post-basal band continued along v1b to meet the discal band

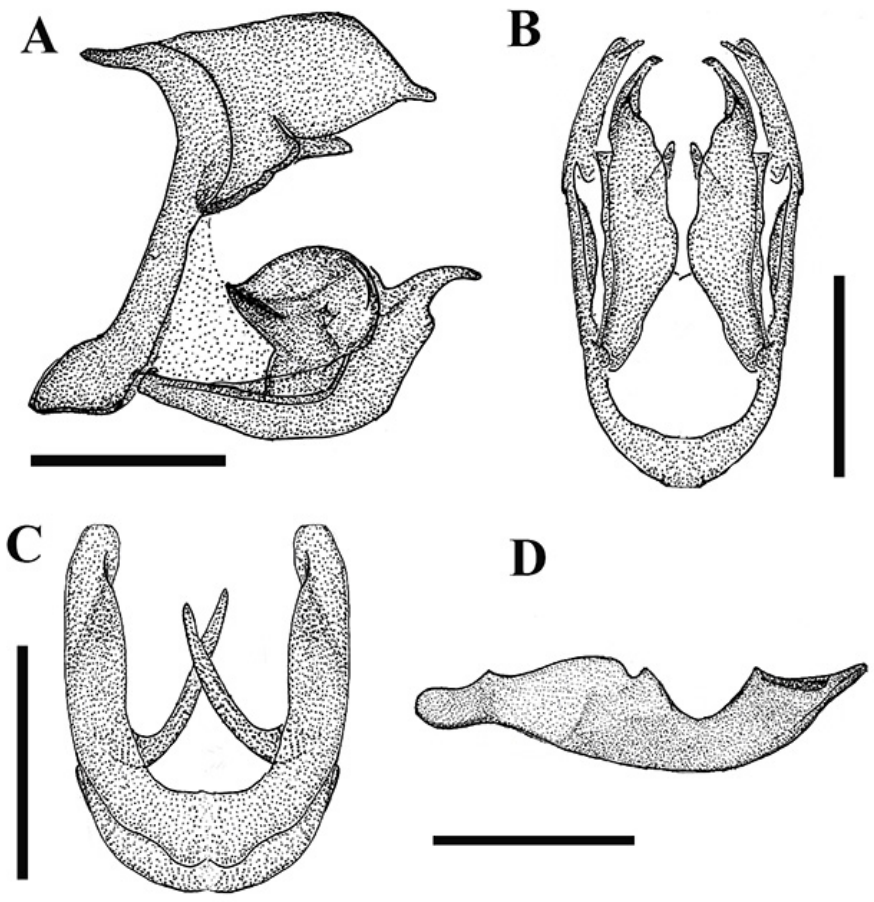

Fig. 6 *Cigaritis meghamalaiensis* **sp. nov.,** Illustration of male genitalia (scale bar 1.5 mm). A–right lateral view of the genitalia with the aedeagus removed; B–ventral view of the valva; C–dorsal view of the uncus; D–right lateral view of the aedeagus

near the tornus; below creamy yellow to cinnamon red, bands black to red; male above azure blue (Figs. 7A, B) .....*Cigaritis lohita lazularia*

– UnH post-basal band ends at vein 1b, not continue along it to reach the discal band….....….....2

2. UnH the post-basal band continuous as judged by continuity of outer black margin of that band….....3

– UnH post-basal band from base broken into 3 spots and not continuous….....5

3. UpF and UpH with orange stripes, in grey background; discal and post discal bands always separate at their origin at the costa.....4

– UpF and UpH are marked extensively in blue on a black background; UnF discal and post discal bands conjoined and lying parallel from their origin at the costa. (Figs. 7G, H) .....*Cigaritis meghamalaiensis* **sp. nov.**

4. A conspicuous small patch of blue scales near the orange tornal patch on UpH; orange patches on UpF apex restricted. (Figs. 8C, D).....*Cigaritis schistacea*

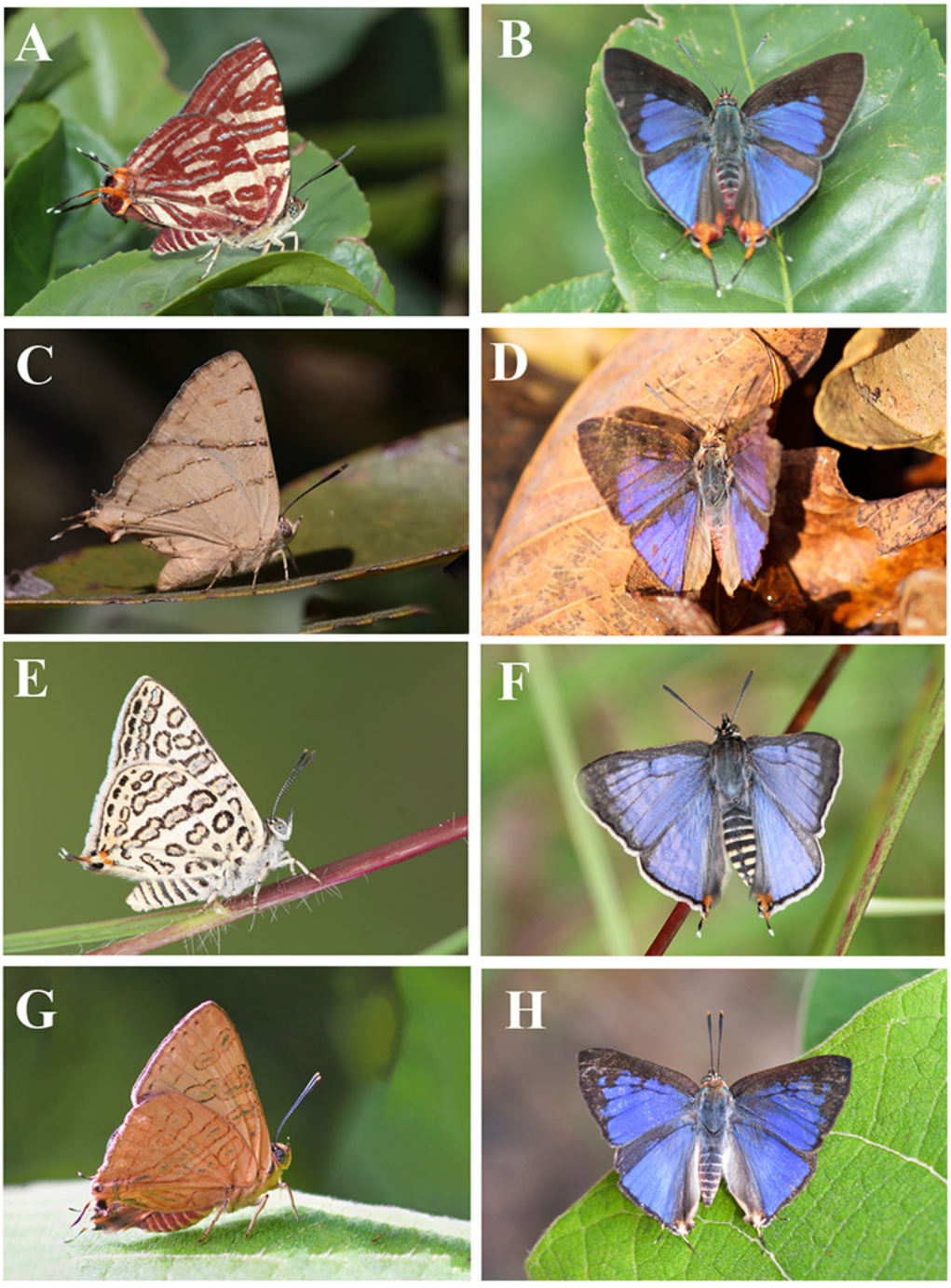

Fig. 7 *Cigaritis* of Western Ghats. A–*Cigaritis lohita* male ventral view © Kalesh Sadasivan; B–*Cigaritis lohita* male dorsal view © Kalesh Sadasivan; C–*C. abnormis* male ventral view © Milind Bhakare; D–*C. abnormis* female dorsal view © Prateik More; E–*C. lilacinus* male ventral view © Kalesh Sadasivan; F–*C. lilacinus* male dorsal view © Haneesh KM: G–*C. meghamalaiensis* **sp. nov.** male ventral view © Ramasamy Naicker; H–*C. meghamalaiensis* **sp. nov.** male dorsal view © Ramasamy Naicker

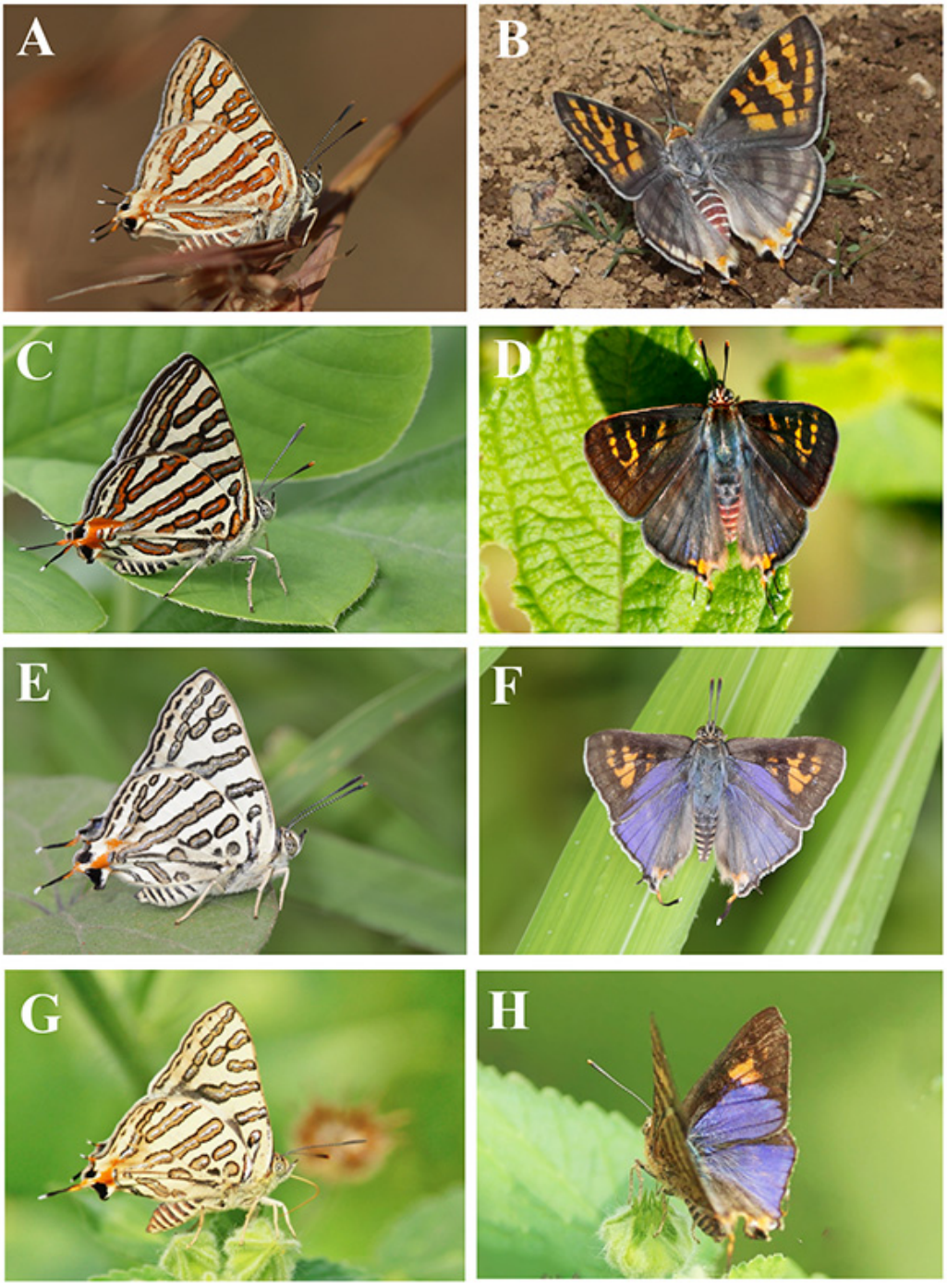

Fig. 8 *Cigaritis* of Western Ghats. A–*Cigaritis vulcanus* male ventral view © Milind Bhakare, B–*C. vulcanus* male dorsal view © Milind Bhakare; C–*C. schistacea* male ventral view © Milind Bhakare; D–*C. schistacea* male dorsal view © Jebin Jose; E–*C. ictis* male ventral view © Milind Bhakare; F–*C. ictis* male dorsal view © Milind Bhakare; G–*C. elima* male ventral view © Haneesh KM; H–*C. elima* male dorsal view © Haneesh KM

– UpH without blue patch; orange patches on the UpF extensive. (Figs. 8A, B) .....*Cigaritis vulcanus*

5. UnH the lower two basal bands conspicuous, UpF apical orange patch present in males, above bright blue; three seasonal forms, pale yellow WSF with dark edged dark yellow bands, cinnamon or khaki autumn form with black-edged bands or khaki spring form with bands defined by silver lines and black margins absent….....6

– UnH the lower two basal bands inconspicuous and markings abnormal and narrow and only central bands are seen; male above only lightly blue, no orange apical patches; dull reddish brown below; forewing apex violet-brown and generally grey otherwise (Figs. 7C, D) .....*Cigaritis abnormis*

6. UpF with orange patches in brown background……...…….7

– UpF lilac blue in grey background (Figs. 7E, F)……..…….....…….*Cigaritis lilacinus*

7. UpF apical orange patch is developed and conspicuous; the basal blue patch does not reach vein 2; last band (postdiscal) on UnH meets or leans towards the submarginal band. (Figs. 8E, F) .....*Cigaritis ictis ictis*

– UpF apical orange patch restricted, basal blue patch reaches vein 2; the last band (postdiscal) on UnH never meets and leans away from the submarginal band. (Figs. 8G, H) .....*Cigaritis elima elima*

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