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Geetha Iyer & Ian James Kitching

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A PRELIMINARY STUDY OF THE HAWKMOTH DIVERSITY (LEPIDOPTERA: SPHINGIDAE) OF KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

Geetha Iyer¹ & Ian James Kitching²

¹ Independent Consultant-Education, Teppakulam Street, Suchindrum, Kanyakumari District, Tamil Nadu 629704, India.

² Department of Life Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

¹scopsowl@gmail.com (corresponding author), ²i.kitching@nhm.ac.uk

Abstract: Kanyakumari District is situated at the southernmost tip of peninsular India in Tamil Nadu State and is bounded by the Western Ghats and the coasts of three seas. There are no detailed historical records of the moths of this region, which, before India's independence, was part of Travancore State. This paper presents a brief account of the 27 species of hawkmoths of Kanyakumari District, recorded during surveys conducted from 2011-2015, and is the first formal record of the hawkmoths of this region. A list of the species from the collection of the Natural History Museum, UK, collected in the erstwhile Travancore State that are likely to be found in the Kanyakumari region is also included.

Keywords: Kanyakumari Wildlife Sanctuary, species checklist, Suchindrum.

Abbreviations: FW - Forewing | HW - Hindwing | KK(WS) - Kanyakumari (Wildlife Sanctuary) | NHMUK - Natural History Museum, London, UK | UP - Upperside | UN - Underside.

The Western Ghats, recognized as a Natural World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (UNESCO 2012), is a mountain chain approximately 1,600km in length running along the western side of peninsular India. Kanyakumari District, the southernmost region of Tamil Nadu State, is

situated between the mountain ranges of the Western Ghats and the Arabian Sea to the west, between 8.083°-8.583°N and 77.167°-77.0°E. Rivers here are perennial and rain-fed, and the district is criss-crossed by canals and ponds to facilitate storage of rainwater draining from the Ghats. Habitats range from coastal to estuarine and freshwater and from wetlands and mangroves to forests, and support diverse ecosystems and biodiversity. About 30% of the region is forest (Rehamathulla 1970), which serves as the catchment area for 10 reservoirs (Gopala Krishnan 1995), which in turn feed into almost 1500 large and small ponds serving to sustain paddy, coconut and flower cultivation, many also being used to grow lotus.

The moths of Tamil Nadu State remain relatively less studied, with only a very few published studies on their diversity. Ramkumar et al. (2010) and Sivasankaran & Ignacimuthu (2014) both reported on the family Erebiidae; Sivasankaran et al. (2011) recorded 154 species of noctuid moths from the Western Ghats; and Rathikannu & Chitra (2017) discussed crambid moths from a few localities in Tamil Nadu. Elanchezhian et al. (2014) reported 105 moth

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species from the Maruthamalai Hills, however, none of these studies included Kanyakumari District. Indeed, a literature survey of the older Indian records in Moore (1858), Cotes & Swinhoe (1887), Hampson ([1893]) and Bell & Scott (1937) found mention of “Madras”, “Nilgiris” and “Ceylon” but not Kanyakumari District. It is worth mentioning that until India’s Independence Kanyakumari was part of what was then Travancore State and can be found described as the “South Travancore District” (Menon & Padmanabha 1929). Soon after independence, it became Kanyakumari District in the state of Tamil Nadu. Although there are records for some moth species from “Travancore” (see Appendix 1) as a geographical region, generally there is no specific mention as to what part of Travancore. Hence this paper presents, for the first time in nearly a century, a dedicated survey of moths in this unique part of the Western Ghats.

The focus of the present paper is the hawkmoths of the family Sphingidae. Adult hawkmoths are generally active at night, although some are diurnal or crepuscular in habit. They are mostly strong fliers that imbibe nectar from flowers while hovering, and many are important pollinators of night-blooming flowers. They are often robust moths, with elongate, triangular forewings and small hindwings, which makes them agile fliers. They have large eyes, antennae that are thick, hooked and apically pointed, and strong legs with well-developed spurs and numerous spines on the tarsi. The most comprehensive study of Indian sphingids, which focused on NW India and Kanara, remains that of Bell & Scott (1937), which included 75 species, subspecies and forms belonging to 27 genera. More recent faunal studies of sphingid moths in southern India are those of Sondhi et al. (2017) (Kerala; 29 species recorded over 31 nights’ sampling), Gurule (2013) (Maharashtra; 23 species from 67 nights’ sampling), Melichar (2012) (NW Karnataka; 49 species from surveys during the period 2008-2012) and Shubhalaxmi & Chaturvedi (1999) (Maharashtra; 21 species from surveys during the years 1994-1997).

MATERIALS AND METHODS

Study sites

The forests of Kanyakumari District and the village Suchindrum form the sites for the present survey. About 30% of Kanyakumari District is forest, occupying an area of about 40,000ha between 8.083° and 8.583°N, and 77.167° and 77.0°E. In 1996, Veerapuli and Klamalai Reserve Forests in this district came under the authority of the newly created Kalakad Mundanturai Tiger Reserve. In 2002, the remaining parts of the reserve forests were declared as Kanyakumari Wildlife Sanctuary (KKWS). The

sanctuary includes several different forest types, wet evergreen, moist and dry deciduous, shola, montane and riparian (Fig. 1, Table 1). The village of Suchindrum, at 8.15°N, 77.45°E, is located on the banks of the Pazhayar River and is surrounded by paddy, fields, coconut groves, irrigation tanks, and temple ponds. The Suchindrum, Theroor and Vembanoor irrigation tanks have been declared Important Bird Areas by BirdLife International (IBA-IN279) and from 2015 the Forest Department has maintained Suchindrum tank as a Conservation Reserve (Vismiju Viswanathan, former DFO, pers. comm. 01 May 2015).

Moths were surveyed at the following locations during the years 2011-2015. The surveys at Kalikesam, Maramalai, Balamore estate and Upper Kothayar were dependent upon the availability of accommodation at the sites and permissions from the forest department, so were quite unsystematic with regard to their scheduling.

Moths were surveyed primarily using a light trap consisting of a 160W mercury vapour bulb hung above a 3x5 feet white cotton sheet stretched between either two posts or trees, or sometimes nails on a wall. In case electricity was not available (Balamore and Maramalai), a petrol-powered Honda generator was used. The white screen was illuminated from 18.00h or 18.30h, depending upon sunset time, till 02.30h. Where electricity was available, the light was switched off at 03.30h. At Suchindrum, daytime moth activity was also recorded.

Unlike the neighbouring states of Kerala and Karnataka, the Tamil Nadu Forest Department actively discourages collecting, which is one of the contributory factors to the poor faunal record from this part of the Western Ghats. Although repeated requests were made and photographic evidence of new range records provided, permission to collect voucher specimens was not granted. Consequently, digital photography and manual observation notes were the only options available for recording. Digital photographs were taken using a Panasonic FZ 200 and a Panasonic FZ 35 with a Lumix lens. The studies were self-funded by the first author.

Identification of moths and compilation of distribution ranges were undertaken using the following literature sources: Cotes & Swinhoe (1887), Hampson ([1893]), Rothschild & Jordan (1903), Bell & Scott (1937), Holloway (1987), Pittaway & Kitching (2014) and Kitching (2018).

This paper presents a brief description of 27 hawkmoths recorded from KKWS and Suchindrum, Kanyakumari District, Tamil Nadu, India, supplemented by a list of hawkmoths from “Travancore” region, compiled from published records and specimens in the



Figure 1. India showing the state of Tamil Nadu - specific study sites in Kanyakumari District.

collection of the NHMUK (Appendix 1).

The moth species recorded in this study are discussed below in taxonomic sequence.

Subfamily Macroglossinae Harris, 1839

Tribe Macroglossini Harris, 1839

Subtribe: *Sphingonaepiopsis* genus-group

1. *Neogurelca hyas* (Walker, 1856)

Diagnosis: Head, thorax and abdomen grey-brown; patagia and tegulae edged in red brown; several pairs of reddish-brown lateral segmental on the abdomen. FW UP grey brown with a black basal spot; with two indistinct, curved antemedial lines, two highly angulate

postmedial lines, a curved submarginal line, and a subtriangular dark marginal patch below the apex. HW UP basally yellow; annular spot present at apex of discal cell; marginal band broad, brown and evenly curved. FW UN and HW UN ochreous and mottled brown, with a broad irregular, marginal grey brown band; inner margin of HW yellow.

Kanyakumari District locality: Suchindrum.

Distribution: Southern India & Sri Lanka; NW India along the southern edge of the Himalayas, east to southeastern China, Taiwan and southern Ryukyu Islands (Japan: Ishigaki-shima), then south to the Philippines, Sumatra and Java. Apparently absent from Borneo.

Similar species in southern India: none.

Table 1. Location of study sites along with elevation, habitat, and timeline.

	Place	Latitude	Longitude	Elevation in metres	Habitat type	Date
1	Kalikesam	8.4°N	77.383°E	115m	riparian	2011-2014
2	Maramalai	8.45°N	77.4°E	500m	mixed forest/estates	2012, 2015
3	Balamore	8.767°N	77.65°E	459m	wet deciduous & estates	2013
4	Upper Kothayar	8.533°N	77.45°E	950m	evergreen and montane	2012-2014
5	Suchindrum	8.25°N	77.767°E	0m	village near a river	2011-2017

Subtribe: Acosmerygina Tutt, 1904**2. *Acosmeryx akanshi* Melichar, Řezáč, Manjunatha & Horecký, 2014**

Diagnosis: FW UP grey, with transverse scalloped antemedial, postmedial and submarginal lines; discal spot inconspicuous; oblique dark band from middle of costa to tornus; outer margin excavated below the apex and again below the apex of vein M1. HW UP dark grey brown, slightly paler over basal half.

Kanyakumari District locality: KKWS, Maramalai. First record for Tamil Nadu

Distribution: Endemic to southern Western Ghats and Sri Lanka.

Similar species in southern India: none.

Subtribe: Choerocampina Grote & Robinson, 1865**3. *Hippotion celerio* (Linnaeus, 1758)**

Diagnosis: UP: Ground colour brown green; thorax with a white lateral stripe; abdomen with a pale white dorsal stripe, highlighted with spots on the segmental margins, and a white dorsolateral spot on each segment; FW with an oblique silvery band from the apex to the inner margin, with several more distal oblique brown lines and a whitish submarginal line; veins beyond the discal cell streaked black up to the black discal spot, followed by silvery streaks to the wing base; HW basal and tornal area bright pink; broad black medial and narrow submarginal bands separated by a row of broad pink patches, separated by the veins highlighted in black.

Kanyakumari District locality: Suchindrum.

Distribution: Widespread across the entire Old World tropics and subtropics, migratory into northern temperate regions.

Similar species in southern India: none.

4. *Hippotion rosetta* (Swinhoe, 1892)

Diagnosis: FW UP brown, with a pattern of indistinct, oblique lines across the centre of the wing, the heaviest of which are the basal most, which runs from the costa to the inner margin, and that which runs in from the apex as far as vein M3. HW UP pink with dark brown scaling along the costa and a similar narrow marginal band; tornus cream-buff.

Kanyakumari District locality: KKWS, Maramalai.

Distribution: Widespread in southeastern Asia, from Pakistan east to Taiwan, the southern Ryukyu Islands (Japan) and Palau, then south and east through the Philippines and Sunda Islands, to New Guinea, the Solomon Islands and Queensland (Australia). Also recorded from the Maldives, Cocos-Keeling Islands and the Andaman Islands in the Indian Ocean. Introduced

into Hawaii (USA).

Similar species in southern India: *Hippotion boerhaviae* (Fabricius, 1775), from which *H. rosetta* can be distinguished with certainty only by the shape of the juxta of the male genitalia. However, *H. rosetta* is in general less striped and has a slightly shorter forewing than *H. boerhaviae*. *Hippotion rafflesii* (Moore, [1858]) is also similar but has a richer brown ground colour to the FW UP and the tornus of the HW UP is pinkish, rather than the cream-buff of *H. rosetta* and *H. boerhaviae*. *H. boerhaviae* has yet to be recorded from Tamil Nadu but has been reported from other states in southern India.

5. *Hippotion velox* (Fabricius, 1793)

Diagnosis: Head, thorax, abdomen and HW UP dark brown; tegulae edged in cream; abdomen with black dorsal and subdorsal lines with cream/white lateral patches on abdominal segments 5-8. FW UP brown, with a series of oblique pale, slightly waved lines; discal spot black, conspicuous; dark brown spot near the tornus and three dark brown lines extending in from the apex as far as vein M2; fringe chequered cream and brown. HW UP brown, tornus and inner margin paler.

Kanyakumari District locality: Upper Kothayar.

Distribution: South India and Sri Lanka; from Nepal east to Taiwan and the Ryukyu Islands (Japan), then south and east through the Philippines, Sunda Islands, New Guinea, the Solomon Islands and Queensland (Australia) to Vanuatu, New Caledonia, Fiji, Tonga and Tokelau. Also recorded from the Maldives, Cocos-Keeling Islands, the Andaman Islands and Christmas Island in the Indian Ocean.

Similar species in southern India: none.

6. *Theretra castanea* (Moore, 1872)

Diagnosis: Overall ground colour bright reddish-brown to deep chestnut brown. Opening between segment 1 and 2 of the labial palps covered by single long scales. Antennae and legs white. FW UP with an irregular grey marginal band and a black discal spot. HW UP tawny; white fringes between veins CuA₂ and A. FW UN bright rufous with a broad but irregular marginal band.

Kanyakumari District locality: Upper Kothayar.

Distribution: Endemic to the Western Ghats.

Similar species in southern India: none.

7. *Theretra latreillii lucasii* (Walker, 1856)

Diagnosis: UP: Ground colour buff with tinges of olive brown or (when fresh) olive green; markings on abdomen indistinct. Forewings noticeably less elongate

than most other species of the genus. First segment of labial palp with slightly irregular scaling; apical cavity partly concealed by this scaling. FW UP with a series of faint to well-developed oblique lines, the first and fourth stronger than the others; discal spot black. HW UP dark brown. UN: Both pairs of wings with a pinkish tinge of wings; HW with a submarginal row of black spots on the veins.

Kanyakumari District locality: Suchindrum.

Distribution: Southern India and Sri Lanka; Nepal east to eastern China and Taiwan, then south through Burma, SE Asia and the Philippines, to Sumatra, Borneo, Java and the Lesser Sunda Islands. The nominotypical subspecies, *Theretra latreillii latreillii* occurs east from Sulawesi and the Moluccas, through New Guinea, to the Solomon Islands and Australia.

Similar species in southern India: *Theretra clotho clotho* (Drury, 1773) *Theretra gnoma* (Fabricius, 1775) and *Theretra shendurneensis* Sondhi, Kitching, Basu & Kunte, 2017. However, *T. latreillii lucasii* is easily distinguished from these three species by its relatively shorter forewings and the lack of a pair of lateral black spots near the base of the abdomen.

8. *Theretra nessus nessus* (Drury, 1773)

Diagnosis: UP: Head, thorax and centre of abdomen green, fading to brown. Second segment of labial palp strongly triangular in comparison to those of other species in the genus; opening between segments 1 and 2 large. FW UP olive brown with a green band along the costal margin, a pale medial band, a wavy postmedial band and a black discal spot; apex strongly falcate. Abdomen with conspicuous and diagnostic broad, golden yellow lateral stripes. HW UP: base black, with an irregular buff submarginal band. UN: Body and wings russet with a green streak at the base that extends to thorax; FW and HW postmedial bands and lines black, wavy and incomplete and a thin submarginal line extending to the apex.

Kanyakumari District locality: Upper Kothayar; KKWS, Kalikesam.

Distribution: Southern India and Sri Lanka; northwestern India east to Taiwan (migratory into southern Japan), then south through southeastern Asia, the Philippines and Indonesia as far as New Guinea. A second subspecies, *Theretra nessus albata* Fukuda, 2003, occurs east from New Guinea and eastern Australia, through the Solomon Islands, Vanuatu and New Caledonia to Fiji.

Similar species in southern India: none.

9. *Theretra silhetensis silhetensis* (Walker, 1856)

Diagnosis: Upperside of abdomen with a diagnostic single, solid white line. FW UP with a broad, oblique, brown discal band that narrows towards the apex; immediately distal and parallel to this, in the space between the third and fourth postmedial lines, is a narrow silvery line running from near the apex to the inner margin; space between the fourth and fifth postmedial lines beige and broader; fifth postmedial line broader than the sixth; discal spot black.

Kanyakumari District locality: Suchindrum.

Distribution: Southern India and Sri Lanka; NW India east to Taiwan (migratory into southern Japan), then south through southeastern Asia, to Borneo, Sumatra, Java and the Lesser Sunda Islands. A second subspecies, *Theretra silhetensis intersecta* (Butler, [1876]), occurs east from the Philippines and Sulawesi and eastern Australia, through the Solomon Islands, Vanuatu and New Caledonia to Fiji.

Similar species in southern India: *Theretra oldenlandiae oldenlandiae* (Fabricius, 1775). However, *T. silhetensis* is easily distinguished from this species by the single, rather than double, dorsal abdominal line.

Subtribe: Macroglossina Harris, 1839

10. *Angonyx krishna* Eitschberger & Haxaire, 2006

Diagnosis: UP: Head, thorax (except metanotum), abdomen and wings bright green, but fading to brown in old specimens or dead specimens exposed to high humidity; metanotum russet. Labial palps large, obtuse, second segment longer than the first. FW UP with a pink-grey medial band running from the costa to the inner margin; black submarginal spot present between veins M1 and M3, black colour extending to the outer margin; a pale green oblique patch from the base from costal margin to R1(?). HW UP blackish with a pinkish- or orange-grey submarginal band and a thin white band on the margin. UN: Wings russet with a brown submarginal band.

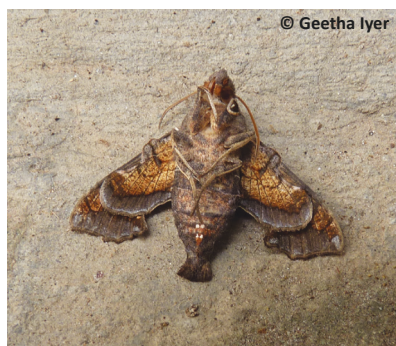
Kanyakumari District locality: KKWS, Maramalai; Kalikesam. First record for Tamil Nadu

Distribution: Endemic to the Western Ghats and Sri Lanka.

Similar species in southern India: none.

11. *Daphnis nerii* (Linnaeus, 1758)

Diagnosis: UP: Ground colour bright green, with wavy bands of grey and pink, but often fading to brown in old specimens or dead specimens exposed to high humidity. Head rufous in front, green behind, with a grey band on vertex; thorax green; patagia grey posteriorly; abdomen

Image 1a. *Neogurelca hyas* - UNImage 1b. *Neogurelca hyas* - UPImage 2. *Acosmeryx akanshi*Image 3. *Hippotion celerio*Image 4. *Hippotion rosetta*Image 5. *Hippotion velox*Image 6a. *Theretra castanea* - UNImage 6b. *Theretra castanea*Image 7. *Theretra latreillii lucasii*Image 8. *Theretra nessus nessus*Image 9. *Theretra silhetensis silhetensis*Image 10. *Angonyx krishna*

pale green with dark green lateral oblique stripes. FW with a conspicuous small green spot surrounded by a paler halo; basal patch solid green; antemedial line closer to basal patch than to the proximal edge of the medial green area; green and pink oblique bands from costa to M3 and an oblique streak from apex to M1. HW UP greenish, with brown scaling along the costa and a thin white postmedial line. FW and HW UN with a strong pale postmedial line bordered distally by an orange band.

Kanyakumari District locality: Suchindrum.

Distribution: Widespread across the entire Old World tropics and subtropics, migratory into northern temperate regions

Similar species in southern India: *Daphnis hypothous crameri*. However, *D. nerii* is readily distinguished from *D. hypothous* by its brighter green ground coloration and the lack of a conspicuous white spot near the apex of the forewing upperside.

12. *Daphnis hypothous crameri* Eitschberger & Melichar, 2010

Diagnosis: UP: Ground colour dark olive-green. Head and patagia dark purple brown; thorax pale grey; tegulae and first two abdominal segments dark green, the remaining segments dark olive brown, with the streaks and spots as in *D. nerii*. FW UP ground colour dark olive green; pattern elements similar to those of *D. nerii* but with a conspicuous white apical spot (visible also on the underside). FW and HW UN postmedial line inconspicuous and often diffuse and incomplete.

Kanyakumari District locality: KKWS, Maramalai.

Distribution: Southern India and Sri Lanka; NW India east to Taiwan (migratory into southern Japan), then south through southeastern Asia, the Philippines, Borneo and Sulawesi, to Sumatra, Java and the Lesser Sunda Islands. The nominotypical subspecies, *Daphnis hypothous hypothous* (Cramer, 1780) occurs in the Moluccas.

Similar species in southern India: *Daphnis nerii*. However, *D. hypothous crameri* is readily distinguished from *D. nerii* by its darker, olive green ground coloration and the presence of a conspicuous white spot near the apex of the forewing upperside.

13. *Macroglossum assimilis* Swainson, 1821

Diagnosis: UP: Overall ground colour brown and grey. Abdomen with orange yellow lateral patches on segment 2-4 and dark brown lateral patches on segments 5 and 6. FW UP flushed with grey medial and submarginal bands, antemedial and postmedial bands dark brown;

antemedial band broadening from costa to inner margin; conspicuous and diagnostic dark brown or black ovate spot apically between veins Rs4 and M1; the grey costal area on its proximal side not sharply limited posteriorly but continuous with the grey submarginal area. HW upperside orange-yellow with a dark brown/black base and broad marginal band. FW and HW UN ground colour brown, greyish towards the base; HW inner margin with a sharply delimited chrome yellow patch.

Kanyakumari District locality: KKWS, Maramalai.

Distribution: Endemic to southern India and Sri Lanka.

Similar species in southern India: *Macroglossum belis*, from which *M. assimilis* differs primarily in the more conspicuous dark brown or black spot near the apex of the forewing upperside.

14. *Macroglossum belis* (Linnaeus, 1758)

Diagnosis: UP: Head, thorax and abdomen brown with tinges of red. Labial palps dirty white. Abdomen with orange yellow lateral marks segments 2-4; dark brown/black patches laterally on segment 5, dorso-laterally on segment 6 and mesally on segment 7; lateral white tufts on distal segments. FW UP: antemedial band narrowing slightly towards the costa; postmedial lines converging slightly on the costa and diverging slightly on the inner margin; subapical brown spot between veins Rs4 and M1 not prominent and proximal grey patch sharply delimited by vein M1. HW UP: orange-yellow medially, with a dark brown basal patch and a dark brown marginal band. UN: Labial palps, head and thorax dirty white; legs and abdomen brown; FW and HW UN ground colour brown (slightly darker than in *M. assimilis*), greyish towards the base; HW inner margin with a sharply delimited chrome yellow patch.

Kanyakumari District locality: KKWS, Maramalai.

Distribution: Pakistan, east through the southern Himalaya to southeastern China, then south to Thailand, Cambodia and Vietnam. Records from Sumatra, Java, Taiwan and the Ryukyu Islands remain to be confirmed.

Similar species in southern India: *Macroglossum assimilis*. from which *M. belis* differs primarily in the inconspicuous (or absent) brown near the apex of the forewing upperside.

15. *Macroglossum gyrans* Walker, 1856

Diagnosis: UP: Head, thorax, and basal half of abdomen and forewing grey-brown; metanotum tawny laterally. Abdominal segments 2-4 with three large confluent orange patches; white patch with a black central spot on the base of segment 7. FW grey; paired

antemedial and postmedial lines with spaces between them ground colour; postmedial lines sinuate, strongly directed distally between veins M1 and M3. HW orange, with a brown marginal band, one merging gradually into the other. UN: Labial palps, head, thorax, and legs, except tarsomeres, pure white, this coloration extending onto the first three abdominal segments; laterally, thorax and legs brown; abdomen a mix of white and brown scaling, with white lateral tufts on segment 4. FW and HW UN grey brown; basal half of FW tinged with orange; HW inner margin with a chrome yellow patch that gradually becomes orange then brown distally.

Kanyakumari District locality: Suchindrum. First record for Kanyakumari District and Tamil Nadu.

Distribution: From the Maldives and India, east to Thailand, Laos and Vietnam; also reported from Borneo, Java, the Lesser Sunda Islands and Sulawesi.

Similar species in southern India: *Macroglossum affictitia* Butler, 1875, from which *M. gyrans* differs in the brownish (rather than orange) medial band of the hindwing with a diffuse outer edge.

Tribe Macroglossini Harris, 1839

Subtribe: Clarinina Tutt, 1904

16. *Epinanga assamensis* (Walker, 1856)

Diagnosis: Strongly sexually dimorphic. Male UP: Head, thorax, abdomen and wings pale greyish-brown. A pair of divergent, broad, dark-brown stripes from the head to the tegulae, continuing as paler patches to abdominal segment 2. FW strongly excavated below the apex, outer margin sinuate from vein M3 to tornus. FW UP with a small black basal spot followed by two faint antemedial lines; four contiguous black patches from vein CuA₁ to costa at end of discal cell; postmedial band pale brown, running from inner edge to M2, gradually fading. HW mostly uniformly dark brown, with an indistinct orange buff medial band across wing from near tornus to vein Rs. UN: Body and legs pinkish-grey; small patches of pinkish-orange enclosing a yellow-white spot on abdominal segments 4-8 and white tufts apically. FW and HW UN mostly pinkish-orange; postmedial lines mostly faint, strongest between vein M1 and costa on; marginal bands on both wings greyish-brown, inner edges highlighted in brown (more strongly on the FW than the HW), that on the FW with a median pale grey band.

Female (not yet observed in southern India): UP: ground colour brown; pair of divergent, broad, dark brown stripes from the head to the tegulae, continuing as paler patches to abdominal segment 2, as in male

but much less conspicuous against the darker ground colour. FW outer margin less strongly sinuate than the male. FW UP lacking the four dark brown patches of the male, instead with a conspicuous dark brown discal spot and narrow medial band. HW UP: orange suffused with brown scales; marginal band brown. FW and HW undersides similar to the male but brighter orange with few scattered brown scales.

Kanyakumari District locality: KKWS, Kalikesam. First record for Tamil Nadu.

Distribution: Southern India; NE India and Bangladesh, east through Thailand, Laos and Vietnam, to SE China; also, the Andaman Islands. A new record for southern India and a range extension for the species. However, it remains to be critically determined whether this population is conspecific with *E. assamensis* from elsewhere or a separate species, a study that cannot be undertaken in the absence of voucher specimens.

Similar species in southern India: none.

Subfamily Smerinthinae Grote & Robinson, 1865

Tribe Ambulycini Butler, 1876

17. *Ambulyx matti* (Jordan, 1923)

Diagnosis: UP: Tawny coloured moth with long wings. Labial palps, foretibiae and foretarsi yellow. Outer edges of tegulae and metathorax laterally dark chocolate brown. Abdomen with a distinct brown longitudinal dorsal line. FW: inner margin shallowly excavated before the tornus. FW UP: a small circular spot and a prominent dark brown spot on the costa subbasally; a diffuse black patch near the tornus; antemedial and postmedial lines indistinct; veins distal to discal spot highlighted in dark brown; submarginal line dark brown with an indistinct yellowish inner edge. HW UP yellow with a diffuse black basal patch and blackish-brown antemedial, postmedial and submarginal lines extending from inner margin to costa.

Kanyakumari District locality: KKWS, Maramalai. First record for Tamil Nadu.

Distribution: Endemic to the Western Ghats.

Similar species in southern India: *Ambulyx auripennis* Moore, 1879, *Ambulyx belli* (Jordan, 1923) and *Ambulyx substrigilis aglaia* (Jordan, 1923). *Ambulyx matti* differs from *A. belli* in the presence of a strong brown dorsal line along the abdomen (very faint or absent in *A. belli*) and from *A. auripennis* and *A. substrigilis aglaia* in the presence of a conspicuous dark brown spot on the costa near the base on the forewing upperside. However, these features are rather individually variable, and dissection of the male genitalia and DNA barcoding is

advised for confirmation of identifications in this difficult genus.

18. *Amplypterus panopus karnatakaensis* Melichar & Řezáč, [2014]

Diagnosis: UP: Head and thorax chocolate brown, anterior half of abdomen pale grey, distal half brown with paired subdorsal greyish patches. FW UP: Basal area chocolate brown with two narrow, zigzag basal lines and a broader, more even subbasal band; middle part of the wing pale grey with a purplish tinge; postmedial line narrow, chocolate brown, straight; rudimentary eye-spot pattern at the tornus. When at rest, the basal lines are continuous across with the dark posterior margin of the thorax, and the postmedial lines are continuous with the dividing line across the abdomen. The effect is to cut the moth into three parts with straight lines and is effective camouflage among leaves. HW UP medially pink, distal to which are narrow dark brown postmedial and submarginal lines and a brown marginal band, all crossed by dark brown highlights along the veins. FW and HW UN mostly pale yellow (FW distally orange) with irregular pale grey brown bands and spots.

Kanyakumari District locality: Upper Kothayar. First record for Tamil Nadu.

Distribution: Endemic to the Western Ghats. Other subspecies occur from NW India, east to SE China, the Philippines, Timor and the Moluccas.

Similar species in southern India: none.

Tribe Sichiini Tutt, 1902

19. *Marumba dyras dyras* (Walker, 1856)

Diagnosis: UP: Body and wings pale greyish-brown, with a darker brown dorsal line running from the head to the tip of the abdomen; FW outer margins strongly scalloped. FW UP: Wing crossed by 10 narrow brown transverse lines, representing the subbasal (1), antemedial (4), postmedial (2) and submarginal (3) bands. The antemedial lines converge towards the inner edge and may meet before or on the edge or not meet, this being individually variable. Two dark brown spots near the tornus, one anterior and more basal than the other, which is on the inner margin; the submarginal lines converge distal to these spots and then are sharply reflexed back and around each side of the spots. HW UP: Ground colour orange brown, tornal pale grey, containing two dark brown spots. UN: Body rusty brown. FW UN: marginal area darker than the rest of the wing with a few indistinct lines and an orange patch at the tornus. HW UN: pinkish-brown, with two postmedial and two submarginal dark brown lines; tornus with an

orange patch similar to that on the FW.

Kanyakumari District locality: Upper Kothayar; KKWS, Maramalai; Kalikesam.

Distribution: Southern India and Sri Lanka; northern Pakistan and northwestern India, east to eastern China and Taiwan, then south through southeastern Asia and Borneo, to Sumatra and Java.

Similar species in southern India: none.

20. *Marumba nympha* Rothschild & Jordan, 1903

Diagnosis: UP: Body and wings orange-brown, with a lilac flush on the thorax and FW; labial palps, uppersides of legs and antenna brownish black; black mesial line on head and thorax; thorax crested. FW UP: Transverse lines and bands as in *M. dyras* but much less conspicuous; areas between these bands flushed with lilac; dark brown tornal spots small, edged in lilac. HW UP: Ground colour similar to the FW but slightly greyish and lacking the lilac flush except near the tornus around the dark brown spots. UN: Head dark brown; thorax and abdomen orange. FW and HW UN: Similar in ground colour to upperside but flushed with pink, particularly on the body and HW.

Kanyakumari District locality: Upper Kothayar.

Distribution: Endemic to the Western Ghats.

Similar species in southern India: none.

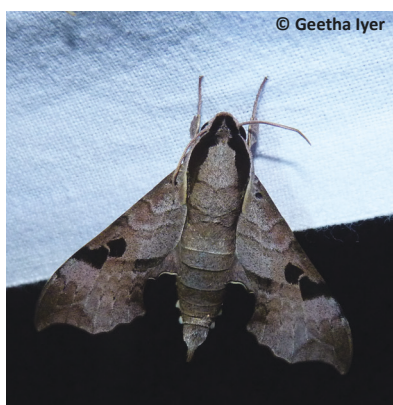
Subfamily Sphinginae Latreille, [1802]

Tribe Sphingini Latreille, [1802]

Subtribe "*Psilogramma* genus-group"

21. *Psilogramma vates* (Butler, 1875)

Diagnosis: UP: Ground colour of head, thorax, abdomen and FW pale grey; outer edges of tegulae and metathorax laterally and posteriorly dark brown/black, the latter with a yellowish anterior margin and two small lateral pale blue patches; abdomen with a dorsal and two lateral, black longitudinal stripes that fade out by the sixth and seventh segments respectively. FW UP: Subbasal, antemedial, postmedial and submarginal bands generally represented by short, dark brown lines that extend across the wing no further than the discal cell; two short, longitudinal stripes below the discal cell between veins M3 and CuA₁ and CuA₁ and CuA₂; a black zigzagged streak extending in from the apex as far as the submarginal line. Occasionally, the entire area between the antemedial and submarginal lines may be filled in black. HW UP uniformly brown, except for some pale grey scaling at the tornus. Fringes of both wings chequered black and white. UN: Abdomen pure white, with only slight brownish colour on segments 5-8.

Image 11. *Daphnis nerii*Image 12. *Daphnis hypothous crameri*Image 13. *Macroglossum assimilis*Image 14. *Macroglossum belis*Image 15a. *Macroglossum gyrans* showing HWImage 15b. *Macroglossum gyrans*Image 16. *Enpinanga assamensis*Image 17. *Ambulyx matti*Image 18. *Amplypterus panopus karnatakaensis*Image 19. *Marumba dyras*Image 20. *Marumba nympa*Image 21. *Psilogramma vates*

Kanyakumari District locality: KKWS, Kalikesam. First record for Tamil Nadu.

Distribution: Sri Lanka and the Western Ghats, north to Maharashtra; also, N and NW Pakistan.

Similar species in southern India: *Psilogramma renneri*, from which *P. vates* differs in its generally smaller size, overall grey ground colour to the forewing upperside and pure white underside to the abdomen.

22. *Psilogramma renneri* Eitschberger, 2001

Diagnosis: UP: Similar in pattern to *P. vates* but ground colour dark brown with grey brown elements replacing the pale grey (the degree of development of which is subject to much individual variation); in particular, in most specimens the triangle between the outer antemedial line, the inner postmedial line and vein CuA₂ is much darker than the surrounding areas and as a result, the pale discal spot is very prominent. UN: Abdomen with scattered brown scales on all segments, rendering it a rather dirty brown-white overall.

Kanyakumari District locality: KKWS, Kalikesam. First record for Tamil Nadu.

Distribution: Endemic to the Western Ghats and Sri Lanka.

Similar species in southern India: *Psilogramma vates*, from which *P. renneri* differs in its generally larger size, overall brown ground colour to the forewing upperside and a brownish suffusion of scales on the underside of the abdomen.

Subtribe: *Acherontiina* Boisduval, [1875]

23. *Acherontia styx* Westwood, 1847

Diagnosis: UP: Head brown; thorax pale brown with grey shades and a pair of black dots centrally; tegulae dark blue-grey with a longitudinal dark brown line medially and the inner edge highlighted in dark brown. Together these form the characteristic “skull mark” of *Acherontia* species, hence the common name of ‘Death’s head hawkmoths’. Abdomen yellow with black bands on segments and a blue-grey dorsal band. FW UP: brown and grey, with three discontinuous antemedial lines and two curved postmedial lines. HW UP: yellow with a narrow black postmedial and submarginal band, neither of which reach the costa or inner margin.

Kanyakumari District locality: Upper Kothayar.

Distribution: From Syria, Jordan and western Saudi Arabia, east to the Korean Peninsula and Japan (migratory into Manchuria and the Russian Far East), the Philippines, Sulawesi and Timor

Similar species in southern India: *Acherontia lachesis*, from which *A. styx* differs in its generally smaller size,

yellow base to the hindwing upperside and lack of red scaling below the “skull-mark” on the thorax.

24. *Acherontia lachesis* (Fabricius, 1798)

Diagnosis: Larger and darker than *A. styx*. UP: Metathorax, posterior margin of mesothorax and edges of the “skull mark” with red hairs; “skull mark” more contrastingly patterned, with a longitudinal median yellow line and yellow surrounds to the pair of dark spots. Abdomen predominantly dark brown/grey with thick black segmental bands; medial blue grey band and yellow lateral patches greatly reduced. HW UP: Yellow coloration greatly reduced by the dark brown basal patch and the broad medial and postmedial bands.

Kanyakumari District locality: Upper Kothayar.

Distribution: Pakistan, east to Japan, Taiwan, the Philippines, New Guinea and the Bismarck Archipelago. Also recorded from the oceanic island groups of Chichijima, Palau and the Chagos Archipelago, with a single record from Socotra.

Similar species in southern India: *Acherontia styx*, from which *A. lachesis* differs in its generally larger size, black base to the hindwing upperside and presence of red scaling below the “skull-mark” on the thorax.

25. *Agrilus convolvuli* (Linnaeus, 1758)

Diagnosis: Sexually dimorphic grey moth. UP: Abdomen with a broad grey, dorsal band and a thin darker central line, segment 1 with lateral black patches, those on segments 2-6 anteriorly dirty pink and posteriorly black. FW UP: in male, light to dark grey with extensive contrasting dark grey and brown markings; in female, uniformly pale grey, with few or no contrasting markings. HW UP ground colour pale grey with brown antemedial, (double) postmedial and submarginal bands.

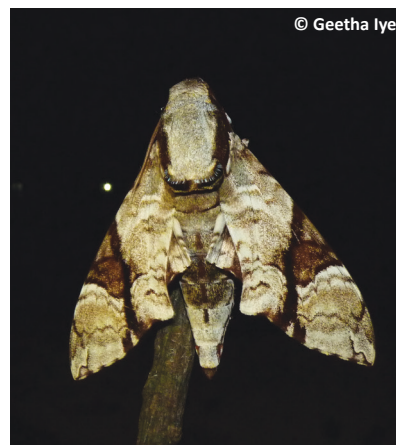
Kanyakumari District locality: Upper Kothayar.

Distribution: Widespread across the entire Old World tropics and subtropics, migratory into northern temperate regions.

Similar species in southern India: none.

26. *Megacorma obliqua obliqua* (Walker, 1856)

Diagnosis: Proboscis longer than the body. Labial palp structure distinctive: apex of segment 1 with a large cavity, segment 2 shorter than segment 1, triangular and narrow at the base. Thorax very long, more than half length of the abdomen. FW with outer and inner margins strongly excavate before tornus, making the tornal angle more produced. FW UP: Ground colour pale grey/white; a dark brown/black line crossing the wing

Image 22. *Psilogramma renneri*Image 24. *Acherontia lachesis*Image 26. *Megacorma obliqua obliqua*Image 23. *Acherontia styx*Image 25. *Agrius convolvuli* FemaleImage 27. *Dolbina manjunatha*

from the costa to the outer margin above the tornus; the area between this and the postmedial band pale brown. HW UP: Brown, marginal area either side of the tornus pale grey.

Kanyakumari District locality: Upper Kothayar. First record for Tamil Nadu.

Distribution: Southern India and Sri Lanka; NE India and Bangladesh, east to the Philippines, Borneo and Java; also, the Moluccas and New Guinea. Replaced by other subspecies in Sulawesi, the Bismarck Archipelago and the Solomon Islands.

Similar species in southern India: none.

Tribe Sphingulini Rothschild & Jordan, 1903

27. *Dolbina manjunatha* Haxaire & Melichar, 2013

Diagnosis: UP: Head, thorax and abdomen dark brown. Thorax with a 'skull mark' (though not as

conspicuous as that of the *Acherontia* species due to the much darker and more uniform coloration). Fore tibia without an apical thorn. Abdomen with a dark brown central line as far as segment 7, bisected by a transverse brown black band at the posterior margin of each segment that has a small white central spot. FW UP: ground colour dark brown, with a complex pattern of zigzag transverse black and pale grey lines. UN: ground colour dirty white, abdominal segments 2-6 with large median brown patches, posterior segments all brown. FW & HW UN: anthracite grey; transverse pattern elements extremely inconspicuous or absent.

Kanyakumari District locality: KKWS, Maramalai. First record for Tamil Nadu.

Distribution: Endemic to the Western Ghats.

Similar species in southern India: none.

CONCLUSION

The present survey reports on 27 species of hawkmoths, all new records for Kanyakumari District, of which nine are also new records for the state of Tamil Nadu. Although the survey was conducted opportunistically over a relatively short time period, this nevertheless clearly indicates that the district has appropriate habitats- not only in forests but also in villages and other anthropogenic environments - where hawkmoth diversity can thrive. A more thorough survey for longer periods of time throughout the year is likely to reveal the presence of not only greater diversity but also endemism. It is hoped that the results of the present study will encourage conservation activities to save the diverse habitats in Kanyakumari District.

Species in the collection of the Natural History Museum, UK, collected in the erstwhile Travancore State that are likely to be found in the Kanyakumari region. Names in parentheses are the collectors of the specimens.

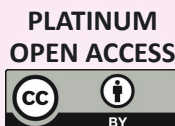
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Appendix 1. Species from the collection of the Natural History Museum UK, collected from the erstwhile Travancore State and likely to be found in the Kanyakumari District.

1. *Theretra gnoma* (Fabricius, 1775): Travancore (Place)
2. *Theretra lycetus* (Cramer, 1775): Travancore (Place)
3. *Theretra oldenlandiae oldenlandiae* (Fabricius, 1775): Travancore (Place)
4. *Pergesa acteus* (Cramer, 1779): Travancore
5. *Macroglossum divergens heliophila* Boisduval, [1875]: Travancore (Place)
6. *Macroglossum mitchellii imperator* Butler, 1875: Travancore, 1932 (C. Rowson)
7. *Leucophlebia lineata* Westwood, 1847: Travancore (Place); Travancore, Peermaade; Travancore, Peermaade (Mrs Imray); Travancore, Pirmad (R.S. Imray)





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