

Notes on Hawk Moths (Lepidoptera—Sphingidae) in the Karwar-Dharwar transect, peninsular India: a tribute to T.R.D. Bell (1863-1948)¹

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Abstract. This is an update of the Hawk-Moths flying in the transect between the cities of Karwar and Dharwar in northern Karnataka state, peninsular India, based on and following up on the previous fairly detailed study made by T.R.D. Bell around Karwar and summarized in the 1937 FAUNA OF BRITISH INDIA volume on Sphingidae. A total of 69 species of 27 genera are listed. The Western Ghats 'Hot Spot' separates these towns, one that lies on the coast of the Arabian Sea and the other further east, leeward of the ghats, on the Deccan Plateau. The intervening tract exhibits a wide range of habitats and altitudes, lying in the North Kanara and Dharwar districts of Karnataka. This paper is also an update and summary of Sphingidae flying in peninsular India. Limited field sampling was done; collections submitted by students of the Agricultural University at Dharwar were also examined and are cited here. Larval food-plants, inclusive of crop plants, are noted under each species and the known host range given.

Introduction

This paper is a preliminary effort towards a future updated documentation of the Entomology of what is known as the "southern Bombay Deccan and Mahratta Country" (see Butler, 1881; and map). Our paper is also an encomium of T.R.D. Bell, I.F.S., a well-known British (Irish) amateur naturalist who joined as D.F.O. at Dharwar on 24th November, 1884 and whose 150th birth anniversary falls this year. An informative obituary about Bell was written by Norman Kinnear (1949) about his life in what are now India and Pakistan, and about his extensive field work and studies on our insects, birds and plants here.

One of us (KG) now resides in the small university town of Dharwar (pronounced, and now spelled "Dharwad," in local vernacular), on the foothills of the Western Ghats, and his immediate current focus for researches on select insect taxa, and of birds, are the districts of Ratnagiri (+ Sindhudurg), Satara, Sangli, Kolhapur (all in Maharashtra State); Bijapur (+ Bagalkot), Belgaum, Raichur (+ Koppal), Dharwar (+ Gadag, Haveri), North Kanara (these in Karnataka); and the state of Goa as well. Besides the Konkan—Canara coastal lowlands (35-80 km wide, sea level to 200m) and the Bhima and Krishna river valley plains 656-1,640ft (200-500m) in the extreme north-east of Bijapur and most of Raichur districts, all of this SBDMC area is a plateau (Deccan) above 500m lying east of the Western Ghats. The highest peak on the ghats in this area is at Mahabaleshwar 4,719ft (1438m) and all other peaks on the crest average 3,000ft (900-1000m). The Deccan Plateau here has hillocks (droogs) of 2,101 to 2,487ft (640-758m) and the area of KG's current focus (SBDMC) lies in the south-western one-third corner of this biogeographical area. Ghorpadé (1996) had pointed out earlier the lack of detailed research on Deccan Plateau birds and other fauna.

The Deccan Plateau is sadly downplayed by conservationists and their creed, owing perhaps to ignorance and lack of proper documentation of its biota. As one of us had tried to point out (Ghorpadé, 2004) why are only areas of high species diversity recognized, celebrated, as "Hot

¹This paper is dedicated to T.R.D. Bell (1863-1948) in the year of his 150th birth anniversary.

Spots" ? If we say that the Blackbuck (*Antelope cervicapra*) and not the Tiger (*Panthera tigris*) is our dominantly endemic mammal, would we be wrong ? Col. W.H. Sykes' pioneering "Dukhun" focus is a fascinating, singular ecosystem located in our peninsula which is geologically among the most ancient of any landmass on earth. Subba Rao's (1999) book on the "Deccan Volcanic Province" throws a lot of light on the various stages in the growth and evolution of the Deccan traps. Its evolution—geological, climatological, botanical, and zoological—should be fascinating historical events for field biologists, taxonomists, biogeographers, phylogeneticists and others. It is surprising and noticeable that even Mani (1974) in his comprehensive tome on the "Ecology and Biogeography in India" did not have a chapter on the Deccan Plateau and even that (Chapter XIX) on the biogeography of the peninsula (pp. 614-647) had nothing to say of the Deccan elements, either endemics or others. As an indication of the animal diversity already known from this target area, a search of the available literature (by KG) gave the following species numbers of some popular and fairly well researched groups: Butterflies 271 spp., Dragonflies & Damselflies (Odonata) 57 spp., Lady beetles (Coccinellidae) 91 spp., Tiger beetles (*Cicindela*) 35 spp., and Birds 495 spp. (these additionally including those flying on the ghats).

This paper is dedicated in tribute to Mr Thomas Reid Davys Bell (1863-1948), a classical naturalist who lived in Dharwar and then at Karwar from 24th November 1884 to 24th June 1948, almost 64 years. A small part of his collection is maintained at our department in UAS Dharwar, but the major portion of it was sent in 1930 to the then British Museum (Natural History) in London and presented to the National Collection there. Norman Kinnear (1949) wrote : "This magnificent gift was probably the largest collection personally collected by one man and consisted of 3,000 butterflies, 12,000 moths, 1,900 coleoptera, 1,720 hymenoptera and 20 orthoptera. In many cases there were long series of butterflies and moths bred by himself. For many years he had taken an interest in hawkmoths and had been in correspondence with the late Lord Rothschild and Dr. K. Jordan in England and Major F.B. Scott, a keen collector in Assam. By 1924 Bell and Scott between them had bred eighty out of the one hundred and ninety-two species known to occur in India, Burma and Ceylon, and the former's collection contained some 1,500 specimens. He now was desirous of publishing a review of the Kanara Sphingidae with descriptions of the larvae, but unfortunately his manuscript was so bulky that none of the Societies he approached would publish it. This was a very great blow to him, but fortunately it was ultimately arranged that he and Scott should combine together and write the volume on the Sphingidae in the fauna of British India series which was published in 1937."

"In the early nineties [1890s] natural history flourished in Kanara. Bell was the Forest Officer, James Davidson, his life-long friend, the Collector and E.H. Aitken ["EHA"] in charge of Salt and Excise. . . In his study of lepidoptera Bell owed much to these two, and in 1896 all three combined in writing a paper on the butterflies of North Kanara, his first contribution to the *Journal* [see Davidson et al., 1896]. In addition to his great interest in entomology Davidson was a keen ornithologist and had contributed papers to *Stray Feathers* and the *Journal*."

"He will be mourned by a very large circle of friends who will look back with pleasure to the delightful days spent in his company. One can picture him now in his beloved Kanara, his tall, slim figure, with exceptionally long legs, clad in a suit of green shikar cloth of peculiar make, with white canvas rope-soled shoes on his feet striding through the jungle or jumping from one rock to another with extraordinarily youthful agility. That was T.R.D. Bell as we love to think of him."

This obituary written by Kinnear (1949) in the B.N.H.S. *Journal* gives five interesting pages of information about Bell, along with a portrait of this quintessential British Indian naturalist, and is interesting reading for those who may want to.

The Sphingidae of the Indian subregion were documented extensively and accurately by Bell & Scott (1937). They treated a little more than 200 species, of which less than 75 species in 27 genera probably occur in "Dravidia" (Central and Peninsular India) (see Bell & Scott, 1937: 34). Bell reported 62 species of 26 genera from the North Kanara district (*ibid.*, pp. 499-500). Pogue (2009) recently mentioned a total of 1,348 described species of Sphingidae (superfamily Bombycoidea) known from the world and placed in 203 genera, with "greatest diversity in the tropics." Kitching & Cadiou (2000) is the definitive monograph of Sphingidae of the world. Hampson (1893: 65-122) had listed 121 Indian species, mostly hill forms not recorded from the plains. But a few species are common in the plains.

Maxwell-Lefroy in his classic book on *Indian Insect Life* (1909: 464-469) wrote that “caterpillars are wholly herbivorous, feeding on the leaves of their foodplants which usually embrace a few allied species. They feed usually in the morning and evening only. . . The moths are usually crepuscular, the smaller ‘humming bird hawks’ being alone seen flying by day. Food is the nectar extracted from flowers, the moth hovering before the flower, the long proboscis being inserted to suck it out; white flowers that bloom at night attract these moths and it is a wonderful sight to watch such plants when large numbers of the moths come. *Quisqualis indica* is a favourite flower, being white at night to attract these moths, though it is red by day. The moths are extraordinarily swift of flight and very powerful. . . The duration of the larval stage is relatively long, the larger species requiring two months to become full-grown, the pupal stage then being moderately long and the imaginal life shorter. . . Few are pests since they are insects that increase but slowly, but a few are found feeding on cultivated plants and are occasionally numerous. . . The larvae are parasitized by parasitic Hymenoptera and Diptera as are other caterpillars, and these parasites are the chief check. Birds readily eat the caterpillars when they find them, and help to check them when they are numerous.” On collecting he wrote “Moths are caught on the wing by day (*Macroglossinae*) or at dusk at flowers. Some come to light and the occurrence of these is worth noting even if they be common species.”

Chandaragi et al. (2011) noted 11 species from the “transitional tract of Dharwad” based on the first author’s masters degree research. It is unfortunate that there have been no other studies of Sphingidae faunistics from peninsular India in the past 70-80 years ! Roonwal & Thapa (1963) published a list of identified Sphingidae material present in the F.R.I. collection, and those recorded from peninsular India are also incorporated in the checklist below. They cited “the more important references on the family” (q.v., Pp. 455-456). Nayar et al. (1976) appended a most useful “List of Insects infesting shrubs, plants and trees in India” (for 161 spp.) in their textbook on *General and Applied Entomology*, and whatever Sphingidae species have been cited by them are also included below, with crop plant names, for more complete information. The Forest Research Institute published comprehensive bulletins on insects feeding on forest plants, and data on Sphingidae species in peninsular India have been incorporated below. However, we can expect not more than 70 species of Sphingidae in the transect that this paper documents (known spp. from the Dharwar area are asterisked in the checklist below) and all available details of the known fauna are given below for the interested student :

Annotated Checklist of Sphingidae from the Karwar—Dharwar transect

SPHINGIDAE—ASEMANOPHORAE

Subfamily ACHERONTIINAE

Tribe Acherontiini

**Acherontia styx* Westwood, 1848 [FBI, Moths 5: 58-60, Fig. 9C, Pl. VIII]

Ubiquitous and frequent in drier tracts in open country. Bell & Scott (1937: 508) list the following food-plants of larvae: *Dolichos lablab* (Fabaceae), *Eugenia jambolana* (Myrtaceae), *Coccinia* sp. (Cucurbitaceae), *Jasminum* spp., *Nyctanthes* sp. (Oleaceae), *Solanum* spp., *Datura* sp. (Solanaceae), *Bignonia megapota*, *Tecoma stans* (Bignoniaceae), *Sesamum indicum* (Pedaliaceae), *Vitex negundo*, *Clerodendron* spp., *Citharexylum suberratum* (Verbenaceae), *Coleus* sp. (Lamiaceae). Usman & Puttarudriah (1955: 79) give “Collected on jasmine in Bangalore, April.” Mathur & Balwant Singh (1957: 5, 6; 1959: 17, 57, 86, 101; 1960a: 75; 1960b: 31, 127, 129; 1961b: 9, 80) write larva defoliates *Clerodendrum inerme*, *C. infortunatum*, *Vitex negundo* (Verbenaceae), *Datura* sp., *Nicotiana tabacum* (Solanaceae), *Syzygium cuminii* (Myrtaceae, as ‘*Eugenia*’), *Erythrina lithosperma*, *Jasminum arborescens*, *Ligustrum lucidum*, *Nyctanthes* sp. (Oleaceae) *Tecoma stans* (Bignoniaceae) and *Dolichos lablab* (Fabaceae). Ramakrishna Ayyar (1963) gave “Lab-lab, gingelly and brinjal” as food crops of this pest moth. Nayar et al. (1976) mention this as a pest on Gingelly or *Til* (*Sesamum indicum*), Brinjal (*Solanum melongena*), Jasmine (*Jasminum sambac*), and Field Bean (*Lablab niger*). One specimen from Surat (Gujarat) [as ‘*Bombay*’ = Presidency?] is in the

Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 456). Recorded from Dharwar and reared from sesame plants (Chandaragi et al., 2011).

***Acherontia lachesis* (Fabricius, 1798) [FBI, Moths 5: 55-58, Fig. 9A, Pls I, VI, XIII]**

Ubiquitous and frequent in wet forested tracts on the ghats and open country. Bell & Scott (1937: 508) give host plants from which larvae have been bred: *Erythrina* spp. (Fabaceae), *Jasminum* spp., *Nyctanthes arbor-tristis* (Oleaceae), *Ipomoea* spp. (Convolvulaceae), *Solanum* spp., *Nicotiana tabacum*, *Datura* sp. (Solanaceae), *Tecoma grandiflora*, *Stereospermum* sp., *Spathodea campanulata* (Bignoniaceae), *Lantana camara*, *Stachytarpheta indica*, *Tectona grandis*, *Vitex negundo*, *Clerodendron* spp., *Callicarpa arborea* (Verbenaceae), *Coleus* sp., *Colebrookia oppositifolia*, *Anisomeles ovata* (Lamiaceae), and *Antidesma* sp. (Euphorbiaceae). Usman & Puttarudriah (1955: 79) give "Collected on lantana in Bangalore, September and October." Mathur & Balwant Singh (1957: 5, 6; 1959: 17, 57, 61, 66, 67, 82, 86; 1960a: 72, 78; 1960b: 20, 127, 129; 1961b: 9, 19, 53, 80) write larva defoliates *Clerodendrum inerme*, *C. infortunatum*, *Duranta ellisia*, *Lantana camara*, *Tectona grandis*, *Vitex negundo* (Verbenaceae), *Datura* sp., *Nicotiana tabacum* (Solanaceae), *Ehretia acuminata*, *E. microphylla* (Boraginaceae), *Erythrina caffra*, *E. lithosperma*, *Ipomoea* sp. (Convolvulaceae), *Jasminum* sp., *Nyctanthes arbor-tristis* (Oleaceae), *Tecoma grandiflora* (Bignoniaceae), *Thunbergia laurifolia* (Acanthaceae) and *Dolichos lablab* (Fabaceae). Nayar et al. (1976) mention this as a pest on Gingelly (*Sesamum indicum*), Brinjal (*Solanum melongena*), and Field Bean (*Lablab niger*). Three specimens from Nilambur (Kerala) [as 'Madras' = Presidency ?] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 456).

****Herse convolvuli* (Linnaeus, 1758) [FBI, Moths 5: 61-65, Fig. 10, Pl. IX]**

Ubiquitous and frequent in drier tracts in open country. Bell & Scott (1937: 508) give following host plants from which larvae have been bred : *Phaseolus* spp., *Dolichos lablab*, *Arachis hypogaea* (Fabaceae), *Helianthus* sp. (Asteraceae), *Ipomoea* spp., *Convolvulus* spp. (Convolvulaceae). Maxwell-Lefroy (1909: 467) adds "convolvulaceous creepers" as other host plants. Usman & Puttarudriah (1955: 79) write "Common on pulses in Bangalore ; caterpillars feed on leaves." Mathur & Balwant Singh (1959: 57; 1960a: 72; 1961b: 19, 86) write larva defoliates *Dolichos lablab* (Fabaceae), *Tectona grandis* (Verbenaceae), *Vitis vinifera* (Vitaceae) and *Ipomoea* sp. (Convolvulaceae). Ramakrishna Ayyar (1963) gave "Sweet potato and green-gram" as food crops of this pest moth. One specimen from Bangalore (Karnataka) [as 'Mysore & Coorg'] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 456). Nayar et al. (1976) mention this as a pest on Green Gram (*Phaseolus aureus*), Black Gram (*Phaseolus mungo*), and Sweet Potato (*Ipomoea batatas*). Recorded from Dharwar [pronounced 'Dharwad' in local vernacular] and reared from green gram (*Phaseolus aureus*) and black gram (*P. mungo*) crop plants (Chandaragi et al., 2011). We bred larvae feeding on greengram and *Sesamum (indicum ?)* in UASD croplands, and adults emerged in October 2008 (KG colln # D749). This species is sometimes placed in the genus *Agrius* Hübner, 1819, but this is questionable.

Tribe Sphingini

***Meganoton nyctiphanes* (Walker, 1856) [FBI, Moths 5: 73-76, Pl. IX]**

Rare and local in heavy rainfall forest country under 1,000ft. Larvae bred by Bell from *Symphorema involucreatum* (Verbenaceae) vide Bell & Scott (1937: 508). One specimen from Karwar (Karnataka) [as 'Bombay' = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 457).

? *Meganoton rufescens* (Walker, 1856) [FBI, Moths 5: 73-76, Pl. IX]

One specimen from "Central Thana" (Maharashtra) [as 'Bombay' Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 457). But Bell & Scott (1937: 76) cite this species as taken only on the E. Himalaya and the Andaman Islands, so the F.R.I. identification could be suspect and needs to be confirmed.

***Psilogramma menephron* (Cramer, 1780) [FBI, Moths 5: 77-81, Pls I, VIII, XIII]**

Peregrine throughout the subcontinent and locally common, in both forest and open country up to 6,000ft elevation. Bell & Scott (1937: 508) write larvae have been reared from *Jasminum* spp., *Ligustrum robustum*, *Nyctanthes arbor-tristis*, *Olea dioica* (Oleaceae), *Spathodea*

campanulata (Bignoniaceae), *Tectona grandis*, *Clerodendron tunatum*, *Vitex negundo*, *Callicarpa inforarborea* (Verbenaceae) and *Meliosoma fordii* (Sabiaceae). Mathur & Balwant Singh (1957: 5, 6; 1960a: 19, 42, 77; 1960b: 31, 85, 129, 133, 136; 1961b: 19, 80) write larva defoliates *Clerodendrum inerme*, *C. infortunatum*, *Gmelina arborea*, *G. hystrix*, *Tectona grandis*, *Vitex negundo* (Verbenaceae), *Jasminum sambac*, *Ligustrum lucidum*, *L. robustum*, *Nyctanthes arbor-tristis*, *Olea dioica* (Oleaceae), *Melia azedarach* (Meliaceae) and *Heterophragma adenophyllum*, *Oroxylum indicum* (Bignoniaceae). One specimen from Nilambur (Kerala) [as 'Madras' = Presidency ?] in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 457). Nayar et al. (1976) mention this as a pest on Parijath (*Nyctanthes arbortristis*), but misspell it as *P. 'memephron.'* But probably 'lumped' and in need of taxonomic revision (Kitching vide Smetacek, 1994: 9).

Tribe Sphingulini

Dolbina inexacta (Walker, 1856) [FBI, Moths 5: 95-98, Pl, VIII]

Bell & Scott (1937) write it is confined to wooded ghats and is fairly common, especially on stream bank trees. Larvae found in North Kanara district were reared on *Olea dioica* (Oleaceae) and *Linociera malabarica* (Oleaceae). Mathur & Balwant Singh (1959: 157; 1960b: 31, 133, 138) write larva defoliates *Fraxinus* sp., *Ligustrum robustum*, *Olea dioica*, *Osmanthus fragrans* (Oleaceae).

Subfamily AMBULICINAE

**Campsogene panopus* (Cramer, 1779) [FBI, Moths 5: 104-108, Pls. I, VIII]

Peregrine throughout the subcontinent and locally common, in both forest and open country up to 6,000ft elevation, and larvae have been reared from mango, *Rhus vernicifera*, *Dracontometum mangiferum* (Anacardiaceae), *Calophyllum inophyllum*, and *Garcinia* sp. (Clusiaceae) in China (Bell & Scott, 1937). Mathur & Balwant Singh (1959: 58; 1960b: 76; 1961a: 106, 113) write larva defoliates *Dracontomelum mangiferum*, *Mangifera indica*, *Rhus wallichii* (Anacardiaceae), and *Quercus* sp. (Fagaceae). One specimen from North Kanara (Karnataka) [as 'Bombay' = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 458). But Smetacek (1994: 12) writes that *Amplipterus panopus* was not recorded on the Kumaon hills and "probably occurs at low elevation where its larval foodplant *Mangifera* [sic!] is plentiful." Chandaragi et al. (2011) took a *Campsogene* sp. at light in Dharwar which is probably *panopus*, now placed in *Amplipterus*?

Oxyambulyx belli Jordan, 1923 [FBI, Moths 5: 119-123, Fig. 24A-H, Pls. I, II, VIII]

Taken by Bell in heavy rainfall forests below 1,000ft where he found it common. Larvae were reared from *Xylia xylocarpa* (Fabaceae) (Bell & Scott, 1937: 509). Restricted to peninsular India.

Oxyambulyx aglaia Jordan, 1923 [FBI, Moths 5: 128-131, Pl. II]

Taken by Bell in the Kanara District in "dense jungle near the coast" where it is rare. Larvae were reared from *Xylia xylocarpa* (Fabaceae) (Bell & Scott, 1937: 509). Restricted to peninsular India. Bell & Scott placed this and *auripennis* (Moore, 1879) as subspecies of *substrigilis* Westwood, 1848 (as *Ambulyx*) which latter was taken on the western Himalaya and foothills by Smetacek (1994: 14) in March-April and July-September. Ghorpadé prefers to treat all three as good allopatric species, *aglaia* restricted to the southern Indian ghats, *auripennis* to Ceylon and *substrigilis* to the Himalayas, these probably not extending to Bengal, Bangladesh, Hainan and the Andaman & Nicobar Islands from where recorded, where other distinct species (or 'subspecies') perhaps occur? Larvae reared from *Aglia littoralis* (Meliaceae) (Bell & Scott, p. 509, ex Rothschild & Jordan, 1903). Bhasin & Roonwal (1954: 41) lists *Aglia littoralis* as host plant. Mathur & Balwant Singh (1959: 50) write larva defoliates *Dipterocarpus tuberculatus* (Dipterocarpaceae). One specimen from Karwar (Karnataka) [as 'Bombay' = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 458), determined as *substrigilis* but obviously misidentified as this nominate 'race' is from the E. Himalaya and the Andamans.

***Oxyambulyx matti* Jordan, 1923 [FBI, Moths 5: 132-134, Fig. 27]**

Larvae bred by Bell in the Kanara District, where “very rare, only four larvae having been found, in forests of heavy rainfall up to 2,000 feet elevation, and three ♂♂ and one ♀ obtained from them.” Host plant is *Terminalia tomentosa* (Combretaceae), which is a large timber tree and larvae were found “on the topmost branches at a height of 80 feet or so from the ground. No eggs were found. The larvae eat the leaves of the food-plant completely except for the midribs, which they then, curiously enough, eat through at the base so that they fall to the ground. The fallen midribs and the frass reveal the presence and position of the larvae, which are otherwise very difficult to locate” (Bell & Scott, 1937: 133-134). Mathur & Balwant Singh (1961b: 44) write larva defoliates *Terminalia tomentosa* (Combretaceae).

***Oxyambulyx subocellata* (Felder, 1874) [FBI, Moths 5: 136-138, Fig. 21D-H, Pl. VIII]**

Larvae bred by Bell in North Kanara were found on *Odina wodier* and *Buchanania latifolia* (Anacardiaceae) in forests of heavy rainfall below 1,000 ft; common in monsoon months of July and August, as well as in November. Probably ‘lumped’ but polyphyletic, the status of this, of *turbata* Moore, 1882 and of *thwaitesi* Moore, 1882 requiring deeper study. Mathur & Balwant Singh (1960b: 17) write larva defoliates *Lannea coromandelica* (Anacardiaceae). One specimen from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 458).

***Clanis phalaris* (Cramer, 1777) [FBI, Moths 5: 142-146, Figs 28A-B, 29, Pl. I]**

Bell has “bred it in S. India, where it is very common in both open and forest-clad country.” Larvae are plentiful in the monsoon, feeding on Fabaceae like *Xylia xylocarpa* in jungle country and on *Pongamia glabra* in open country. More rarely on *Pterocarpus marsupium*. It has been found on *Millettia atropurpurea*, *Macuna pruriens*, and *Dalbergia volubilis*, all large climbers, and on *Cassia fistula* the yellow flowered Indian Laburnum. The moths never come to light. Probably ‘lumped’ but polyphyletic; the status of this, of *nicobarensis* Schwarz, 1810 and of *cervina* Walker, 1856 requiring deeper study. Maxwell-Lefroy (1909: 468) quotes Forsayeth (1884, *Trans. Ent. Soc. Lond.*, p. 393) giving dhak or palas (*Butea frondosa*) as food-plant of this species misidentified or named as *Ambulyx pagana* and *Clanis cervina*.” Mathur & Balwant Singh (1960b: 96; 1961a: 52) write larva defoliates *Millettia atropurpurea*, and *Pongamia pinnata* (Fabaceae). One specimen is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 457).

***Clanis bilineata* (Walker, 1866) [FBI, Moths 5: 150-153, Figs 31A-E, Pl. II]**

Bell has bred this in southern India at all elevations “where it is found commonly in both forest and open country, usually near water.” Food plants are *Pongamia glabra*, *Millettia atropurpurea*, and *Pterocarpus marsupium* (Fabaceae). .” Mathur & Balwant Singh (1959: 7; 1960b: 96, 115; 1961a: 52, 81, 84, 117) write larva defoliates *Dalbergia latifolia*, *Millettia atropurpurea*, *Mucuna* sp., *Pongamia pinnata*, *Pterocarpus marsupium*, *Pueraria* sp., and *Robinia pseudo-acacia* (Fabaceae). One specimen from North Kanara (Karnataka) [as ‘Bombay’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 457).

***Clanis titan* Rothschild & Jordan, 1903 [FBI, Moths 5: 150-153, Figs 28G-J, Pl. II]**

Bred in the N. Kanara district by Bell, “where it is scarce and local, larvae being found only in forests with rainfall of over 100 inches and up to 1,000 feet elevation.” Food plant is *Pterocarpus marsupium* (Fabaceae), a large tree. Moth never comes to light. Mathur & Balwant Singh (1960b: 96; 1961a: 81) write larva defoliates *Millettia atropurpurea*, and *Pterocarpus marsupium* (Fabaceae).

***Leucophlebia lineata* Westwood, 1848 [FBI, Moths 5: 157-159, Fig. 32A-B, Pl. II]**

Bell has bred it in N. Kanara district on *Saccharum* sp. (Poaceae), where it is very common in some seasons. Also breeds on other coarse grasses and comes to light freely but not caught feeding on flowers. Mathur & Balwant Singh (1960a: 66) write larva defoliates *Imperata arundinacea* (Poaceae). Incidentally, Nayar et al. (1976: 491) do not mention this as a pest on Sugarcane (*Saccharum officinarum*).

***Leucophlebia emittens* Walker, 1866** [FBI, Moths 5: 159-160, Pl. II]

Bell found this species “in open grass-land above 1,500 feet elevation and with rainfall not exceeding 50 inches a year, east of the Western Ghats, and do great damage to the grass-crop. It is rare on the coast, and also in some seasons around Belgaum. The moths come freely to light from about 8 P. M.” Larval food-plants are *Bambusa* sp. and other grasses (Poaceae).

***Polyptychus sonanthis* Jordan, 1930** [FBI, Moths 5: 163-167, Pl. II]

Bell found it rather “local and rare, larvae being found in forests with heavy rainfall” in N. Kanara district. Food-plants are *Ehretia laevis* and *Cordia obliqua* (Boraginaceae) and the moth is seldom attracted by light. Bell & Scott (1937) treat it as a subspecies of *trilineatus* Moore, 1888, but state that it is probably polyphyletic and ‘lumped,’ needing more careful taxonomy. Mathur & Balwant Singh (1957: 23; 1959: 66) write larva defoliates *Cordia dichotoma* and *Ehretia laevis* (Boraginaceae). One specimen from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 459)

***Polyptychus dentatus* (Cramer, 1777)** [FBI, Moths 5: 169-172, Fig. 33G-I, 34, Pls II, III]

Bell & Scott (1937: 180) wrote “We have bred the species in S. India and at Allahabad. Common in open country with rainfall below about 50 inches. . . The moths do not come to light or flowers.” Maxwell-Lefroy (1909: 468) quotes Forsayeth (op. cit.) that its larvae feed on *Lasora (Cordia myxa)*” of Boraginaceae. Mathur & Balwant Singh (1957: 23; 1959: 66) write larva defoliates *Cordia dichotoma*, and *Ehretia acuminata* (Boraginaceae).

***Marumba dyras* Walker, 1856** [FBI, Moths 5: 179-182, Figs 35F-I, 37, Pl. III]

Bell & Scott (1937: 180) write “Common and widely distributed, but prefers thickly wooded areas with heavy rainfall.” The larvae feed on several food-plants like *Bombax malabaricum*, *Kydia calycina* (Malvaceae), *Sterculia* spp., *Helicteres isora*, *Pterospermum* sp., *Buettneria* sp. (Sterculiaceae), *Grewia* spp. (Tiliaceae), *Schleichera trijuga* (Sapindaceae), and *Bridelia* spp. (Euphorbiaceae). Mathur & Balwant Singh (1960a: 39, 87; 1960b: 95; 1961a: 83) write larvae defoliate *Helicteres isora*, *Pterospermum* sp. (Sterculiaceae), *Microcos paniculata* (Tiliaceae) and *Kydia calycina* (Malvaceae). The moths do not appear to be attracted by light. One specimen from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 458).

***Marumba nympha* Rothschild & Jordan, 1903** [FBI, Moths 5: 182-185, Fig. 38, Pl. III]

Bell found this species “local and rather rare, a few larvae being found in forests with rainfall of about 150 inches, up to 1,000 feet elevation.” He bred it from a captive female at Karwar found on *Alseodaphne semicarpifolia* (Lauraceae). Bhasin & Roonwal (1954: 61) also list *Alseodaphne semicarpifolia* as host plant.

***Marumba poliotis* Hampson, 1911** [FBI, Moths 5: 187-188, Fig. 39]

Occurs in N. Kanara district in heavy rainfall forest under 1,000 ft elevation, rare and local. Restricted to Dravidia. Bell & Scott (1937: 499) mention it as having been bred in their table (Appendix A) but no specific information is given in the text.

***Marumba indicus* (Walker, 1856)** [FBI, Moths 5: 189-190, Fig. 35J]

Bell & Scott write they have “bred it in the Kanara district of S. India, where it is rare and very local, being confined to the forest-clad hills with heavy rainfall, under 1,000 feet elevation.” The usual food-plant is *Sterculia villosa* (Sterculiaceae) but larvae also feed on *Helicteres isora* of the same plant family and on *Bombax malabaricum* (Malvaceae) and *Grewia tiliaefolia* (Tiliaceae). Mathur & Balwant Singh (1960a: 31, 39) write larvae defoliate *Grewia tiliaefolia* (Tiliaceae) and *Helicteres isora* (Sterculiaceae).

***Agnosia orneus* (Westwood, 1848)** [FBI, Moths 5: 210-211, Fig. 49A-C, Pl. III]

Larvae feed on *Grewia asiatica* (Tiliaceae) and occur in forest-clad hills with heavy rainfall, under 1,000 feet elevation, where it is rare and very local. Studies to determine if *pudorinus* Walker, 1856 from N. India is conspecific need to be carefully conducted. Mathur & Balwant Singh (1960a: 26, 31) write larva defoliates *Grewia asiatica*, and *G. tiliaefolia* (Tiliaceae).

SPHINGIDAE—SEMANOPHORAE

Subfamily SESIINAE

Tribe Sesiini

Cephonodes hylas (Linnaeus, 1771) [FBI, Moths 5: 247-250, Fig. 64A-C, Pl. III]

Bell & Scott (1937: 248) write "We have bred it in many localities in India. It is found in both hills and plains in all types of country, always common, and in some seasons so numerous as to become a pest by defoliating Rubiaceae trees and shrubs. . . The moths are rather slow in taking to the wing, but when they do so the flight is very rapid. They make a deep humming note, as do *Macroglossum* moths, when slightly alarmed. They are very active in the morning and evening, and dart rapidly from flower to flower, and oviposit on the wing. They are not attracted by light." Food-plants recorded (ibid., p. 512) are *Adina cordifolia*, *Coffea bengalensis*, *Gardenia* sp., *Hymenodictyon excelsum*, *Ixora brachiata*, *Pavetta indica*, *Randia dumetorum*, and *Wendlandia* spp. (Rubiaceae). Maxwell-Lefroy (1909: 468) calls it the common humming bird hawk moth of the plains "which comes in dull weather and at dusk and flies softly through shrubs seeking flowers; it is a shy insect, hard to see or catch, with a distinctive deep hum in flight." Bhasin & Roonwal (1954: 37) list *Adina cordifolia* as host plant. Usman & Puttarudriah (1955: 79) give "Collected in Bangalore, July." Mathur & Balwant Singh (1957: 14; 1960a: 3, 62; 1960b: 104; 1961a: 9, 106, 108; 1961b: 19, 89) write larva defoliates *Coffea bengalensis*, *Gardenia florida*, *Hymenodictyon excelsum*, *Mitragyna parvifolia*, *Pavetta indica*, *P. tomentosa*, *Randia spinosa*, *Wendlandia exserta* (Rubiaceae), *Tectona grandis* (Verbenaceae) and *Quercus* sp. (Fagaceae). One specimen each from Karwar and Bangalore (Karnataka) [as 'Bombay' = Presidency ? and Mysore & Coorg] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 463). Smetacek (1994: 24) notes that it is "Fond of *Lantana* L. [Verbenaceae] and *Buddleia* L. [Buddleiaceae] flowers." With a distinctive deep hum in flight."

**Cephonodes picus* (Cramer, 1777) [FBI, Moths 5: 250-251, Fig. 64D-E, Pl. X]

Very close to the preceding species, initially misidentified as *hylas*, or as a variety of that, by Hübner. Butler, Swinhoe, Hampson and Guérin-Méneville. But much earlier Cramer had described *picus* as new from Pondicherry (*hylas* was described from China). This species has its fore tibia ending in a prominent apical thorn, which is absent in *hylas*; larval spiracles are immaculate, unlike in *hylas* where they have a broad, transverse, orange medial band. Bell & Scott (1937: 251) write "As common as *hylas*, and also defoliates Rubiaceae trees and shrubs in some seasons. May be found in all types of country." Food-plants recorded were *Adina cordifolia*, *Gardenia* sp., *Pavetta indica*, and *Randia dumetorum* (Rubiaceae). Bhasin & Roonwal (1954: 37) list *Adina cordifolia* as host plant. Mathur & Balwant Singh (1957: 16; 1960a: 4; 1960b: 106; 1961a: 108) write larva defoliates *Coffea robusta*, *Morinda tinctoria* and *Gardenia* sp., *Randia spinosa* (Rubiaceae). Chandaragi et al. (2011) took it at light at Dharwar.

Sataspes infernalis (Westwood, 1848) [FBI, Moths 5: 253-256, Fig. 65A-C, Pl. X]

Rare and local. Bell & Scott (1937: 254-255) write "We have bred it in S. India, where it is not uncommon in September and October at the foot of the Western Ghats and in hills with heavy rainfall. . . The moth may be seen feeding at flowers up till about 10 A.M." Food-plants are *Dalbergia volubilis* in India and *Albizia lebbek* and *Lespedeza* sp. (Fabaceae) in China. There is a form *uniformis* Butler, 1875 (very rare) in which the abdomen has little yellow on tergites 6 and 7, unlike the nominate form which has a broad yellow band on them. Bhasin & Roonwal (1954: 46) lists *Albizia lebbek* (Fabaceae) as host plant. Mathur & Balwant Singh (1959: 7, 15, 16) write larva defoliates *Dalbergia latifolia*, *D. sissoo*, and *D. volubilis* (Fabaceae).

Subfamily PHILAMPELINAE

Tribe Nephelini

**Deilephila nerii* (Linnaeus, 1758) [FBI, Moths 5: 268-271, Figs 68A-E, 69, Pl. III]

Bell & Scott (1937: 269) write "We have bred it in many localities in India, where it is very common, and may be found in all types of country. . . The beautiful moth comes to light freely, and may also be seen feeding at flowers shortly after dark, and "Occurs as a rare straggler in England, where it is known as the Oleander Hawk-Moth." Recorded food-plants are

Ervatamia heyneana, *Holarrhena antidysenterica*, *Nerium odorum*, *Tabernaemontana* spp., and *Vinca* spp. (Apocynaceae) (Bell & Scott, 1937: 513). Maxwell-Lefroy (1909: 468) calls it the “beautiful dark olive-green and pink moth whose larva feeds on the Oleander.” Usman & Puttarudriah (1955: 79) give “Collected on *Nerium* in Bangalore, October.” Mathur & Balwant Singh (1960a: 54; 1960b: 126; 1961b: 2, 56, 77) write larvae defoliate *Holarrhena antidysenterica*, *Nerium odorum*, *Tabernaemontana coronaria*, *T. dichotoma*, *Trachelospermum* sp. (Apocynaceae), and *Viscum capitellatum* (Loranthaceae). Ramakrishna Ayyar (1963) gave “Garden oleander” as host plant of this pest moth. Nayar et al. (1976) mention this as a pest on Oleander (*Nerium odorum*), and the medicinal plant *Rauwolfia serpentina*. Recorded from Dharwar and reared from “*Nerium* and Crape Jasmine” (Chandaragi et al., 2011).

***Deilephila hypothous* (Cramer, 1780) [FBI, Moths 5: 271-273, Fig. 68F-G, Pl. XIV]**

Habits similar to *nerii*, “larva found on low bushes, usually near water” and in the Khasi Hills larva “occurs somewhat rarely at an elevation of about 4,000 feet in dense jungle during the rainy season” (Bell & Scott, 1937: 272-273). Food-plants recorded by them are *Cinchona* spp., *Uncaria* sp. and *Wendlandia paniculata* (Rubiaceae). Bhasin & Roonwal (1954: 79) list *Anthocephalus cadamba* (Rubiaceae) as host plant. Mathur & Balwant Singh (1961b: 64) write larva defoliates *Uncaria* sp. (Rubiaceae).

***Deilephila minima* (Butler, 1877) [FBI, Moths 5: 274-276, Fig. 68K, Pl. III]**

Rare and local on the Western Ghats, occurs under 1,000 ft in heavy rainfall forest. Other habits as of *nerii*. Food-plant recorded by Bell & Scott (1937: 276, 513) is *Alangium lamarckii* (as “Cornaceae,” now Alangiaceae). Bhasin & Roonwal (1954: 43) lists *Alangium salviifolium* as host plant. Two specimens from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 461).

***Acosmeryx anceus* (Stoll, 1865) [FBI, Moths 5: 294-295, Fig. 74C-E, 75A, Pl. IV]**

The taxonomy of this species is confusing. Bell & Scott (1937) give Moore as the author, not Stoll, but Smetacek (1994: 28) credits *anceus* to Stoll, and writes that “The sub-species *subdentata* Roths. & Jord. occurs in India, and there are two forms, coloured pinkish-cinnamon and brownish. Bell & Scott (1937) give *subdentata* Rothschild & Jordan, 1903, as local and rare in N. Kanara ghats in dense forests with heavy rainfall, from sea level to about 2,000 ft elevation. They give food-plants as *Vitis indica* (Vitaceae) and *Leea* sp. (Leeaceae) (ibid., pp. 295, 513). Mathur & Balwant Singh (1961b: 82) write larva defoliates *Vitis lanceolaria* (Vitaceae).

***Acosmeryx socrates* Boisduval, 1875 [FBI, Moths 5: 295-297, Fig. 74F, Pl. IV]**

Bell & Scott (1937) give it as “common during the monsoon, from sea level up to 2,500 feet elevation.” They give food-plants as *Vitis* sp. (Vitaceae), *Leea* sp. (Leeaceae) and *Dillenia pentagyna* (Dilleniaceae) (ibid., pp. 297, 513). The form *cinerea* Butler, 1875, also occurs here and differs in shape of the oblique discal band on fore wing. Mathur & Balwant Singh (1959: 33; 1961b: 87) write larva defoliates *Dillenia pentagyna*, and *Vitis* sp. (Vitaceae). One specimen of this form from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 461).

***Panacra atima* Rothschild & Jordan, 1915 [FBI, Moths 5: 302-304, Pls IV, XIV]**

Bell & Scott (1937) give it as rare and local, “larvae being found in dense, damp, evergreen jungles in the Western Ghats” and “The moths are rarely caught feeding at flowers and do not appear to be attracted by light.” Food-plant is *Pothos scandens* (Araceae). Mathur & Balwant Singh (1961a: 57) write larva defoliates *Pothos scandens*.

***Angonyx testacea* (Walker, 1856) [FBI, Moths 5: 316-318, Fig. 80A-C, Pl. X]**

Bell & Scott (1937) state that they bred this species in Kanara district “where the larva is common in damp forests in the rainy season, from sea level to 6,000 feet [*sic!*].” This is repeated by Smetacek (1994: 32) but must be a misprint as no hill peak in Kanara rises to that height. They also write (ibid., p. 318) that the “moth has been seen feeding at dusk, but does not appear to be attracted by light.” Food-plant given (pp. 318, 514) is *Strychnox nux-vomica*

(Loganiaceae). Two specimens from Karwar (Karnataka) [as 'Bombay' = Presidency ?] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 461).

Cizara sculpta (Felder, 1874) [FBI, Moths 5: 321-324, Fig. 83A-B, Pls IV, X, XII, XIV]

Bell & Scott (1937) state that they "bred the species in S. India, where larvae are local, but not scarce, in areas of heavy rainfall, but during the dry season." *Randia dumetorum* (Rubiaceae) is the food-plant of the larvae. Mathur & Balwant Singh (1957: 6; 1960: 3, 4; 1961a: 108) write larvae defoliate *C. infortunatum* (Verbenaceae), *Gardenia campanulata*, *G. sessiliflora*, and *Randia spinosa* (Rubiaceae). One specimen from Tithimatti, South Coorg (Karnataka) [as 'Mysore & Coorg'] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 461).

****Nephele didyma*** (Fabricius, 1775) [FBI, Moths 5: 325-328, Pl. IV]

Bell & Scott (1937) mention it as peregrine throughout our subcontinent and have bred it in many localities in India, very common, especially in the plains. The flight of the moth is rapid, and it comes to flowers before dark, being also attracted by light. Food-plant of larva is *Carissa carandas* (Apocynaceae). Maxwell-Lefroy (1909: 468) calls it a smaller olive-green moth, reared in Calcutta on Karunda (*Carissa Carandas*) (Indian Mus. Notes, V, p. 126)." Puttarudriah (1955: 79) give "Collected in Bangalore" for *N. hespera*. Two specimens (also of form *hespera*) from N. Kanara (Karnataka) [as 'Bombay' = Presidency ?] are the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 462). Smetacek (1994: 33) states it is a "rather variable insect, with many grades between the extreme forms, *hespera* Fabricius and *didyma* Fabricius. Swarms around flowering trees of *Bauhinia vareigata* [sic!] and at *Quisqualis* and *Lonicera* at dusk. Ghorpadé collected moths coming to *Quisqualis indica* flowers at night in Baroda (Gujarat). Chandaragi et al. (2011) took it at light in Dharwar.

Gurelca hyas (Walker, 1856) [FBI, Moths 5: 331-334, Fig. 85A-C, Pl. XV]

Bell & Scott (1937) state it is more common during the dry months in S. India, in open country above 1,000 ft in areas of light rainfall. Larval food-plants are *Morinda tinctoria*, *M. citrifolia* and *Paederia foetida* (Rubiaceae). Mathur & Balwant Singh (1961a: 1) write larva defoliates *Paederia foetida* (Rubiaceae).

Macroglossum bombylans (Boisduval, 1875) [FBI, Moths 5: 353-355, Fig. 90A-B, 92, Pl. IV]

Usman & Puttarudriah (1955: 80) give "Collected in Bangalore" naming it "*M. walkeri* Butler" which Bell & Scott (1937: 353) treat as a synonym but record it only from the Himalayas, noting it as being "Fairly common at an elevation of 2,000 to 5,000 feet" and give the food-plant as *Rubia cordifolia* (Rubiaceae). Mathur & Balwant Singh (1961a: 122) write larva defoliates *Rubia cordifolia* (Rubiaceae).

Macroglossum regulus (Boisduval, 1876) [FBI, Moths 5: 355-356, Fig. 90C-D, Pl. XI]

Bell & Scott (1937) give it as common during the wet months above 1,000ft elevation in N. Kanara. The flight of many species of this genus is very rapid. Most of the species are on the wing at about dusk, but some may be seen feeding and laying their eggs at any time of the day. The eggs are deposited while the moth hovers on the wing. Some species are attracted by light. Larval food-plant is *Rubia cordifolia* (Rubiaceae). Mathur & Balwant Singh (1961a: 122) write larva defoliates *Rubia cordifolia* (Rubiaceae).

Macroglossum gyrans (Walker, 1856) [FBI, Moths 5: 356-360, Fig. 90E-F]

Bell & Scott (1937) write "We have bred it in S. India, where it is common in open upland country with small rainfall, rare in low forest country" and that the "moths feed in the morning and evening, and have been known to come to light," Food-plants of larvae are *Morinda tinctoria* and *M. citrifolia* (Rubiaceae). Mathur & Balwant Singh (1960b: 106; 1961b: 19) write larva defoliates *Morinda tinctoria* (Rubiaceae) and *Tectona grandis* (Verbenaceae). Specimens (11) from R. Palghar Range, North Thana (Maharashtra) [as 'Bombay' = Presidency ?] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 462).

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Macroglossum affictitia (Butler, 1875) [FBI, Moths 5: 360-362, Fig. 90G-H, Pl. XI]

Bell & Scott (1937) write they “have bred it in S. India, where it is common though apparently confined to forests and hills, independent of the rainfall” and the “moth makes a deep humming note before flight by a quivering motion of the wings. It does not appear to be attracted by light.” *Strychnos nux-vomica* and other species of this genus (Loganiaceae) are food-plants of larvae. Mathur & Balwant Singh (1960b: 87) write larvae defoliate *Memecylon* sp. (Melastomaceae) but misspell it as ‘*affictitia*.’ Ramakrishna Ayyar (1963) gave “*Morinda*” [Rubiaceae] as food plant of this pest moth, named by him as “*Macroglossa vialis*” Butler, which is placed as a synonym of *affictitia* by Bell & Scott. One specimen from Karwar (Karnataka) [as ‘*Bombay*’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 462), misspelt as ‘*affictitia*.’

Macroglossum particolor Rothschild & Jordan, 1903 [FBI, Moths 5: 362-365, Fig. 90I-J, Pl. XI]

Bell & Scott (1937) write that it “is common in open country with moderate rainfall, but scarce in wet forest areas.” And that the “moth, if alarmed when at rest, makes a deep, low, humming note. It may be seen feeding in the morning and evening.” Larval food-plant is *Morinda citrifolia* (Rubiaceae). Mathur & Balwant Singh (1960b: 106) write larva defoliates *Morinda citrifolia* (Rubiaceae),

Macroglossum belis (Linnaeus, 1758) [FBI, Moths 5: 365-368, Fig. 94, Pl. XI]

Common in both forest and open country, independent of rainfall, up to 3,000ft altitude (Bell & Scott, 1937). Food-plants of larvae are *Hamiltonia suaveolens*, *Saprosoma indicum* (Rubiaceae), and *Strychnos nux-vomica* (Loganiaceae). Maxwell-Lefroy (1909: 469) writes it is most abundant of the *Macroglossum* species of *M. gyrans* and *pyrrhosticta* (as ‘*pyrrosticta*’). Mathur & Balwant Singh (1960: 35) write larvae defoliate *Hamiltonia suaveolens*.

Macroglossum assimilis Swainson, 1821 [FBI, Moths 5: 368-370, Fig. 90K-L, Pl. XI]

Locally common in heavy rainfall forest and open country under 1,000ft altitude. Larval food-plant is *Memecylon edule* (Melastomaceae). Mathur & Balwant Singh (1960b: 87) write larvae defoliate *Memecylon* sp. (Melastomaceae) but misspell it as ‘*affictitia*.’

Macroglossum troglodytus (Boisduval, 1875) [FBI, Moths 5: 372-373, Fig. 90O-P, 96, Pl. XV]

Bell & Scott (1937) write that it is “probably the most common species of *Macroglossum*” and that “The moth is frequently on the wing in the morning and evening.” Food-plants of larvae are *Hedyotis uncinella* and *H. scandens* (Rubiaceae). However, it is mistakenly (?) omitted in the table (p. 500) by them from the Kanara district, though included in that (p. 40) of Sphingidae from the Indian region. Mathur & Balwant Singh (1960: 37) write that larvae defoliate *Hedyotis* sp.

Macroglossum insipida (Butler, 1875) [FBI, Moths 5: 373-375, Fig. 90Q-R, 97, Pl. XI]

Bell & Scott (1937) write “it is very plentiful towards the end of the rainy season, in forests with very heavy rainfall, up to 1,000 feet elevation.” Moth does not appear to be attracted by light. Larval food-plants are *Corchorus capsularis* (Tiliaceae) and *Spermacoce hispida* (Rubiaceae). Mathur & Balwant Singh (1957: 21; 1960b: 87) write larva defoliates *Corchorus capsularis* or white jute (Tiliaceae), and *Memecylon* sp. (Melastomaceae) but misspell it as ‘*affictitia*.’

Macroglossum vicinum Jordan, 1923 [FBI, Moths 5: 376-378, Fig. 90S-U, 98, Pl. XI]

Known only from N. Kanara district, where larvae were bred from *Chasalia curviflora* (Rubiaceae) and are common in forests with heavy rainfall, above 1,000 ft altitude, during rainy months. The moths have not been observed feeding nor coming to light.

***Macroglossum sitiene* (Walker, 1856) [FBI, Moths 5: 378-379, Fig. 90V-W]**

Found all over Indian subregion. Food-plants of larvae are *Paederia tomentosa*, and *Morinda umbellata* (Rubiaceae) (Bell & Scott, 1937). However, it is mistakenly (?) omitted by them in the table (p. 500) from Kanara district, though included from S. India in that (p. 40) of Sphingidae from the Indian region. Mathur & Balwant Singh (1960b: 107) write larva defoliates *Morinda umbellata* (Rubiaceae).

***Macroglossum fringilla* (Boisduval, 1875) [FBI, Moths 5: 379-382, Pl. XI]**

Bell & Scott (1937) bred it in S. India where larvae are found in evergreen forests, above 1,000ft altitude. The moths may be seen feeding during the afternoon, but do not appear to be attracted by light. The larval food-plant is *Psychotria dalzelli* (Rubiaceae). Mathur & Balwant Singh (1961a: 77) write larva defoliates *Psychotria dalzelli*.

***Macroglossum corythus* (Walker, 1856) [FBI, Moths 5: 387-388]**

Occurs ubiquitously in upland open country with light rainfall, early stages and food-plant unknown. The entry indicating 'bred' for this species in the table (Appendix A) on p. 500 (Bell & Scott, 1937) is a mistake. Mathur & Balwant Singh (1960b: 106, 107; 1961a: 1) write larva defoliates *Morinda citrifolia*, *M. umbellata*, *Paederia foetida* (Rubiaceae), but give for one as '*M. proxima*' which is a synonym of *M. corythus* (Bell & Scott, 1937: 387). Smetacek (1994: 37) quotes Dudgeon (1898, *J. Bombay nat. Hist. Soc.*, Vol. 9) observing that it is a low elevation species, ascending to 2,000 feet.

***Rhopalopsyche bifasciata* Butler, 1875 [FBI, Moths 5: 396-397]**

Bell & Scott write that "We have bred this subspecies [of *nycteris* Kollar, 1848] in one locality in S. India, at an elevation of about 4,000 feet on an isolated hill. . . Food plant : *Rubia cordifolia*" (Rubiaceae). Mathur & Balwant Singh (1961a: 122) write larva defoliates *Rubia cordifolia* (Rubiaceae). Ramakrishna Ayyar (1963) gave "*Morinda*" as food plant of this pest moth (Rubiaceae).

Subfamily CHOEROCAMPINAE***Celerio livornica* (Esper, 1779) [FBI, Moths 5: 408-409, Pl. XII]**

Treated as a subspecies of *lineata* by Bell & Scott (1937: 408) but Smetacek (1994: 39) places this species in the genus *Hyles*. Bell & Scott (1937: 500) write it is common here in uplands of open country with light rainfall. *C. lineata* is widespread, from Africa to southern Europe east to China, sometimes wandering to central Europe and England where it is known as the Striped Hawk-Moth. In England its larvae feed on species of *Galium* (Rubiaceae), *Oenothera* (Onagraceae), *Portulaca* (Portulacaceae), *Prunus* (Rosaceae), *Rumex* (Polygonaceae), and *Vitis* (Vitaceae). Mathur & Balwant Singh (1961a: 125; 1961b: 86) write larva defoliates *Rumex* sp. (Polygonaceae) and *Vitis vinifera* (Vitaceae).

***Hippotion velox* (Fabricius, 1793) [FBI, Moths 5: 415-417, Fig. 105A-D, 106]**

Widespread species, found in N. Kanara at all altitudes, but local and rare in heavy rainfall forests. The moth has been caught at flowers after dark but does not appear to be attracted by light (Bell & Scott, 1937: 417). Food-plants of larvae are *Pisonia morindifolia*, *P. alba* and *P. aculeata* (Nyctaginaceae). Mathur & Balwant Singh (1961a: 38) write larva defoliates *Pisonia aculeata*, and *P. alba*.

****Hippotion celerio* (Linnaeus, 1758) [FBI, Moths 5: 417-420, Fig. 107, Pls V, XV]**

Bell & Scott (1937) write that they "have bred the species in many localities in India, where it is very common and widely spread, though less so in forest areas with heavy rainfall than in open country" and that "It occurs rarely in England, where it is known as the Silver-striped Hawk-Moth." They further write "The larva is impatient of light and during the day it hides among leaves near the ground. The moth may be caught at flowers and is also attracted by light. Its flight is very swift." Larval food-plants are *Vitis* sp. (Vitaceae), *Spermacoce hispida* (Rubiaceae), *Boerhavia* sp. (Nyctaginaceae), *Beta* spp. (Chenopodiaceae), *Rumex* spp. (Polygonaceae), *Cryptocoryne* sp., and *Caladium bicolor* (Araceae). Maxwell-Lefroy (1909: 469) gives "Balsam and *Beta vulgaris* [beetroot]" as larval food-plants. Usman & Puttarudriah (1955: 80) give "Collected on grape leaves" in old Mysore State. Mathur & Balwant Singh (1961a: 125; 1961b: 86) write larva defoliates *Rumex* sp. (Polygonaceae) and *Vitis vinifera*

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(Vitaceae). Ramakrishna Ayyar (1963) gave “Grape-vine” as host plant of this pest moth. Nayar et al. (1976) mention this as a pest on Elephant Yam (*Amorphophallus campanulatus*), and Grapevine (*Vitis vinifera*). Chandaragi et al. (2011) took it at light in Dharwar.

Hippotion echeclus (Boisduval, 1879) [FBI, Moths 5: 420-422, Fig. 105E-G]

Bell & Scott (1937) write that they “have bred the species in S. India and the E. Himalayas (Khasi Hills) [*sic!*]. It is rare in areas with a heavy rainfall, but fairly common in dry areas, and is sometimes very abundant locally.” They also state that the moth does not appear to be attracted by light. *Sesamum indicum* (Pedaliaceae) is the food-plant in S. India, where it is grown as a crop (*Til*), and larvae are sometimes found feeding on it in large numbers. Larvae also feed on *Monochoria hastaeifolia* (Pontederiaceae). Maxwell-Lefroy (1909: 469) gives “Sesamum” as larval food-plant.

**Hippotion rafflesii* (Butler, 1877) [FBI, Moths 5: 422-424, Fig. 105H-I, 108, Pl. V]

Seems to prefer wet forest areas to dry open country, common at all altitudes. The moths come readily to flowers and are also attracted by light (Bell & Scott, 1937). Larvae feed on species of *Impatiens* (Geraniaceae). Usman & Puttarudriah (1955: 80) give “Collected in Kolar” but misspell it *rafflesia*. Mathur & Balwant Singh (1960a: 65) write larva defoliates *Impatiens balsamina* (Geraniaceae). Chandaragi et al. (2011) took it at light in Dharwar.

Hippotion boerhaviae (Fabricius, 1775) [FBI, Moths 5: 424-427, Fig. 105J-K, 109, Pl. V]

“This species is common in open country but also in forests at all altitudes and in both heavy and light rainfall areas. The moth comes to light freely, and sometimes visits flowers before dark. We once saw hundreds come on board a ship sailing between Aden and Bombay during a cyclone” (Bell & Scott, 1937). Larvae feed on *Impatiens balsamina* and other spp. (Geraniaceae), *Knoxia mollis*, *Spermococe stricta*, *S. hispida* (Rubiaceae), *Glossostigma spathulatum* (Scrophulariaceae), *Boerhavia repens*, *B. diffusa* (Nyctaginaceae) and other plants. Mathur & Balwant Singh (1960a: 65; 1960b: 107) write larva defoliates *Impatiens balsamina* (Geraniaceae), and *Morinda umbellata* (Rubiaceae).

Theretra nessus (Drury, 1773) [FBI, Moths 5: 430-433, Fig. 110A-B, 111, Pl. V]

This is a common species in suitable localities, preferring hills and forest areas with heavy rainfall, to open dry country. Larvae feed widely on several food-plants like *Pongamia glabra* (Fabaceae), *Barringtonia* sp. (Myrtaceae), *Passiflora* sp. (Passifloraceae), *Convolvulus* sp. (Convolvulaceae), *Dioscorea* sp. (Dioscoreaceae), *Amorphophallus* sp. and others (Araceae) (Bell & Scott, 1937). Puttarudriah (1955: 80) give “Collected in Bangalore, February.” Mathur & Balwant Singh (1959: 35; 1961a: 8, 52) write larva defoliates *Dioscorea* sp. (Dioscoreaceae), *Passiflora* sp. (Passifloraceae), and *Pongamia pinnata* (Fabaceae). One specimen from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 460). Smetacek (1994: 42) states it is abundant on the W. Himalaya in years of heavy rainfall.

**Theretra clotho* (Drury, 1773) [FBI, Moths 5: 434-437, Fig. 110C, 112, Pls V, XII, XV]

Bell & Scott (1937) state it is common in areas of medium and heavy rainfall in forests and open country. They write that the moth has a very swift and powerful flight; it is sometimes attracted by light, and may often be seen visiting flowers at or after dusk. Larval food plants recorded as *Dillenia pentagyna*, *D. indica* (Dilleniaceae), *Hibiscus mutabilis* (Malvaceae), *Vitis* sp. (Vitaceae), *Fuchsia* sp. (Onagraceae), *Amorphophallus* sp. (Araceae), and *Begonia* sp. (Begoniaceae). Mathur & Balwant Singh (1959: 33; 1961b: 82, 86) write larva defoliates *Dillenia pentagyna* (Dilleniaceae), *Vitis lanceolaria*, and *V. vinifera* (Vitaceae). One specimen each from North Kanara (Karnataka) [as ‘Bombay’ = Presidency ?] and Aiyur, N. Salem (Tamil Nadu) [as ‘Madras’ = Presidency ?] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 457). Chandaragi et al. (2011) took it at light in Dharwar.

**Theretra gnoma* (Fabricius, 1775) [FBI, Moths 5: 437-438, Pl. V]

Bell & Scott (1937) write that they “have bred this species in S. India, where it is rather rare and local, occurring in open country with moderate rainfall up to 4,000 feet elevation” Larval food plant is *Vitis* sp. (Vitaceae). Maxwell-Lefroy (1909: 469) gives Grape vine as larval food-

plant. Usman & Puttarudriah (1955: 80) give "Collected in ragi fields ; Bangalore, August." Mathur & Balwant Singh (1961b: 86) write larva defoliates *Vitis vinifera* (Vitaceae). Chandaragi et al. (2011) took it at light in Dharwar.

***Theretra lucasi* (Walker, 1856) [FBI, Moths 5: 438-440, Fig. 110D-G, Pl. V]**

Treated as a subspecies of *latreillei* by Bell & Scott (1937: 408) who write that "it is very common in the Kanara District, and may be found at all times of the year. The moth starts feeding before dark and frequently comes to light." Larval food-plants are *Saurauja* [*sic!*] = *Saurauia tristyla* (as Ternstroemiaceae, now Saurauiaceae), *Impatiens* sp. (Geraniaceae), *Vitis* sp. (Vitaceae), *Lagerstroemia flos-reginae* (Lythraceae), and *Begonia* sp. (Begoniaceae). Mathur & Balwant Singh (1960a: 65; 1960b: 9; 1961b) write larva defoliates *Impatiens balsamina* (Geraniaceae), *Vitis vinifera* (Vitaceae) and *Lagerstroemia speciosa* (Lythraceae). One specimen from Karwar (Karnataka) [as 'Bombay' = Presidency ?] in the Forest Research Institute collection is in Dehra Dun (Roonwal & Thapa, 1963: 460).

***Theretra alecto* (Linnaeus, 1758) [FBI, Moths 5: 440-443, Fig. 110H, 113, Pl. V]**

This species occurs in many localities in India, where it is very common, and may be found in all types of country. The moths are frequently caught visiting flowers, and are also attracted by light. The larval food-plants are *Dillenia indica* (Dilleniaceae), *Saurauia nepaulensis* (Saurauiaceae), *Vitis* sp. (Vitaceae), *Leea* sp. (Leeaceae), *Psychotria* sp., and *Rubia cordifolia* (Rubiaceae). Maxwell-Lefroy (1909: 469) gives "Peas, Teak, *Vitis trifolia*" as larval food-plants. Mathur & Balwant Singh (1959: 34; 1960b: 83; 1961a: 77, 122; 1961b: 19, 86) write larva defoliates *Dillenia* sp. (Dilleniaceae), *Melastoma malabathricum* (Melastomaceae), *Tectona grandis* (Verbenaceae), *Vitis vinifera* (Vitaceae), *Psychotria* sp., and *Rubia cordifolia* (Rubiaceae).

***Theretra lycetus* (Cramer, 1856) [FBI, Moths 5: 445-448, Fig. 110I-J, Pl. VI]**

This species is fairly common here in areas of heavy rainfall during the wet months. Larval "food-plants are *Dillenia pentagyna* (Dilleniaceae), *Vitis* sp. (Vitaceae) and *Leea sambucina* (Leeaceae). Mathur & Balwant Singh (1959: 33; 1961b: 87) write larva defoliates *Dillenia pentagyna* (Dilleniaceae) and *Vitis* sp. (Vitaceae). One specimen from Karwar (Karnataka) [as 'Bombay' = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 460).

***Theretra oldenlandiae* (Fabricius, 1775) [FBI, Moths 5: 448-451, Fig. 115, Pl. VI]**

It is common and widely distributed in N. Kanara district in forest and open country with heavy or light rainfall at all altitudes. The moth is often caught feeding at flowers at dusk, and is also attracted by light. Larval food-plants are *Corchorus capsularis* (Tiliaceae), *Impatiens* spp. (Geraniaceae), *Vitis* sp. (Vitaceae), *Careya arborea* (Myrtaceae), *Jussiaea suffruticosa* (Onagraceae), *Oldenlandia corymbosa* (Rubiaceae), *Ipomoea batatas* (Convolvulaceae), *Cryptocoryne* sp., *Arisaema* spp., *Colocasia fallax*, and *Caladium bicolor* (Araceae). Maxwell-Lefroy (1909: 469) gives "Balsam, *Vitis trifolia*" as larval food-plants. Mathur & Balwant Singh (1957: 21) write larva defoliates *Corchorus capsularis* or white jute (Tiliaceae). Mathur & Balwant Singh (1960a: 65, 72; 1960b: 105, 106; 1961b: 86) write larva defoliates *Impatiens balsamina* (Geraniaceae), *Momordica dioica* (Cucurbitaceae), *Morinda tinctoria* (Rubiaceae), *Vitis vinifera* (Vitaceae) and *Ipomoea* sp. (Convolvulaceae). Ramakrishna Ayyar (1963) gave "*Colocasia*" as host plant of this pest moth he gave as *Hippotion oldenlandiae*. One specimen from Elenjeri, Nilambur (Kerala) [as 'Madras' = Presidency ?] is in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 460). Nayar et al. (1976) mention this as a pest on Balsam (*Impatiens balsamina*) but misspell it as *T. oldenlendidae*.

***Theretra pinastrina* (Martyn, 1797) [FBI, Moths 5: 451-453, Pl. VI]**

Bell & Scott (1937) write they have bred it in S. India, where it is common in open country with moderate rainfall" and "have caught the moths feeding at flowers after dark, but have not known of them coming to light." Larval food-plants are *Jussiaea repens* (Onagraceae), *Boerhavia* (Nyctaginaceae), and *Colocasia antiquorum*, *Caladium bicolor* and others (Araceae).

? *Theretra griseomarginata* (Hampson, 1898) [FBI, Moths 5: 454-455, Fig. 117]

Chandaragi et al. (2011) list this as attracted to light at Dharwar, but Bell & Scott (1937) state it is only found in the E. Himalaya. Obviously misidentified by Chandaragi et al., but correct ID only possible after examination of specimens, which are currently unavailable as no voucher specimens were preserved by them.

Theretra pallicosta (Walker, 1856) [FBI, Moths 5: 455-459, Fig. 118, Pl. VI]

Bell & Scott (1937) write they have “bred it in S. India, where it is fairly common in wooded hills with a heavy rainfall [*sic!*]” and “we have not seen the moth feeding or coming to light.” Larval food-plants are *Aporosa lindleyana* and *A. roxburghii* (Euphorbiaceae). Bhasin & Roonwal (1954: 46) also list *Aporosa lindleyana* as host plant. Mathur & Balwant Singh (1961b: 86) write larva defoliates *Vitis vinifera* (Vitaceae). One specimen each from Karwar (Karnataka) [as ‘Bombay’ = Presidency ?] and Edamon (Kerala) [as *Travancore & Cochin*] are in the Forest Research Institute collection in Dehra Dun (Roonwal & Thapa, 1963: 461).

Theretra castanea (Moore, 1872) [FBI, Moths 5: 459-461, Pl. VI]

Bell & Scott (1937) write they have “bred it in the Kanara District and in the Nilgiris up to 6,000 feet. The larvae are common during the monsoon months.” Larval food plants are *Impatiens cuspidata* (Geraniaceae), *Knoxia mollis* (Rubiaceae), *Arisaema* spp., *Ariopsis peltata* and others (Araceae).

Rhyncholaba acteus (Cramer, 1779) [FBI, Moths 5: 462-465, Fig. 119, Pls VI, VII]

Bell & Scott (1937) have bred it in many localities in India and in Burma. Very common and widely spread in forest and open country at all altitudes in heavy and light rainfall areas. Larval food-plants are *Vitis* sp. (Vitaceae), *Begonia* sp. (Begoniaceae), *Commelina bengalensis* (Commelinaceae), *Arisaema* sp., *Amorphophallus* sp., *Colocasia* sp., *Caladium bicolor*, and others (Araceae). Mathur & Balwant Singh (1957: 18; 1960b: 28; 1961a: 100; 1961b: 82) write larva defoliates *Colocasia esculenta* (Araceae), *Quercus incana* (Fagaceae), *Vitis lanceolaria* (Vitaceae) and *Leea indica* (Ampelidaceae). Ramakrishna Ayyar (1963) gave “*Colocasia*” as food plant of this pest moth. Nayar et al. (1976) mention this as a pest on Elephant Yam (*Amorphophallus campanulatus*), but misspelt it as ‘*R. actens*.’

Conclusions

This paper is essentially a review and update of the Sphingidae or hawk-moths flying in peninsular India. We expect this paper to be a model for other work on insect taxa of this area, and Bell’s extensive field research in this transect (see especially Bell & Scott, 1937: 499-507) will be an inspirational introduction and guide. More field survey and sampling of Sphingidae is required in this transect (and in southern India) to uncover further locality records, and perhaps some still undiscovered species here. It should be noted that except for T.R. Bell’s extensive field research and rearing of immatures of Sphingidae (as also of Butterflies by him) there is absolutely little work done in southern India on the distribution, biology and life-cycles of Sphingidae. Much remains to be searched for and discovered and these could be excellent postgraduate projects for M.Sc. and Ph.D. students under a capable, suitably learned guide.

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