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PETER SMETACE

Zoological Survey of India

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The Hawkmoths (*Lepidoptera . Sphingidae*) of Kumaon, N. India : A Probable Case of Faunal Drift.

by

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INTRODUCTION

The administrative division of Kumaon, in the western hills of Uttar Pradesh, lies between 28° 44′ North to 30° 49′ North latitude and 78° 45′ East to 81° 1′ East longitude. Comprising a cross section of the Himalayan range, from the Terai belt below the foothills to the rainshadow area of the Himalaya, it harbours a wide variety of flora and fauna, ranging from typically tropical to nival zone species. The presence of deep valleys throughout the central and outer ranges has facilitated the colonisation of these areas by low elevation species. Thus, it is not unusual for a single hillside to possess a faunal representation characteristic of several climatic zones.

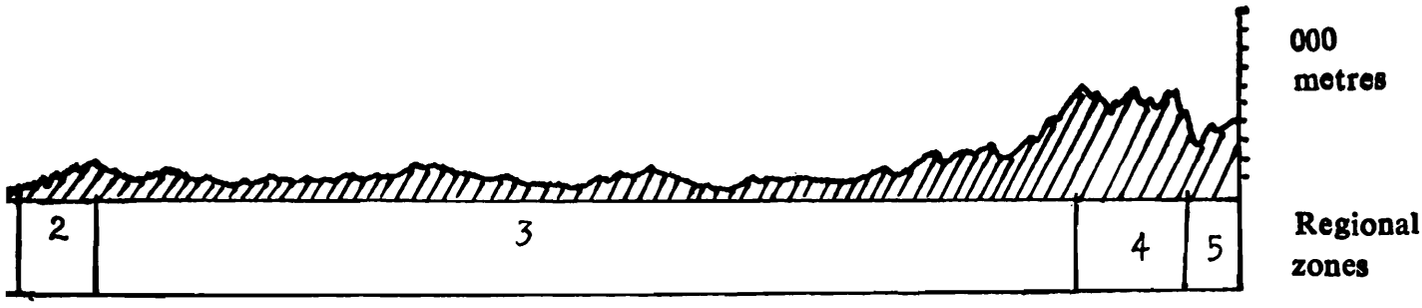


Fig. 1 : Cross section of regional climatic zones of Kumaon division (Not to scale)

Osmaston (1927) has distinguished five regional belts on a north to south axis, the outermost being the sub-montane tract below the foothills. The second tract, which receives the heaviest rainfall in the region (see Fig. 1) extends to the crest of the outermost hill range. The third and largest tract comprises the major part of Kumaon, from the crest of the outermost range to the southern face of the main range. The fourth consists of the main Himalayan range and the fifth, the rain shadow area north of the main range.

The first four tracts are subject to monsoon rains from late June to September with some rain during January and February. Hailstorms

are not unusual during March and April while May and the first half of June are usually rather hot and dry months.

The present study has been undertaken mainly in order to contribute faunal data towards the eventual re-introduction of indigenous forests in this and neighbouring areas.

MATERIAL AND METHODS

The present list has been compiled from specimens collected since 1970 by Fred Smetacek Sr. and regular observations by the author since 1983, mainly at Jones Estate, which occupies the micro-watershed between the Bhimtal and Sattal lake systems in the outermost hill range. The Bhimtal (4340 ft.) and Sattal (4220 ft.) lakes occupy the lowest parts of their respective valleys while the highest point on the watershed (5680 ft.) looks on to the adjoining plains, where the Gaula river emerges from the hills.

Jones Estate is well forested, possessing three major biotypes: Broadleaf Evergreen with *Quercus leucotrichophora* A. Camus (*Fagaceae*) and *Persea odoratissima* Nees (*Lauraceae*) as dominant species; Conifer, with *Pinus roxburghii* Sarg. (*Pinaceae*) and *Cupressus torulosa* D. Don (*Cupressaceae*) as dominant species; and Miscellaneous Deciduous with *Anogeissus latifolia* Wall. (*Combretaceae*), *Bauhinia vareigata* Linne', *B. retusa* Roxb., *Erythrina suberosa* Roxb. (*Leguminosae*) and *Sapium insigne* Trim. (*Euphorbiaceae*) as prominent components.

Forest type in other parts of Kumaon were visited during peak flying periods. In the second regional belt, these were:

(a) Kilbury, (alt. 7,200 ft.) a dense Reserve Forest 8 Km. by road roughly north of Nainital where specimens were collected in dense forest at kilometer 8 and on a grassy hillside near kilometer 6 along the road.

Dominant vegetation within several kilometers is Broadleaf Evergreen (*Quercus floribunda*) Lindley ex. A. Camus, *Q. leucotrichophora* and some *Q. lanata* Smith: (*Fagaceae*); Conifer (*Cupressus torulosa*) on the slopes of the adjoining Nainital valley and *Pinus roxburghii* on the lower slopes around the village of Pangot.

(b) The Pines (alt. 5,900 ft.) roughly 5 km. south-east by road of Nainital, near a small patch of *Quercus lanata* amidst *Pinus roxburghii* on the adjoining slopes, with *Quercus floribunda* higher up the hillside.

(c) Maheshkhan Reserve Forest (alt. 7,200 ft.), a dense forest 17 km. by road east of Nainital with *Quercus floribunda* and *Q. leucotrichophora* as dominant species ; *Rhododendron arboreum* Smith (*Ericaceae*) and *Quercus lanata* higher up.

(d) Gagar Pass (alt. 7,700 ft.), above Maheshkhan Reserve Forest with widespread apple cultivation and grassy hillsides adjoining the forest. Very few specimens of hawkmoths were collected here. The absence of *Langia zenzeroides* Moore from this area is surprising.

(e) Okhalkanda Forest (alt. 7,200 ft.), circa 60 km. by motor road east of Nainital, with *Abies pindrow* Royle (*Pinaceae*) and *Quercus floribunda* as dominant species.

In the third regional belt, the following sites were visited :

(1) Katarmal (alt. 4,200 ft.), 6 km. north west of Almora, at the Forest Rest House, which is surrounded by a small patch of *Quercus leucotrichophora*, with scattered *Pinus roxburghii* above and cultivation in the valley below. Only two specimens were collected here. One, a male *Thamnoecha uniformis* Rothschild & Jordan, was interesting while the second, *Theretra oldenlandiae* Fabricius was expected.

(2) Binsar Sanctuary (roughly alt. 7,700 ft.), 30 km. north of Almora, a dense *Quercus floribunda*, *Q. leucotrichophora* and *Rhododendron arboreum* dominated forest, with *Pinus roxburghii* on the lower slopes. The absence of *Cechenena mirabilis* Butler from this area is surprising.

(3) Jageshwar (approx. alt. 6,000 ft.), a temple town 34 km. north east of Almora with a small patch of *Cedrus deodara* G. Don (*Pinaceae*) with *Q. leucotrichophora* and *Pinus roxburghii* on the higher slopes. There is cultivation further down the valley.

(4) Kausani (alt. 5,250 ft.), 52 km. roughly north west of Almora, where no hawkmoths were recorded near the State Bungalow on June 17th, 1990, at a mercury vapour lamp.

(5) Ganai (alt. 3,200 ft.), 108 km. north west of Almora, where

one *Agrius convolvuli* Linnaeus was collected.

In the main range, only one site was visited in Kumaon, that is, the village of Sama (alt. approx. 6,500 ft.), approximately 35 km. north-east of Bageshwar town, which is surrounded by a dense forest dominated by *Quercus floribunda* and *Q. leucotrichophora.*

I collected a specimen of *Acosmerxy naga* Moore at Joshimath in N. Garhwal as well as one *Clanidopsis exusta* Butler, one *Eupanacra metallica* Butler and two specimens of *Cechenena scotti* Rothschild in Auli forest above Joshimath on Aug. 17, 1992. Also three specimens of *Rhopalopsyche nycteris* Kollar at 13,200 feet elevation in the Khiron valley north of Joshimath, on the southern slope of Neelkanth (20,300 ft.). They were active in a fog that had sent even the bumble bees to seek shelter.

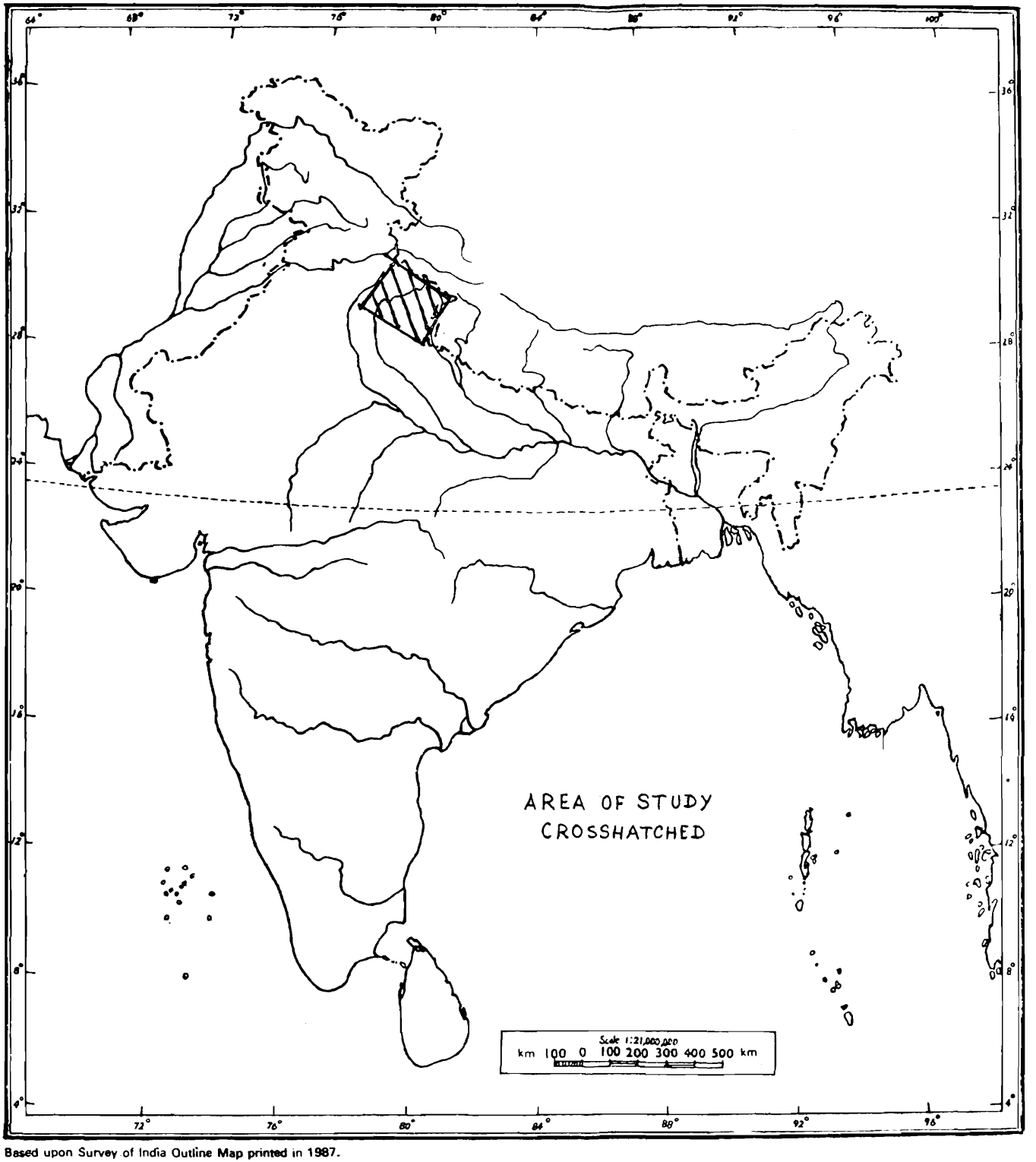
In the present study, very little work has been carried out at low elevation in Kumaon. In order to compensate for this lacuna, species recorded by Bell & Scott (1937) and D'Abrera (1986) have been included.

BREEDING

Little emphasis was placed on breeding experiments. Notes have been entered in cases where a particular foodplant was accepted or rejected by larvae of a particular species, which modifies or adds to the literature on the subject, mainly work carried out by Bell & Scott (1937).

ATTRACTANTS

The main method of surveying populations was white mercury vapour lamps, of 160 watts at the main study site in Jones Estate and 125 watts intensity at the other locations. Experiments with blue ultra-violet lamps and tubelights, in combination with a mercury vapour lamp at the main study site did not perceptibly improve attendence. When blue UV light was used without a mercury vapour lamp, numerous



Based upon Survey of India Outline Map printed in 1987.

The territonal waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Responsibility for correctness of internal details shown on the map rests with the publisher.

beetles (*Coleoptera* : *Scarabaeidae*) were attracted and little else. Hence, a single mercury vapour lamp, reflected off a white sheet, appears to be the most effective attractant.

Only two species of hawkmoths in this area appear to be occasionally attracted to over-ripe fruit, i.e. *Anambulyx elwesi* Druce and *Ampelophaga rubiginosa* Bremer & Grey. Specimens of *Macroglossum* Scopoli, *Cephonodes* Hübner, *Gurelca* Kirby, *Hemaris* Dalman and *Rhopalopsyche* Butler were collected at flowers during the day while some specimens of *Nephele didyma* Fab., *Theretra clotho* Drury and *Theretra oldenlandiae* Fab. were taken at flowers of *Bauhinia vareigata* Linnaeus at dusk.

FLYING TIME

The period of emergence of hawkmoths from their pupae has been observed to be governed by the weather rather than dates. In the wake of a major forest fire in Jones Estate in May 1984 and the drought years of the latter part of the eighties, population levels of most species dropped. Some hawkmoths (*Acherontia* Laspeyres) have at times extended their pupation period to two years in captivity. A similar capability in other species, particularly those that prefer to emerge during the damp monsoon months, might account for the rapid re-establishment of many species in the years of normal precipitation following the forest fire and drought years.

During the hours of darkness, hawkmoths are active from dusk until about 10 p.m. at night, with only a few stragglers being attracted to the light after 11 p.m. The early hours of the morning witness a decline in activity although some species, such as *Theretra griseomarginata* Hampson, tend to appear between 11 p.m. and 2 a.m. and are possibly active mainly during this period.

DISTRIBUTION

Being strong fliers, hawkmoths are capable of travelling over large distances, possibly in search of suitable breeding zones. Bell & Scott

(1937) mention that European females of *Argius convolvuli* Linnaeus which manage to cross the English Channel are sterile, so they cannot reproduce in the British Isles, though the larval hostplant occurs naturally there. This feature does not necessarily apply to all the rest of the family, although other migratory genera are subject to this constraint.

The hawkmoth fauna of Kumaon possesses a generous sprinkling of cosmopolitan species. However, the majority consists of rather local species, characteristic of the Indo-Malayan respresentation.

Hawkmoths are, for the major part, extremely selective in their choice of breeding zones. The important condition, in today's context, is an undisturbed breeding site. Bell & Scott (1937) note that many localised Indian species are restricted to regions of heavy rainfall. Extremely local species, such as *Pseudodolbina fo* Walker, *Anambulyx elwesi* Druce and *Thamnoecha uniformis* Butler indicate that they require uncommon breeding conditions and therefore, suitable breeding areas are restricted. Precise factors governing the distribution of such species have not been understood.

In this list, the recorded distribution of species globally has been excerpted from D'Abrera's *Sphingidae Mundi* (1986), while Bell & Scott's work (*Fauna of British India* series, *Moths*, Vol. V, *Sphingidae*, 1937) has served as the major source for details of distribution within the Indian subcontinent. With reference to Kumaon, D'Abrera (*pers. comm.*) includes this area in the term "Northern India" and the region west of a approximately 75°E longitude as "North-western India, while Bell & Scott refer to this area as the "Western Himalaya".

Unless otherwise mentioned, all specimens mentioned in the systematic section have been recorded at "The Retreat" Jones Estate, near Bhimtal in Naintal district, U.P.

AH=Armin Hauenstein, Untermunkheim-Schonenberg, Germany.
BM=British Museum (Natural History), Cromwell Road, London, U. K. (The Natural History Museum).
Coll.=Collection (insect).
FS=Fred Smetacek Sr. (late), Jones Estate, Bhimtal, U. P., India.

H. = Armin Hauenstein, Untermunkheim-Schonenberg, Germany.
JMC = Dr. J. M. Cadiou, Saint Cloud, France.
Ox. = Hope Entomological Collections, University Museum, Parks Road, Oxford, U. K.
PS = Peter Smetacek, Jones Estate, Bhimtal, U. P., India.

KEY WORDS

Faunal Drift ; Global Warming ; Climatic Change ; Himalaya ; Afforestation ; Lepidoptera ; *Sphingidae*.

1. **Acherontia lachesis** Fabricius

1798. *Sphinx lachesis* Fabricius, *Ent. Syst. Suppl.* : 434.
1882. *Acherontia lachesis*, Moore, *Lep. Ceylon* ii : 6.

Material examined : 11 exs. : 29.iv.84 PS ; 6.ix.83 FS ; 5.ix.83 FS ; 5.ix.81 FS ; 9.viii.83 FS ; 4.x.80 (♀) FS (Coll. S) ; 13.vii.83 FS ; 21.vi.82 FS ; 13.vii.83 FS ; 7.vi.81 (♀) AH ; 14.vii.80 AH (Coll. H)

Length of Forewing : 44-60 mm.

Distribution : Throughout India, Sri Lanka and Burma. To China, the Philippines and S. Moluccas.

Remarks : Occurs in several broods through the summer months.

2. **Acherontia styx** Westwood

1848. *Sphinx styx* Westwood, *Cab. Or. Ins.*; 88, pl. 42, fig. 3.
1903. *Acherontia styx*, Roths. & Jord., *Rev. Sphing.* : 23.

Material examined : 8 exs. : 18.ix.84 PS ; 5.ix.83 FS ; 9.ix.73 FS ; 5.vii.88 PS ; 6.ix.73 FS ; 19.vii.88 PS (Coll. S) ; 22.ix.86 (♀)AH ; 28.v.90 Kilbury AH (Coll. H).

Length of Forewing : 38-50 mm.

Distribution: Lower Mesopotamia, eastern Arabia, throughout India, Sri Lanka to Japan and (?) New Guinea.

Remarks : Occurs in several broods through the summer months.

3. **Agrius convolvuli** Linnaeus

1758. *Sphinx convolvuli* Linnaeus, *Syst. Nat.* 10 : 490.
1819 (1816). *Agrius convolvuli*, Hübner, *Verz. bekk. Schmett.* : 137.

Material examined : 8 exs. : 24.vi.89 Ganai, Kumaon 3,200 ft. Harish Pangtey ; 5.xi.83 FS ; 24.iii.82 FS (Coll.S.) ; 24.viii.80 AH ; 22.ix.86 AH ; 10.v.82 FS ; 6.iv.82 (♀) FS ; 24.viii.80 (♀) AH (Coll.H).

Length of Forewing : 38-47 mm.

Distribution : The Palearctic, Oriental, Afrotropical and Australian Regions. Occurs throughout the Indian sub-region, in both wet and dry areas, at all elevations up to 7,000 feet.

Remarks : Common in years of heavy rainfall.

4. **Megacorma obliqua** Walker

1856. *Macrosila obliqua* Walker, *List. Lep. Ins. B. M.*, vii : 208.
1903. *Megacorma obliqua*, Roths. & Jord., *Rev. Sphing.* : 15.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Northern India, Sri Lanka to the Bismarck Archipelago.

Remarks : D' Abrera (1986) includes Kumaon in "N. India." This species probably occurs at low elevation in the Dun and Terai belt. Not recorded by Bell & Scott (1937) from the western Himalaya.

5. **Meganoton analis** Felder

1874. *Sphinx analis* Felder, *Reise Novara*, pl. 78. fig. 4.
1903. *Meganoton analis*, Roths. & Jord., *Rev. Sphing.* : 37.

Material examined : 2 exs. : 1.vii.90 PS ; 26.vi.90 PS (Coll. S).

Length of Forewing : 64-73 mm.

Distribution : India (W Bengal : Darjeeling ; Meghalaya : Khasi Hills) ; Burma, Thailand, Peninsular Malaya to China (? Korea, ? Japan), Taiwan.

Remarks : This species appears to breed in the study area. It has also been recorded from Binsar (7,500 feet, 27.vii.). Appears to be restricted to dense broadleaf forests. A montane species. Not recorded by Bell & Scott (1937) from the W. Himalaya.

6. **Meganoton rufescens** Butler

1875. *Diluda rufescens* Butler, *Proc. Zool. Soc, Lond.* : 260.
1903. *Meganoton rufescens*, Roths. & Jord., *Rev. Sphing.* : 37.

Material examined : Nil.

Forewing Length : Not recorded.

Distribution : North India, (U.P., Sikkim, W. Bengal, Andamans) Bangladesh (Sylhet), to the Philippines (Mindanao, Sulu Is.), China, Ceram, Ambon, New Guinea, Borneo, Australia (N. Queensland).

Remarks : Butler described the nominate sub-species from a specimen from "N. India". D' Abrera (1986) includes N. India in its distribution, although Bell & Scott (1937) do not record it. It is probably a rather local species occuring in bio-types which have not been comprehensively covered in this region, such as low elevation riverine and broadleaf deciduous bio-types.

7. **Psilogramma menephron** Cramer

1780. *Sphinx menephron* Cramer, *Pap. Exot.*, 3 : 164.
1903. *Psilogramma menephron*, Roths. & Jord., *Rev. Sphing.* ; 43.

Material examined : 17 exs. : 11.vii.83 FS ; 10.vii.83 x 2 FS ; 27.viii.83 FS ; 15.vii.83 FS ; 26.iv.92 PS ; 21.vi.92 PS (Coll.S) ; 6.viii. 80 AH ; 10.vii.81 AH ; 10.vii.83 FS ; 14.vii.83 FS ; 20.vi.82 FS ; 19. vi.78 (♀) AH ; 6.vi.80 S. Ihle (♀) ; 1.vii.85 (♀) FS ; 1.ix.73 AH ; 20. vii.77 (♀) AH (Coll. H.).

Length of Forewing : 47-66 mm.

Distribution : ssp. *menephron* Cramer : Oriental Region, Australian Region except New Caledonia, throughout India ; ssp. *lifuense* Rothschild : New Caledonia, Loyalty Is. ; ssp. *jordana* Bethune-Baker : Fiji.

Remarks : A variable and, at times, very common insect. Kitching

(*pers. comm.*) remarks that this and the next species are in need of taxonomic revision.

8. **Psilogramma increta** Walker

1864. *Anceryx increta* Walker, *List Lep. Ins. B. M.* 31 : 36.
1903. *Psilogramma increta*, Roths. & Jord., *Rev. Sphing.* : 43.

Material examined : 8 exs. : 8.viii.83 PS ; 21.vi.92 PS ; 11.vii.83 PS ; 14.vii.83 PS (Coll.S) ; 10.vii.89 PS ; 14.vii.83 FS ; 9.iv.77 S. Ihle ; 10.vii.81 FS (Coll. H.).

Forewing Length : 39-46 mm.

Distribution : China, Korea, Japan (D' Abrera 1986).

Remarks : D' Abrera (1986) remarks that this is possibly only a strongly differentiated race of *Psilogramma menephron* Cramer. Hampson (1892) includes this as a variety of *"Pseudosphinx discistriga"* Walker which included what is now *Psilogramma menephron* Cramer and several others. *P. menephron* and *P. increta* co-exist in the Bhimtal valley, although *P. increta* is not common.

9. **Pseudodolbina fo** Walker

1856. *Zonilia fo* Walker, *List Lep. Ins. B. M.* 8 : 195.
1903. *Pseudodolbina fo*, Roths. & Jord., *Rev. Sphing.* : 100.

Material examined : 13 exs. : 30.vi.91 PS ; 24.vi.90 (♀) PS ; 17.vii.88 PS ; 2.vii.86 PS ; (Coll. S.) ; 14.vii.85 FS ; 11.vii.78 AH ; 16.vii.89 PS ; 8.vii.89 PS ; 26.vii.85 FS ; 24.vii.89 PS ; 29.vii.86 (♀) FS ; 26.vi.86 (♀) FS (Coll. H.) 1897 Nainital 7,000 feet (Coll. Ox.).

Length of Forewing : 22-32 mm.

Distribution : ssp. *fo* Walker : India (Sikkim ; Meghalaya : Khasi Hills). ssp. *celator* Rowan : India (Himachal Pradesh : Dharamsala, Simla ; Uttar Pradesh : Mussoorie), Nepal ?

Remarks : D' Abrera (1986) mentions that ssp. *celator* Rowan differs superficially from the nominate sub-species in the paler ground-colour of the former. Jordan distinguished between tne two sub-species on the basis of the harpe bearing a ventral tooth close to the apex, of

variable size. In terms of D' Abrera's superficial distinction, specimens from Bhimtal seem to be closer to ssp. *fo.* A montane species.

10. **Sphinx ligustri** Linnaeus

1758. *Sphinx ligustri* Linnaeus, *Syst. Nat.* 10 : 490.

Material examined : 1 ex. : 16.ix.80 (♀) FS (Coll. J.M.C.).

Forewing Length : 46 mm.

Distribution : Europe, N. Africa, Azores, Canary Is. to Central Asia, N. China to Japan.

Remarks : The single specimen from Jones Estate is unusual in that it has no pink flush on the hindwings. A new record for India. Certainly a straggler.

11. **Thamnoecha uniformis** Butler

1875. *Hyloicus uniformis* Butler, *Proc. Zool. Soc. Lond.* : 261.
1903. *Thamnoecha uniformis*, Roths. & Jord., *Rev. Sphing.* : 153.

Material examined : 5 exs. : 2.vi.74 FS ; 18.v.89 PS ; 5.vii.89 Katarmal PS (Coll. S.) ; 11.vi.75 W Thomas ; 6.iv.82 (♀) FS (Coll. H.).

Length of Forewing : 25-29 mm.

Distribution : India (Himachal Pradesh : Simla).

Remarks : The single male from Katarmal is more heavily marked than specimens from Bhimtal (Jones Estate). The larval foodplant is Chir Pine (*Pinus roxburghii* Sarg.). Kitching (*pers. comm.*) notes that there is a specimen from Bhimtal in the collections of the British Museum (N.H.), London. A montane species.

12. **Dolbina inexacta** Walker

1856. *Macrosila inexacta* Walker, *List. Lep. Ins. B. M.* 8 : 208.
1903. *Dolbina inexacta*, Roths. & Jord., *Rev. Sphing.* 160.

Material examined : 20 exs. : 13.vi.90 Binsar PS x2 ; 19.iii.91 PS ; 23.vi.90 FS ; 14.vii.90 PS ; 10.vii.90 PS ; 31.iii.91 PS ; 18.iii.91 FS ; 3.iv.91 FS ; 26.iv.92 PS ; 16.vi.90. Sama PS ; (Coll.S) 13.viii.87 FS ;

8.vii.87 FS ; 10.vii.86 AH x2 ; 30.v.90 AH ; 15.v.90 (♀) AH (Coll.H.) ; 15.vii.90 PS ; 17.vii.90 PS (Coll. B.M.) 11.vi.91 PS (Coll. J.M.C.).

Length of Forewing : 32-38 mm.

Distribution : India (Karnataka : Kanara ; Uttar Pradesh : Mussoorie ; Sikkim ; Meghalaya), ? Burma.

Remarks : Bred on *Olea glandulifera* Wallich (*Oleaceae*). Common in years of heavy rainfall. Bell & Scott (1937) note that it occurs in China.

13. Amplypterus panopus Cramer

1779. *Sphinx panopus* Cramer, *Pap. Exot.*, 8 : 50, *pl.* 224, *figs.* A, B.
(1819) 1816. *Amplypterus panopus,* Hübner, *Verz. Bekk. Schmett.* : 137.

Material examined : Nil.

Length of Forewing ; Not measured.

Distribution : Throughout India, including the Andamans and ? Nicobars, China, Sundaland, Philippines and Sulawesi.

Remarks : Not recorded in the hills of the study area. Probably occurs at low elevation where its larval foodplant, *Magnifera* L., is plentiful. *Mangifera* L. (Mango) also occurs in the hills of the study area.

14. Ambulyx sericeipennis Butler

1875. *Ambulyx sericeipennis* Butler, *Proc. Zool. Soc. Lond.* : 252.

Material examined : 17 exs. : 23.vi.90 PS ; 27.v.74 FS ; 14.vii.74 FS ; 10.iv.75 FS ; 15.vi.75 FS ; 3.vii.90 PS ; 1.vii.83 FS ; 22.vi.92 PS (Coll. S.) ; 29.vi.79 AH ; 10.iv.82 FS ; 4.vi.82 FS ; 12.iv.76 AH ; 10.iv. 81 AH ; 6.viii.80 AH ; 13.vii.89 PS ; 22.v.90 AH (Coll. H.) ; 26.vii.90 PS (Coll. B.M.).

Length of Forewing : 45-51 mm.

Distribution : India (Uttar Pradesh : Mussoorie ; Himachal Pradesh : Sabatu, Simla ; Sikkim ; Meghalaya), Nepal, Burma to Japan, Java, ? Bali, ? Lombok, Philippines.

Remarks : The most frequently met *Ambulyx* in Jones Estate. A variable insect, easily confused with the next.

15. **Ambulyx placida** Moore

1888. *Ambulyx placida* Moore, *Proc. zool. Soc. Lond.* : 390.

Material examined : 4 exs. : 15.vi.74 FS ; 18.vii.90 PS ; (Coll. S.) ; 14.vii.83 FS (Coll. H.) ; 12.vi.76 ♂ FS (Coll. J.M.C.).

Length of Forewing : 45-51 mm.

Distribution : India (Himachal Pradesh : Solon, Sabatu.).

Remarks : Kumaon is probably the eastern limit of this species. Specimens from Nepal east to Taiwan have been assigned to *Ambulyx semiplacida* Inoue by Cadiou & Kitching (1990).

16. **Ambulyx maculifera** Walker

Ambulyx maculifera Walker, List Lep. Ins. B.M. 35 : 185.

Material examined : 7 exs. : 29.v.75 FS ; 26.vii.89 PS ; 1.viii.89 PS ; 4.viii.89 PS ; (Coll. S.) ; 15.vii.89 PS ; 22.ix.86 AH ; 8.vi.81 AH (Coll. H.).

Length of Forewing : 44-56 mm.

Distribution : India (Uttar Pradesh ?, W. Bengal : Darjeeling ; Sikkim), Nepal.

Remarks : A variable species. The preferred habitat appears to be montane, with heavy rainfall. Not recorded by Bell & Scott (1937) from the western Himalaya.

17. **Ambulyx liturata** Butler

1875. *Ambulyx liturata* Butler, *Proc. Zool. Soc. Lond.* : 250.

Material examined : 7 exs. : 22.vii.88 PS ; 27.vii.89 PS ; 9.ix.83 FS (Coll. S.) ; 21.iii.76 AH ; 9.iv.81 AH ; 1.iv.83 FS ; 7.iv.82 FS (Coll. H.).

Length of Forewing : 48-58 mm.

Distribution : Sri Lanka, India (W. Bengal : Darjeeling ; Meghalaya) to China and the Philippines.

Remarks : A rare insect. Ova were taken from a female in early June which did not take any of the over twenty plant species offered to them, which included probably all local members of families such as *Fagaceae*, on which Bell & Scott (1937) note this moth has been bred in S. China. A new record for Kumaon.

18. **Ambulyx ochracea** Butler

1885. *Ambulyx ochracea* Butler, *Cistula Ent.* 3 : 113.

Material examined : 6 exs. : 30.iv.74 FS ; 4.v.75 FS ; 26.vi.92 PS (Coll. S.) ; 22.vi.82 FS ; 10.vi.82 FS ; 16.vii.90 Sama PS (Coll. H.).

Length of Forewing : 42-49 mm.

Distribution : India (Uttar Pradesh ; Sikkim (?), Meghalaya) to Japan, Nepal.

Remarks : An uncommon species, record from Sama and Jones Estate. Apparently a montane species. Not recorded by Bell & Scott (1937) from the Western Himalaya.

19. **Ambulyx substrigilis** Westwood

1848. *Sphinx* (*Ambulyx*) *substrigilis* Westwood, Cab. Or. Ent. : 61, pl. 30, fig. 2.
1856. *Ambulyx substrigilis*, Walker, *List Lep. Ins. B. M.* 8 : 122.

Material examined : 6 exs. : 3.ix.71 FS ; 2.iv.75 FS ; 10.viii.88 PS ; 9.vii.91 PS (Coll. S.) ; 13.iv.81 AH ; 22.iii.76 AH (Coll. H.).

Length of Forewing : 47-57 mm.

Distribution : Sri Lanka, India (Karnataka : N. Kanara ; Andamans ; ? Nicobars ; W. Bengal), Bangladesh (Sylhet) to Hainan.

Remarks : Rare in the Bhimtal valley, probably straggling up from lower elevation. Not recorded by Bell & Scott (1937) from the Western Himalaya.

20. **Clanis phalaris** Cramer

1777. *Sphinx phalaris* Cramer, *Pap. Exot.* 2 : 83, pl. 144, fig. A.
1903. *Clanis phalaris*, Roths. & Jord., *Rev. Sphing.* : 217.

Material examined : Specimen not examined.

Length of Forewing : Not measured.

Disiribution : India (Karnataka : N. Kanara ; Uttar Pradesh ; Madhya Pradesh : Mhow ; "Coromandel" ; Sikkim ; Andamans, Nicobars.), Sri Lanka, Nepal.

Remarks : J. M. Cadiou (*pers. comm.*) notes that he has a specimen collected in Jones Estate. Probably a straggler from lower elevation. Not recorded by Bell & Scott from the Western Himalaya.

21. **Clanis deucalion** Walker

1856. *Basiana deucalion* Walker, *List Lep. Ins. B. M.* 8 : 237.
1881. *Clanis deucalion*, Butler, *Illus. Typ. Spec. Lep. Het. B. M.* : 15, pl. 81.

Material examined : 4 exs. : 27.vii.72 Nainital FS (Coll. S.) ; 13. vii.87 FS ; 1.vii.79 AH ; 28.v.90. Kilbury AH (Coll. H.).

Length of Forewing : 52-54 mm.

Distribution : India (Himachal Pradesh : Simla ; Uttar Pradesh : Mussoorie ; Gujarat : Dangs.), W. Nepal.

Remarks : A rare species in Jones Estate. Occurs in Himalayan Oak (*Quercus incana* (=*leucotrichophora*) and Q. *floribunda* forests. The record from the Dangs by Schull and Nadkerney (1964) in Gujarat is unusual.

22. **Clanis bilineata** Walker

1866. *Basiana bilineata* Walker, *List Lep. Ins. B. M.* 35 : 1857.
1881. *Clanis bilineata*, Butler, *Illus. Typ. Spec. Lep. Het. B. M.* : 14, pl. 81, fig. 4.

Material examined : 3 exs. : 6 vii. 74 FS (Coll. S.) ; 17.viii.79 AH (Coll. H.) ; July 1907 Pilcher coll. (Coll. Ox.).

Length of Forewing : 51 mm.

Distribution : India (Karnataka : N. Kanara ; Uttar Pradesh ; W. Bengal) to China, Korea, Japan, Sumatra, Borneo, Peninsular Malaya.

Remarks : Appears sporadically. Also recorded from Kilbury on May 25. Not recorded by Bell & Scott (1937) from the Western Himalaya.

23. **Clanis titan** Rothschild and Jordan

1903. *Clanis titan* Roths. & Jord., *Rev. Sphing.* : 218.

Material examined : 1 ex. : 30.vii.83 male FS (Coll. JMC).

Length of Forewing : 73 mm.

Distribution : India (Karnataka : N. Kanara ; Uttar Pradesh ; Sikkim ; Meghalaya), Nepal, Burma to Sumatra.

Remarks : A single specimen known from Jones Estate, which was probably a straggler from lower elevation. Generally a rare species. Not recorded by Bell & Scott (1937) from the Western Himalaya.

24. **Leucophlebia lineata** Westwood

1848. *Leucophlebia lineata* Westwood, *Cab. Or. Ent.* : 46, pl. 22, fig. 2.

Material examined : 6 exs. : 19.vi.90 Jageshwar PS x 6 (Coll. S.= 2 exs. ; Coll. H.= 4 exs.).

Length of Forewing : 29-30 mm.

Distribution : Throughout India ; the entire Oriental Region.

Remarks : Not recorded from Jones Estate. Although this and the following species appear to be low elevation species, the cultivation of one of their larval host plants *Saccharum* around Jageshwar might account for their appearance at an elevation of approximately 6,000 feet.

25. **Leucophlebia emittens** Walker

1866. *Leucophlebia emittens* Walker, *List. Lep. Ins. B. M.* 35 : 1858.

Material examined: 1 ex. : 19.vi.90 Jageshwar PS (Coll. S.).

Length of Forewing : 29 mm.

Distribution: India (Uttar Pradesh : Almora ; Maharashtra : Belgaum ; Karnataka : N. Kanara ; Madhya Pradesh : Mhow ; Sikkim.), Sri Lanka, Burma.

Remarks: Not recorded from Jones Estate. Butler (1875) recorded it from Almora, along with *Agnosia orneus* (Butler 1881), which has not been recorded from Jones Estate either.

26. **Polyptychus trilineatus** Moore

1888. *Polyptychus trilineatus* Moore, *Proc. Zool. Soc. Lond.* : 390.

Material examined: 17 exs, : 16.viii.75 FS ; 15.viii.70 FS ; 9.ix.83 FS ; 9.iv.83 FS ; 10.vii.83 FS ; 30.vi.90 PS ; (Coll. S.) ; 30.vi.76 AH ; 23.vi.78 AH ; 14.vii.83 FS ; 15.vi.85 FS ; 23.vi.87 FS ; 27.vi.87 FS ; 21. v.81 AH ; 3.ix.81 (♀) FS ; 4.ix.81 (♀) AH ; 3.ix.81 (♀) AH (Coll.H.) ; 13.v.91 PS (Coll. J.M.C.).

Length of Forewing : 43 – 50 mm.

Distribution : India (Himachal Pradesh : Dharmsala ; Uttar Pradesh : Dehra Dun ; Karnataka : Karwar ; Sikkim, Meghalaya.), Sri Lanka, Nepal, Burma, Sumatra, ? China, ? Peninsular Malaya.

Remarks : An uncommon insect which mimics a dry, curled leaf when at rest. D' Abrera (1986) does not recognise ssp. *undatus* Roths. & Jord. as distinct from the nominate sub-species.

27. **Marumba cristata** Butler

1875. *Triptogon cristata* Butler, *Proc. Zool. Soc. Lond.* : 253.
1903. *Marumba cristata,* Roths. & Jord., *Rev. Sphing.* : 272.

Material examined : 21 exs. : 26.vi.76 FS ; 13.vii.74 FS ; 7.vii.83 PS ; 4.viii.83 FS ; 9.vii.83 FS ; 1.vii.83 FS ; 13.vi.83 FS ; 4.vii.9[illegible] PS x 2 exs. ; 22.vi.92 PS ; 19.vi.90 Jageshwar PS ; 16.vi.90 Sama PS; (Coll. S.) ; 28.vi.78 FS ; 12.vii.83 FS ; 23.vii.85 FS ; 23.vi.78 AH1 4.vii.80 AH ; 24.vi.78 FS ; 3.vii.80 (♀) S. Ihle ; 12.vii.83 (♀) FS ; (Coll. H.) ; 4.vii.91 PS (Coll Ox.).

Length of Forewing : 46—56 mm.

Distribution : India (W. Bengal : Darjeeling) to W. China, Taiwan, Peninsular Malaya, Sumatra, Borneo, ? Java, ? Palawan.

Remarks : A well established, common insect throughout Kumaon. The western limit of the range requires clarification. In the event that it is as well established at Mussoorie, Garhwal, it has evidently moved into the area recently, after Bell & Scott (1937) had compiled their data from there.

28. **Marumba spectabilis** Butler

1875. *Triptogon spectabilis* Butler, *Proc. Zool. Soc. Lond.* : 256.
1903. *Marumba spectabilis*, Roths. & Jord., *Rev. Sphing.* : 273.

Material examined : 2 exs. : 7.vii.83 PS ; 4.vii.91 PS (Coll. S.).

Length of Forewing : 42—49 mm.

Distribution : India ["Northern India" (D'Abrera (1986); W. Bengal : Darjeeling ; Meghalaya] Nepal, Thailand, Sumatra, Borneo.

Remarks : Appears infrequently. Only recorded from Jones Estate, although it probably occurs in other areas with heavy rainfall, iSngle annual brood. Not recorded from the Western Himalaya by Bell & Scott (1937).

29. **Marumba dyras** Walker

1856. *Smerinthus dyras* Walker, *List Lep. Ins. B. M.* 8 : 250.
1903. *Marumba dyras*, Roths. & Jord., *Rev. Sphing.* : 274.

Material examined : 14 exs. : 21.vii.91 PS ; 4.vii.91 PS ; 8.vii.90 PS ; 28.vi.83 FS ; 15.vii.83 FS ; 12.vii.83 FS (Coll. S.) ; 5.vii.81 FS ; 7.vii. 85 FS ; 20.vi.83 FS ; 5.vi.82 FS ; 6.vi. 82 FS ; 8.vi.84 (♀) FS ; 15.vii. 85(♀) FS ; 25.vi. 76 AH (Coll. H.).

Length of Forewing : 44—55 mm.

Distribution : India (Uttar Pradesh : Mussoorie ; Gujarat : Dangs ; Karnataka : N. Kanara ; Meghalaya ; Maharashtra ; Anda-

mans), Nepal, Bangladesh, Burma to China, Java, Sumatra, the Philippines, Tanimbar Is. .

Remarks : A fairly common insect during the monsoon.

30. **Marumba sperchius** Menetries

1875. *Triptogon albicans* Butler, *Proc. Zool. Soc. Lond.* : 254.
1903. *Marumba sperchius*, Roths. & Jord., *Rev. Sphing.* : 281.

Material examined : 13 exs. : 13.vii.83 PS ; 15.vii.88 PS ; 24.vi. 92 PS ; 13.vii.90 PS x 2 exs. ; (Coll. S.) ; 19.vi.83 FS ; 4.vii.84 A_H ; 14.vii.85 FS ; 16.vii.83 FS ; 8.vii.87 FS ; 7.vi.83 (♀) FS ; 9.vi.82 (♀) FS (Coll. H.) ; 4.vii.91 PS (Coll. J.M.C.).

Length of Forewing : 46-66 mm.

Distribution : Japan, Riu Kiu Is., China, E. Siberia, India (Uttar Pradesh : Mussoorie ; Meghalaya) Nepal, Taiwan, Sumatra.

Remarks : The western subspecies *albicans* Butler occurs in Jones Estate.

31. **Langia zenzeroides** Moore

1872. *Langia zenzeroides* Moore, *Proc. Zool. Soc. Lond.* : 567.

Material examined : 2 exs. : 23.iii.74 FS ; (Coll. S.) ; 22.iii.7 (♀) FS (Coll. H.).

Length of Forewing : 72 mm.

Distribution : India (Himachal Pradesh : Kotgurh, Simla ; Sikkim ; Meghalaya.), Nepal, China, Taiwan, Japan.

Remarks : Is probably well established at higher elevation, in apple orchards. Both these specimens were taken at MV light, although Bell & Scott (1937) note that it does not come to light or flowers. The two specimens seem to agree better with the Japanese sub-species *nawai* Roths. & Jord. than with the nominate sub-species known to occur here.

32. **Clanidopsis exusta** Butler

1875. *Basiana exusta* Butler, *Proc. Zool. Soc. Lond.* : 252.
1903. *Clanidopsis exusta*, Roths. & Jord., *Rev. Sphing.* : 294.

Material examined : 22 exs. : 8.vii.74 FS ; 17.vii.88 PS ; 1.vii.90 PS ; 15.vii.90 PS x2 exs. ; 4.vii.90 PS ; 17.vi.82 FS ; 23.vi.92 PS ; 8.viii.82 FS ; 19.vi.90 Jageshwar PS ; 13.vi.90 Binsar PS ; 21.vii.91 PS ; 10.vii.91 PS x 2 exs. ; (Coll. S.) ; 27.vii.82 FS ; 24.viii.80 AH ; 7.vi.84 FS ; 27.viii.87 FS ; 28.vi.83 FS ; 13.vi.85 (♀) FS ; 24.viii.80 (♀) AH ; 3.vii.76 AH (Coll. H.).

Length of Forewing : 35-42 mm.

Distribution : India (Himachal Pradesh : Kunawar, Solan, Kulu, Chamba, Simla ; Uttar Pradesh : Mussoorie.).

Remarks : Common in dense forest. Apparently a very loca. species.

33. **Agnosia orneus** Westwood

1848. *Sphinx orneus* Westwood, *Cab. Or. Ent.* : 13, pl. 16, fig. 2.
1903. *Agnosia orneus*, Roths. & Jord., *Rev. Sphing.* : 295.

Material examined : 2 exs. : July, 1902 Almora, Kumaon (Type specimens for *Clanis pudorina* Butler) (Coll. Ox.).

Length of Forewing : 24-25 mm.

Distribution : India (Uttar Pradesh : Almora ; "Central India" ; Karnataka : N. Kanara), Sri Lanka.

Remarks : Not recorded from Jones Estate although the larval hostplant, *Grewia asiatica* (*Tiliaceae*) occurs here. A rare and local splecies.

34. **Parum porphyria** Butler

1877. *Daphnusa porphyria* Butler, *Trans. Zool. Soc. Lond.* 9 : 640.
1903. *Parum porphyria*, Roths. & Jord., *Rev. Sphing.* : 297.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India [W. Bengal : Darjeeling ; Sikkim ; Meghalaya ? ; "Northern India" (D' Abrera 1986], Nepal ?

Remarks : Included here on the basis of D'Abrera 's (1986) note that it occurs in Northern India.

35. **Cypa decolor** Walker

1856. *Smerinthus decolor*. Walker, *List. Lep. Ins. B. M.* 8 : 255.
1886. *Cypa decolor*, Moore, *Journ. As. Soc. Beng.* 4 : 97.

Material examined : 15 exs. : 17.v.90 PS ; 15.vii.83 FS ; 27.viii. 83 FS ; 14.vii.83 FS ; 4.vii.91 PS ; (Coll. S.) ; 16.vi.82 FS ; 22.vii.87 FS ; 17.v.79 AH ; 24.vi.81 AH ; 14.vii.83 FS ; 7.vi.83 FS ; 21.vi.87 FS ; 15.v.90 (♀) AH , 30.v.90 (♀) AH (Coll. H.) ; 21.vii.91 PS (Coll. Ox.).

Length of Forewing : 18-29 mm.

Distribution : India [W. Bengal : Darjeeling ; Sikkim ; "Northern India" (D'Abrera 1986], Sri Lanka, China, Nepal, Sumatra, Borneo. New Guinea, Philippines.

Remarks : A rather uncommon species. Not recorded by Bell & Scott (1937) from the Western Himalaya.

36. **Cypa pallens** Jordan

1926. *Cypa decolor pallens* Jordan, *Novit. Zool.* 33 : 380.
1931. *Cypa pallens* Jordan, *Novit. Zool.* 37 : 238-241.

Material examined : 2 exs. : 30.viii.89 PS ; 27.viii.83 FS (Coll. S.).

Length of Forewing : 30 mm.

Distribution : India (? Uttar Pradesh : Mussoorie ; Sikkim ; Meghalaya ; Assam : Silchar.), Sumatra, ? Peninsular Malaya.

Remarks : Specimens from Jones Estate have a cinnamon ground-colour, matching Bell & Scott's (1937) description but quite unlike D' Abrera's (1986) depiction. Jordan's (1926) type-specimen for *"Cypa decolor pallens"* = *Cypa pallens* came from "Masuri" (Mussoorie) in Uttar

Pradesh, but D'Abrera gives the locality of the nominate sub-species of *C. pallens* as ? Peninsular Malaya.

37. **Smerinthulus perversa** Rothschild

1894. *Cypa perversa* Rothschild, *Novit. Zool.* 1 : 70, pl. vii.
1903. *Smerinthulus perversa*, Roths. & Jord., *Rev. Sphing.* : 300.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India ["Northern India" (D' Abrera 1986) ; Sikkim ; Meghalaya ;] Burma.

Remarks : There appear to be no records from Jones Estate, although specimens may have been taken over the years. Not recorded by Bell & Scott (1937) from the Western Himalaya.

38. **Callambulyx poecilus** Rothschild

1898. *Ambulyx poecilus* Rothschild, *Novit. Zool.* 5 : 604.
1903. *Callambulyx poecilus*, Roths & Jord., *Rev. Sphing.* : 310 pl. 1.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : N. Pakistan (Murree), India (Meghalaya : Khasi Hills) to Burma, Malaya, Sumatra and Taiwan.

Remarks : Not recorded from Jones Estate. Probably occurs at higher elevation.

39. **Callambulyx rubricosa** Walker

1856. *Ambulyx rubricosa* Walker, *List. Lep. Ins. B. M.* 8 : 122.
1903. *Callambulyx rubricosa*, Roths. & Jord., *Rev. Sphing.* : 309.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India : ["Northern India" (D' Abrera 1986) ; Sikkim ; "Assam"] ; to Vietnam and Borneo.

Remarks : Not recorded from Jones Estate. D' Abrera (*pers. comm.*) notes that this species ought to occur in Kumaon.

40. **Anambulyx elwesi** Druce

1882. *Ambulyx elwesi* Druce, *Ent. Mo. Mag.* 19 : 17.
1903. *Anambulyx elwesi*, Roths. & Jord., *Rev. Sphing.* : 312.

Material examined : 14 exs. : 6.vi.74 FS ; 15.vii.88 PS ; 10.vii. 89 PS ; 30 vi. 90 PS ; 22.vi.92 PS ; 25.vi.92 PS (Coll. S.) ; 1.vii.79 AH ; 4.ix.81 FS ; 8.vi.84 (♀) FS ; (Coll. H.) ; 16.vi.91 PS ; 21.vii. 91 PS ; 3.vii.91 PS ; 11.vi.91 PS (Coll. J.M.C.).

Length of Forewing : 41-49 mm.

Distribution : India ["Northern India" (D' Abrera 1986) ; W. Bengal : Darjeeling ; Sikkim ; Meghalaya], ? Nepal.

Remarks : Not recorded from Mussoorie by Bell & Scott (1937). This hawkmoth is also attracted to over-ripe fruit. Appears to be well established in Jones Estate, but not recorded from other locations.

Subfamily MACROGLOSSINAE

41. **Hemaris saundersi** Walker

1856. *Sesia saundersi* Walker, *List. Lep. Ins. B. M.* 8 : 83.
1877. *Hemaris saundersi*, Butler, *Trans. Zool. Soc. Lond*, 9 : 520.

Material examined : 10 exs. 9.vi.72 Nainital FS ; 13.vi.90 Piparseli Almora PS (Coll. S.) ; 6.v.80 AH ; 7.v.80 AH ; 17.v.79 AH ; 10.v.80 AH ; 7.v.80 AH ; 7.v.80 (♀) AH ; 3.v.80 (♀) AH ; 10.v.78 AH (Coll. H.).

Length of Forewing : 22-27 mm.

Distribution : India (Kashmir : Gurias Valley ; Uttar Pradesh : Mussoorie ; Sikkim ; Himachal Pradesh ; Meghalaya) Nepal, Bangladesh to Vietnam.

Remarks : This moth is not as common as *Cephonodes hylas* L. in the Bhimtal Valley. It is uncertain whether this moth has a brood later in the summer as well. Fond of *Lantana* and *Buddleja* L. flowers.

42. **Hemaris fuciformis** Linnaeus

1758. *Sphinx fuciformis* Linnaeus, *Syst. Nat.* 10: 493.
1892. *Hemaris fuciformis*, Hampson, *Faun. Brit. Ind. Ser. Moths.* 1 : 119.

Material examined : Nil

Length of Forewing : Not measured.

Distribution : India (Kashmir, Himachal Pradesh : Kangra), Britain to Korea, Eastern Siberia, China, Algeria, Morocco.

Remarks : Not recorded from Kumaon so far. Probably occurs in the dry inner ranges.

43. **Cephonodes hylas** Linnaeus

1771. *Sphinx hylas* Linnaeus, *Mant. Plant.* : 539.
1882. *Cephonodes hylas*, Moore, *Lep. Ceylon*, 2 : 31, pl. 43, fig. 4.

Material examined : 12 exs. : 22.v.81 FS ; 16.v.81 FS ; 25.iii.89 PS ; 31.iii.91 PS (Coll. S.) ; 14.iii.81 AH ; 13.iii.81 AH ; 9.iv.78 AH ; 30.iv.80 AH ; 27.vi.81 FS ; 15.iv.78 (♀) AH ; 9.iv.81 (♀) AH ; 24.iii.81 (♀) AH (Coll. H.).

Length of Forewing : 23-30 mm.

Distribution : Throughout India, Sri Lanka to Japan to Australia. Also in the Afrotropical Region.

Remarks : More common than the last species. Fond of *Lantana* L. and *Buddleja* L. flowers.

44. **Cephonodes picus** Cramer

1777. *Sphinx picus* Cramer, *Pap. Exot.*, 3 : 38, pl. 148, fig. B.
1903. *Cephonodes picus*, Roths. & Jord., *Rev. Sphing.* : 469.

Material examined : 1 ex. : 24.iii.81 AH (Coll. H.).
Length of Forewing: 29 mm.

Distribution : India (Uttar Pradesh : Mussoorie ; Tamil Nadu : Nilgiris ; Madhya Pradesh : Mhow ; Maharashtra : Bombay, Pune.), Pakistan, Bangladesh to China to Australia and the Marshall Is.

Remarks : Not as frequently met with as the last species.

45. **Sataspes scotti** Jordan

1926. *Sataspes scotti* Jordan, *Novit. Zool.* 33 : 381.

Material examined : Nil.

Forewing Length : Not measured.

Distribution : India (Uttar Pradesh : Dehra Dun.)

Remarks : Not recorded from the Bhimtal area. Probably occurs in the Terai belt at lower elevation.

46. **Daphnis nerii** Linnaeus

1758. *Sphinx nerii* Linnaeus, *Syst. Nat.* 10 : 490.
1857. *Daphnis nerii*, Moore, *Cat. Lep. Ins. E.I.C.*, 1 : 272, pl. x.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Throughout India, Sri Lanka, Britain through France to Saudi Arabia, Pakistan to Sumatra, Hawaii, the Afrotropical Region.

Remarks : Appears to be restricted to low elevation. I have unconfirmed reports that it is not rare in the Terai belt. Not recorded so far from Bhimtal, although its larval foodplants. *Nerium*, *Vinca*, etc. thrive.

47. **Daphnis hypothous** Cramer

1780. *Sphinx hypothous* Cramer, *Pap. Exot.*, 3 : 165, pl. 285, fig. d.
1882. *Daphnis hypothous*, Moore, *Lep. Ceylon*, 2 : 15, pl. 83.

Material examined : 2 exs. : 5.iv.73 FS ; 17.vi.74 FS (Coll. S.).

Length of Forewing : 41-47 mm.

Distribution: India (Sikkim; Assam: Sibsagar; W. Bengal: Calcutta; Andamans), Bhutan, China to Australia (Queensland) and the Solomons.

Remarks: Not recorded since 1974. Probably a low elevation species which strays up occasionally. Not recorded by Bell & Scott (1937) from the Western Himalaya.

48. **Dahira rubiginosa** Moore

1888. *Dahira rubiginosa* Moore, *Proc. Zool. Soc. Lond.*: 391.

Material Examined: 5 exs.: 7.iv.75 FS; 19.iv.83 PS (Coll. S.); 23.iv.79 AH; 19.iv.79 AH; 25.iv.79 S. Ihle (Coll. H.).

Length of Forewing: 33-39 mm.

Distribution: India (Himachal Pradesh: Mandi.), South China, Japan.

Remarks: A single annual brood, usually emerging rather early in the season. Not a common insect.

49. **Ampelophaga rubiginosa** Bremer & Grey

1852. *Ampelophaga rubiginosa* Bremer & Grey, *in* Moutshcoulsky, *Etudes ent.* 1: 61.

Material examined: 11 exs.: 26.vi.83 PS; 28.vi.81 FS (Coll. S.); 7.vi.82 FS; 1.vii.83 FS; 2.vi.84 FS; 1.vi.84 FS; 27.vi.87 FS; 8.vii.87 FS; 26.vi.80 AH; 2.v.79 AH; 24.vi.79 AH (Coll. H.).

Length of Forewing: 35-42 mm.

Distribution: India (Uttar Pradesh: Mussoorie; Himachal Pradesh: Simla, Kulu, Dharmsala, Bukleh; Meghalaya; Assam: Margherita), China, E. Siberia, Japan.

Remarks: The subspecies *fasciosa* Moore occurs in Kumaon. Is attracted to over-ripe fruit. A rather common insect during the monsoon.

50. **Ampelophaga khasiana** Rothschild

1895. *Ampelophaga khasiana* Rothschild, *Novit. Zool.* 2 : 482.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India ["Northern India" (D' Abrera 1986) Meghalaya ; Sikkim.] to China and Peninsular Malaya.

Remarks : The larval foodplant, *Saurauja nepaulensis* DC, oocurs in Kumaon, throughout the hills between 3,000 and 6,000 feet. This moth has probably been overlooked, mistaken for the very similar *Ampelophaga rubiginosa fasciosa* Moore.

51. **Elibia dolichus** Westwood

1848. *Sphinx* (*Chaerocampa*) *dolichus* Westwood, *Cab. Or. Ent.* : 61, pl. 30.
1892. *Elibia dolichus*, Hampson, *Faun. Brit. Ind., Moths*, 1 : 100.

Material examined: Nil.

Length of Forewing : Not measured.

Distribution : India ["Northern India" (D' Abrera 1986) ; Sikkim ; Meghalaya : Khasi Hills.], Bhutan to Java and Palawan.

Remarks : This is a low elevation species, ascending to 4,000 feet in Sikkim and Bhutan. It probably occurs in the Terai belt bordering the foothills. Not recorded from Jones Estate.

52. **Acosmerycoides leucocraspis** Hampson

1910. *Acosmerycoides leucocraspis* Hampson, *Jou. B. N. H. S.* 20 : 88.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India ["Northern India" (D' Abrera 1986) ; Assam : Dibrugarh.] to Vietnam, Taiwan.

Remarks : D' Abrera (*pers. comm.*) observes that Kumaon is well within the area denoted by the term "Northern India". This species has not been recorded from Jones Estate. Probably a low elevation species,

53. **Acosmeryx naga** Moore

1857. *Philampelus naga* Moore, *Cat. Lep. Ins. Mus. E. I. C.*, 1: 271.
1887. *Acosmeryx naga*, Cotes & Swinhoe, *Cat. Mo. Ind.*, 1 : 9.

Material examined : 12 exs. : 17.iii.91 PS ; 17.iii.83 PS ; 26.iv.92 PS ; 22.iv.91 PS ; 17.vii.90 PS ; 15.vii.90 PS (Coll.S.) ; 20.vii.76 AH ; 22.v.90 Maheskhan AH ; 31.v.90 Kibury AH ; 20.vii.85 FS ; 5.vii.83 FS ; 3.v.83 FS (Coll. H.).

Length of Forewing : 45-47 mm.

Distribution : India (Himachal Pradesh : Simla ; Uttar Pradesh : Mussoorie ; Sikkim ; W. Bengal : Darjeeling ; Meghalaya : Khasi Hills), China and Japan.

Remarks : Common throughout the hills in forests above 3,000 feet. The moth is attracted to light, contrary to Bell and Scott's (1937) observation.

54. **Acosmeryx anceus** Stoll

1781. *Sphinx anceus* Stoll, *in* Cramer, *Pap. Exot.* 4 : 124.
1887. *Acosmeryx anceus*, Cotes & Swinhoe, *Cat. Mo. Ind.*, 1 : 8.

Material examined : 18 exs. : 1.vii.90 PS ; 25.vi.90 PS ; 27.vi.90 PS ; 22.vi.85 PS ; 24.vi.90 PS ; 1.viii.92 PS ; 3.vii.83 PS ; 9.ix.83 PS (Coll. S.) ; 8.viii.81 FS ; 1.vii.82 FS ; 24.viii.80 AH ; 3.viii.89 FS ; 19.vi.80 PS ; 11.viii.77 AH ; 5.vii.81 AH ; 4.viii.77 (♀) AH ; 30.v.90 (♀) AH (Coll. H.) ; 16.viii.91 PS (Coll. J. M. C.).

Length of Forewing : 32-36 mm.

Distribution : India ["Northern India" (D' Abrera 1986) ; Sikkim ; W. Bengal ; Karnataka : N. Kanara], Bhutan, Bangladesh, to the Philippines, Moluccas, New Guinea and Australia (Queensland).

Remarks : The sub-species *subdentata* Roths. & Jord. occurs in India. Two forms occur, one with a pinkish-cinnamon, and one with a browner groundcolour. Appears to be generally a low elevation species, well established in the Bhimtal valley. Not recorded by Bell & Scott (1937) from the Western Himalaya.

55. **Acosmeryx sericeus** Walker

1856. *Philampelus sericeus* Walker, *List. Lep. Ins. B. M.*, 8 : 181.
1881. *Acosmeryx sericeus*, Butler, *III. Typ. Spec. Lep. B. M.*, 2 : 1.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India ["Northern India" (D' Abrera 1986) ; Sikkim], Bhutan to the Philippines.

Remarks : Not recorded from Jones Estate. Appears to a low elevation species.

56. **Acosmeryx socrates** Boisduval

1875. *Acosmeryx socrates* Boisduval, *Spec. Gen. Lep.* 1 : 219.

Material examined : 5 exs. : 23.vi.90 PS ; 19.vi.83 PS ; 7.vi.92 PS : (Coll. S.) ; 7.iv.80 AH ; 24.vi.78 AH (Coll. H.).

Length of Forewing : 39-41 mm.

Distribution : Sri Lanka, India (Karnataka : Kanaka ; Sikkim) Bhutan, Bangledesh, Burma to Malaya and the Philippines.

Remarks : The form *cinerea* Butler (1875) has been recorded infrequently from Jones Estate. Not recorded by Bell & Scott (1937) from the Western Himalaya.

57. **Acosmeryx omissa** Rothschild & Jordan

1903. *Acosmeryx omissa* Roths. & Jord., *Rev. Sphing.* : 530.

Material examined : 1 specimen, not seen.

Length of Forewing : Not measured.

Distribution : India (Sikkim) ; Bhutan ; ? Nepal.

Remarks : J. M. Cadiou (*pers. comm.*) notes that he obtained a specimen from Jones Estate, collected by FS. The presence of this species in Kumaon presupposed its presence in Nepal. Not recorded by Bell & Scott (1937) from the Western Himalaya.

58. **Eupanacra metallica** Butler

1875. *Panacra metallica* Butler, *Proc. Zool. Soc. Lond.* : 6.
1989, *Eupanacra metallica*, Cadiou & Holloway *Lamb.* 89, 9-12 : 139.

Material examined : 7 exs. : 19.vi.90 Jageshwar PS ; (Coll. S.) ; 10.ix.86 AH ; 4.ix.81 AH ; 17.ix.79 AH ; 2.vii.82 FS (Coll. H.) ; 16.vi.90 Sama PS x 2 exs. (Coll. B. M.).

Length of Forewing : 28-30 cm.

Distribution : India (Himachal Pradesh : Simla ; Uttar Pradesh : Mussoorie ; Sikkim) ; Nepal, Bhutan, ? Burma.

Remarks : Gehlen (1930) described sub-species *anfracta* from the Simla population. The Sama (and Jones Estate) populations appear to be somewhat intermediate between ssp. *anfracta* Gehlen and the nominate sub-species from Sikkim (Kitching, *pers. comm.*).

59. **Eupanacra variolosa** Walker

1856. *Panacra variolosa* Walker, *List. Lep. Ins. B. M.*, 8 : 156.
1989. *Eupanacra variolosa*, Cadiou & Holloway, *Lamb.* 9-12 : 139.

Material examined : 1 ex. : 20.iv.79 AH (Coll. H.).

Length of Forewing : 27 mm.

Distribution : India [Meghalaya : Khasi Hills ; "Northern India" (D' Abrera 1986)], Bangladesh (Sylhet), Nepal, Bhutan, to Borneo.

Remarks : A rare species. Not recorded by Bell & Scott (1937) from the Western Himalaya.

60. **Eupanacra sinuata** Rothschild & Jordan

1903. *Panacra sinuata*, Roths. & Jord., *Rev. Sphing.* ; 539, pl. 6, fig. 13.
1989. *Eupanacra sinuata*, Cadiou & Holloway, *Lamb.* 9-12 : 139.

Material examined : 3 exs. : July 83 FS ; 10.x.74 FS (Coll. S.) ; 24.viii. 80 S. Ihle (Coll. H.).

Length of Forewing : 29 mm.

Distribution : India (Sikkim, Meghalaya : Khasi Hills), ? Nepal, ? Burma, ? Thailand, ? Indo-China.

Remarks : Little is known about this insect. Not as uncommon as the last species. Not recorded by Bell & Scott (1937) from the Western Himalaya.

61. **Eupanacra radians** Gehlen

1930. *Panacra radians* Gehlen, *Ent. Zeits. Frankfurt* 44 : 174.
1989. *Eupanacra radians,* Cadiou & Holloway, *Lamb.* 9-12 : 139.

Material examined : 2 exs. : 19.x.81 FS x 2 exs. (Coll. H.).

Length of Forewing : 27 mm.

Distribution : Sumatra. ? Java.

Remarks : The two specimens have tentatively been placed as *E. radians*, pending genitalic confirmation. They could also be from an unusually late brood of *E. sinuata*, with slightly unusual markings. If these two specimens do turn out to be *E. radians*, it will be a most unusual new record for India.

62. **Eupanacra mydon** Walker

1856. *Panacra mydon* Walker, *List. Lep. Ins. B. M.* 8 : 155.
1989. *Eupanacra mydon,* Cadiou & Holloway, *Lamb.* 9-12 : 139.

Material examined : 25 exs. : 20.vi.83 PS ; 25.viii.84 PS ; 17.iv.91 PS ; 31.vii.92 PS x 4 exs. ; 1.viii.92 PS (Coll. S.) ; 5.vi.82 FS ; 1.viii.76 AH ; 12.viii.76 AH ; 20.vi.82 FS ; 16.vi.83 FS ; 2.vii.86 FS ; 18.viii.76 AH ; 9.vii.76 AH ; 25.iv.83. AH ; 14.viii.81 AH ; 27.v.81 FS ; 30.vii.80 AH (Coll. H.) ; 4.viii.91 PS (Coll. Ox.) ; 19.vi.91 PS ; 10.viii.91 PS ; 15.viii.91 PS ; 8.ix.91 PS (Coll. J. M. C.).

Length of Forewing : 21-27 mm.

Distribution : India (W. Bengal : Barrackpore), Bangladesh, Burma to Sundaland and the Philippines.

Remarks : The most frequently met *Eupanacra* Cad. &. Holl. in Jones Estate. Not recorded by Bell & Scott (1937) from the Western Himalaya.

63. **Eupanacra automedon** Walker

1856. *Panacra automedon*, Walker, *List. Lep. Ins. B. M.* 8 : 154.
1989. *Eupanacra automedon*, Cadiou & Holloway, *Lamb.* 9-12 : 139.

Material examined : Nil.

Length of forewing : Not measured.

Distribution : India ["Northern India" (D'Abrera 1986) ; Sikkim ; ? Assam], Burma to Sumatra, Nias, Java, Borneo, Bangladesh.

Remarks : Appears to be a low elevation species, occuring in the Terai belt. Not recorded from Jones Estate.

64. **Angonyx testacea** Walker

1856. *Perigonia testacea* Walker, *List. Lep. Ins. B. M.* 8 : 102.
1882. *Angonyx testacea*, Moore, *Lep. Ceylon*, 2 : 26 pl. 89, fig. 1.

Distribution : India ["Northern India" (D' Abrera 1986) ; Meghalaya : Khasi Hills ; Karnataka : N. Kanara], Sri Lanka to Sundaland, Tanimbar, New Guinea, Australia and the Solomon Is.

Remarks : The species ascends to 6,000 feet in Kanara (Bell & Scott 1937). It has not been recorded from Kumaon but might occur at low elevation.

65. **Nephele didyma** Fabricius

1775. *Sphinx didyma* Fabricius, *Syst. Ent.* : 543.
1903. *Nephele didyma*, Roths. & Jord., *Rev. Sphing.*, : 554.

Material examined : 25 exs. : 19.iii.76 AH ; 20.vi.77 AH ; 13.ix.77 AH ; 20.iv.82 FS ; 29.v.90 Kilbury AH ; 1.iv.83 FS ; 9.iv. 82 FS ; 1.v.81 FS ; 3.iv.83 FS ; 31.iii.79 AH ; 19.iii.76 AH (Coll. H.) ; 4.iv.91 PS ; 19.iii.91 PS ; 6.ix.83 PS ; 15.vi.81 FS ; 23.iii.81 FS ; 20.iv.83 PS ; 6.iv.82 FS : 4.vi.84 PS ; 7.viii.83 PS ; 1.iv.82 FS ; 26.iv. 92 PS ; 10.iv.82 PS ; 28.iii.82 FS ; 10.iv.83 PS (Coll. S.).

Length of Forewing : 27-30 mm.

Distribution : India [Maharashtra : Pune, Bombay, Satara ; Sikkim ; Himachal Pradesh : Landour ; "Coromandel" (Cramer 1777) ;

Madhya Pradesh : Mhow ; Karnataka : N. Kanara ; Andamans, Nicobars ; Gujerat : Dangs] ; Sri Lanka, Nepal, Pakistan, Burma to Java.

Remarks : A rather variable insect, with many grades between the extreme forms, *hespera* Fabricius and *didyma* Fabricius. Swarms around flowering trees of *Bauhinia vareigata* and at *Quisqualis* and *Lonicera* at dusk.

66. **Gurelca hyas** Walker

1856. *Lophura hyas* Walker, *List. Lep. Ins. B. M.*, 8 : 107.
1880. *Gurelca hyas*, Kirby, *Proc. R. Dub. Soc.*, (2) ii : 330.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Throughout India to Sundaland, Philippines, Taiwan.

Remarks : Not recorded from Jones Estate although it ascends to 5,000 feet in Sikkim and Bhutan (Dudgeon 1898).

67. **Gurelca masuriensis** Butler

1875. *Lophura masuriensis* Butler, *Proc. Zool. Soc. Lond.* : 244, pl. 36.
1892. *Gurelca masuriensis*, Swinhoe, *Cat. Lep. Het. Oxf.* 1 : 8.

Material examined : 1 ex. : 1.vii.77 FS (Coll. S.)

Length of Forewing : 20 mm.

Distribution : India [Himachal Pradesh : Simla, Bukloh ; Uttar Pradesh : Mussoorie ; Sikkim ; "Assam" (D' Abrera 1986)], Nepal, Burma.

Remarks : Not frequently met with, although Bell & Scott (1937) observe that the larvae are fairly common.

68. **Gurelca himachala** Kirby

1892. *Gurelca himachala* Kirby, *Cat. Lep. Het.*, 1 : 643.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India [Meghalaya : Khasi Hills ; "North Western India" (D' Abrera 1986)] to China, Korea and Japan.

Remarks : Not recorded from Jones Estate, nor from the Western Himalaya by Bell & Scott (1937).

69. **Eurypteryx bhaga** Moore

1865. *Darapsa bhaga* Moore, *Proc, Zool. Soc. Lond.* : 794.
1903. *Eurypteryx bhaga*, Roths, & Jord., *Rev. Sphing.* : 594.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India [Sikkim ; Meghalaya : Shillong, Cherrapunji ; "Northern India" (D' Abrera 1986)], Bhutan to Sumatra, Nias.

Remarks : Not recorded from Jones Estate, although it may occur at lower elevation or inhabitats not covered under the present study.

70. **Hayesiana triopus** Westwood

1848. *Macroglossa triopus* Westwood, *Cab. Or. Ent.* : 14.
1986. *Hayesiana triopus*, D'Abrera, *Sphing. Mundi* : 154, pl. 155.

Material examined : 1 ex. : 12.x.78 AH (Coll. H.).

Length of Forewing : 28 mm.

Distribution : ? Nepal, Bhutan, India (Sikkim ; Assam.), ? Burma.

Remarks : An unusual record. The appearance of this moth in Kumaon would confirm its presence in Nepal.

71. **Macroglossum bombylans** Boisduval

1875. *Macroglossa bombylans* Boisduval, *Spec. Gen. Lep. Het.* 1 : 334.
1903. *Macroglossum bombylans*, Roths. & Jord., *Rev. Sphing.* : 632.

Material examined : 7 exs. : 18. x.88 PS (Coll. S.) ; 12.x.78 AH ; 17.iii.82 FS ; 30.vi.81 AH ; 5.xii.88 PS ; 23.iii.80 (♀) AH ; 29.iv.82 (♀) FS (Coll. H.).

Length of Forewing : 18-21 mm.

Distribution : India (Uttar Pradesh : Dehra Dun ; Sikkim.), Burma to China and Taiwan.

Remarks : Several annual broods. A low to medium elevation species.

72. **Macroglossum gyrans** Walker

1856. *Macroglossa gyrans* Walker, *List. Lep. Ins. B. M.*, 8 : 91.
1903. *Macroglossum gyrans*, Roths. & Jord., *Rev. Sphing.* : 634.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Pakistan, India (Maharashtra : Pune, Bombay ; Madhya Pradesh : Mhow ; Himachal Pradesh : Simla ; Tamil Nadu : Madras ; Assam : Silchar ; Karnataka : N. Kanara.), Sri Lanka, Burma to Sundaland, Sumba, Leti and Kissar Is. (Timor Sea).

Remarks : Not recorded from the present study area, although it ought to occur here.

73. **Macroglossum belis** Linnaeus

1758. *Sphinx belis* Linnaeus, *Syst. Nat.* 10 : 493.
1903. *Macroglossum belis*, Roths, & Jord., *Rev. Sphing.* : 637.

Material Examined : 10 exs. : 15.vii.88 PS ; 28.ix.84 PS (Coll. S.) ; 11.vii.80 AH ; 26.vii.89 PS ; 29.vii.83 FS ; 11.vi. 85 FS ; 15.vi.82 FS ; 3.x.81 AH ; 24.viii.80 AH ; 21.ix.83 FS (Coll. H.).

Length of Forewing : 25-27 mm.

Distribution : Sri Lanka, Pakistan, India (Maharashtra : Belgaum, Satara, Bombay ; Karnataka : N. Kanara ; Madhya Pradesh : Mhow ; W. Bengal : Darjeeling ; Sikkim ; Uttar Pradesh : Dehra Dun ; Gujerat : Cutch ; Assam : Silchar.) to China and Riu Kiu Is.

Remarks : Bell & Scott (1937) note that they have bred this moth in Dehra Dun up to an elevation of 3,000 feet. The moths recorded in the present study are from ca. 5-6,000 feet. They appear regularly, in small numbers, and the recorded larval foodplant, *Hamiltonia suaveolens* Roxb. (*Rubiaceae*), occurs in the area.

74. **Macroglossum saga** Butler

1878. *Macroglossa saga* Butler, *Ent. Mo. Mag.* 14 : 206.
1903. *Macroglossum saga*, Roths. & Jord., *Rev. Sphing.* : 653.

Material examined : 1 ex. : 20.xi.78 AH (Coll. H.).

Length of Forewing : 27 mm.

Distribution : India [Sikkim ; "Northern India" (D' Abrera 1986)] to China and Japan.

Remarks : The single specimen is probably only a straggler from further east. Not recorded by Bell & Scott (1937) from the Western Himalaya.

75. **Macroglossum pyrrhosticta** Butler

1875. *Macroglossa pyrrhosticta* Butler, *Proc. Zool. Soc. Lond.* : 242.
1903. *Macroglossum pyrrhosticta*, Roths. & Jord., *Rev. Sphing.* : 641.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India : "Northern India" (D' Abrera 1986) ; Sikkim ; Assam : Silchar ; Bhutan to Japan, Riu Kiu Is., Sundaland (to Lombok).

Remarks : Dudgeon (1898) notes that this moth occurs between 2,000 to 5,000 feet. Not recorded from the Bhimtal Valley so far.

76. **Macroglossum corythus** Walker

1856. *Macroglossa corythus* Walker, *List. Lep. Ins. B. M.*, 8 : 92.
1903. *Macroglossum corythus*, Roths. & Jord., *Rev. Sphing.* : 641.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Sri Lanka, Bhutan, India ["Northern India" (D' Abrera 1986) ; Karnataka : Kanara ; Assam : Silchar ; Andamans.], Bangladesh to Cocos & Keeling Is., Sundaland, Sulawesi, the Philippines,

Taiwan, China, Riu Kiu Is., New Guinea, Australia, Tanimbar, Duke of York Is., Solomon Is., New Caledonia and Lifu.

Remarks : D' Abrera notes that the sub-species *luteata* Butler (1875) occurs in the Andamans and Northern India, while the sub-species *corythus* Walker 1856 occurs in S. India. Not recorded from the present study area. Dudgeon (1898) observed that it is a low elevation species, ascending to 2,000 feet.

77. **Macroglossum aquila** Boisduval

1875. *Macroglossa aquila* Boisduval, *Spec. Gen. Lep. Het.*, 1 : 340.
1903. *Macroglossum aquila*, Roths. & Jord., *Rev. Sphing.* : 657.

Distribution : India : "Northern India (D' Abrera 1986) ; Darjeeling : W. Bengal ; Sikkim. To Sundaland and the Philippines.

Remarks : Bell & Scott (1937) observe that the species is rather rare. Not recorded from the study area.

78. **Macroglossum hemichroma** Butler

1875. *Macroglossa hemichroma* Butler, Proc. *Zool. Soc. Lond.* : 243.
1903. *Macroglossum hemichroma*, Roths., & Jord., *Rev. Sphing.* : 664.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : India : "Northern India" (D' Abrera 1986) ; Bangladesh : Sylhet ; to Sundaland and the Philippines.

Remarks : Not recorded from the study area. Bell & Scott observe that it is rather rare. Probably a low elevation species.

79. **Rhopalopsyche nycteris** Kollar

1848. *Macroglossa nycteris* Kollar, In Hügel's *Kaschmir* iv : 458.
1877. *Rhopalopsyche nycteris*, Butler, *Trans. Zool. Soc. Lond.* ix : 523.

Material examined : 21 exs. : 3.xii.81 AH ; 18.x.78 AH ; 3.iii82 FS ; 15.i.82 FS ; 28.vii.78 AH ; 15.xi.82 FS ; 22.x.78 AH ; 3.iii.82 FS ; 7,viii.82 FS ; 25.vii.87 PS Khiron Vly., Garhwal 4200 m. (Coll. H.) ;

15.i.89 PS ; 23.ix.72 FS ; 7.ix.88 PS ; 19.xii.72 FS ; 10.vi.84 PS ; 5.i.82 FS ; 27.vii.87 PS. Khiron Vly., Garhwal 4000 m. ; 26.v.92 PS ; 4.iii.88 PS Okhalkanda ; 14.vi.90 PS Binsar 2400m. x2 ; 31.iii.81 FS ; (Coll. S.).

Forewing Length : 15-19 mm.

Distribution : Pakistan, India : Kashmir ; Khasi Hills, Meghalaya ; Himachal Pradesh : Kulu ; Sikkim. Bhutan, Bangladesh to Burma and China, Riu Kiu Islands, ? Taiwan.

Remarks : Appears to be the hawkmoth occuring at the highest elevation, where it is active even on overcast, foggy days, visiting tiny flowers belonging to Labiateae. On the wing throughout the year at lower elevation, around 1500 m.

80. **Hyles euphorbiae** Linnaeus

1758. *Sphinx euphorbiae* Linnaeus, *Syst. Nat.* x : 1 : 492.
(1819) 1816. *Hyles euphorbiae*, Hübner, *Verz. bek. Schmett.* 137.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Algeria, Tunisia, Europe to Turkey ; Iran, Iraq, Saudi Arabia, Pakistan, Afghanistan, India : Ladakh, foot of Zoji La, Kashmir ; Himachal Pradesh : Changla Gali, Sabathu.

Remarks : Not recorded so far from Kumaon, although ssp. *nervosa* Roths. & Jord. (1903) probably occurs along the inner ranges.

81. **Hyles gallii** Rottemburg

1775. *Sphinx gallii* Rottemburg, *Naturf., Halle* vii : 107.
(1819) 1816. *Hyles gallii*, Hübner, *Verz. Bek. Schmett.* 137.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Temperate Europe, Northern Turkey to Japan, Northern North America to Colorado and California. Nepal. India : Kashmir : Gurais Valley 6000 feet ; Bhutan : Chumbi valley 13,000 feet,

Remarks : Not recorded so far from Kumaon, but almost certainly occurs in the drier inner ranges. Ebert (1966) observes that these moths are not attracted to light.

82. **Hyles nicaea** De Prunner

1798. *Sphinx nicaea* De Prunner, *Lep. Pedem.* : 86.
(1819) 1816. *Hyles nicaea*, Hübner, *Verz. Bekan. Schmett.* 137.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Southern Europe to Tibet, Algeria, Morocco. India : "W Himalaya as far east as Nainital "(Bell & Scott 1937), U. P., Himachal Pradesh, Kashmir.

Remarks : The sub-species *lathyrus* Walker has been recorded from Nainital according to Bell & Scott (1937). Not recorded recently from several locations around Nainital. This species is probably established in the drier inner ranges and has shifted westward of Nainital, which is in the outermost hill range, during the last century.

83. **Hyles livornica** Esper

1779. *Sphinx livornica* Esper, *Schmett.*, ii : 88.
(1819) 1816. *Hyles livornica*, Hübner, *Verz. Bekann. Schmett.* 137.

Material examined : 2 exs. : 25.iv.81 AH (Coll. H.) ; 16.iv.89 PS (Coll. S.)

Forewing Length : 34 mm.

Distribution : The Afrotropical Region (excluding the equatorial forest belt of the Congo in W. Africa), Southern Europe to China, N. Africa, India : Maharasthra : Bombay ; Madhya Pradesh : Mhow ; W. Bengal : Calcutta. Pakistan.

Remarks : Breeding status in Jones Estate uncertain. Appears sporadically.

84. **Deilephila elpenor** Linnaeus

1758. *Sphinx elpenor* Linnaeus, *Syst. Nat.* : x : i : 491.
1881. *Deilephila elpenor*, Butler, *Proc. zool. Soc. Lond.* v : 613.

Material examined : Nil.

Length of Forewing : Not measured.

Distribution : Europe to Japan, India : Meghalaya : Shillong ; "Northern India" (D' Abera 1986). Bangladesh.

Remarks : The sub-species *macromera* Butler 1875 occurs in India. I am not certain that this species oocurs in Kumaon but have included it provisionally.

85. **Deilephila rivularis** Boisduval

1875. *Chaerocampa rivularis* Boisduval, *Spec. Gen, Lep.* i : 280.
1881. *Deilephila rivularis*, Butler, *Proc. zool. Soc. Lond.* : 613.

Material examined : 9 exs. : 8.vii.80 AH ; 2.vii.81 AH ; 8.vii.78 AH (Coll. H.) ; 8.vii.77 FS ; 3.vii.83 FS ; 19.vi.90 PS Jageshwar x4 (Coll. S.).

Forewing Length : 33-36 mm.

Distribution : Pakistan. India : Himachal Pradesh : Simla ; Uttar Pradesh : Mussoorie ; W. Bengal : Darjeeling ; Sikkim.

Remarks : Appears occasionally in Jones Estate. Abundant in Jageshwar, although this moth did not seem to be present in Sama, Binsar, Maheshkhan and locations around Nainital.

86. **Hippotion celerio** Linnaeus

1758. *Sphinx celerio* Linnaeus, *Syst. Nat.*, x : 491.
1882. *Hippotion celerio*, Moore, *Lep. Ceylon*, ii : 16.

Material examined : 12 exs. : 7.iv.82 FS ; 9.iv.85 FS ; 28.iv.83 FS ; 24.viii.80 AH ; 7.iv.82 FS ; 9.iv.85 FS ; (Coll. H.) : 23.vi.90 PS ; 13.iv.91 PS x2 ; 20.iii.91 PS.; 25.iv.82 FS ; 9.iv.85 FS (Coll. S.).

Forewing Length : 33-36 mm.

Distribution : Moderate to high evevations throughout the Afrotropical, Oriental and Australian Regions (visitor to New Zealand), also Japan, ? Korea and Southern Europe. India : Maharashtra : Pune, Bombay ; Madhya Pradesh : Mhow ; Gujerat : Kutch ; Sikkim ; Karnataka : Kanara.

Remarks : Not recorded from other locations in Kumaon, probably due to the early appearance of the main brood, when observations were restricted to the main study area.

87. **Hippotion rosetta** Swinhoe

1892. *Hippotion rosetta* Swinhoe, *Cat. Aust. Lep. Hct.* 1 : 16.

Material examined : 4 exs. : 26.vii.77 AH ; 2.vii.86 FS ; 23.vi.79 AH ; 31.iii.81 AH (Coll. H.).

Forewing Length : 23-26 mm.

Distribution : Java, Sumatra, ? Borneo, ? Peninsular Malaya.

Remarks : May be distinguished from *Hippotion boerhaviae* Fabricius 1775 by the comparitively uniform ground colour on the underside, whieh is "spotty" in *H. boerhaviae* Fab., and the shorter and fainter dark bars bordering the collection of medial lines on the upper side of the forewing, in specimens from Jones Estate.

88. **Hippotion boerhaviae** Fabricus

1775. *Sphinx boerhaviae* Fabricius, *Syst. Ent.* 542.
1903. *Hippotion boerhaviae*, Roths. & Jord., *Rev. Sphing.* 756.

Material examined : 3 exs. : 6.vii.80 AH ♂ ; 24.iv.85 FS ♀ (Coll. H.) ; 7.viii.83 FS (Coll.S.).

Forewing Length : 25-26 mm.

Distribution : The Oriental Region, the Australian Region to the Solomon Is., New Caledonia (excluding New Zealand and Southern and Central Australia). India : Madhya Pradesh : Mhow ; Gujerat : Kutch ; Maharashtra : Pune ; Bombay ; Sikkim ; Karnataka : Kanara.

Remarks: Appears sporadically in small batches. More frequently met than *Hippotion rosetta* Swinhoe.

89. **Theretra nessus** Drury

1773. *Sphinx nessus* Drury, *Illus. Exot. Ins.*, ii : 46.
1882. *Theretra nessus*, Moore, *Lep. Ceylon*, ii : 22.

Material examined: 9 exs. : 14.iv.76 AH ; 24.viii.80 AH ; 17.vii.78 E. Bauer ; 16.viii.80 AH ; 3.vii.83 FS (Coll. H.) ; 22.vii.82 FS ; 1. vii. 83 FS ; 27.ix.83 FS ; 26.ix.83 FS (Coll. S.).

Forewing Length : 50-53 mm.

Distribution : The Oriental Region, Australian Region to New Caledonia, Loyalty Is. and the Solomons. Aden. India : Karnataka : Kanara ; Andamans ; Maharashtra : Belgaum ; Tamil Nadu : Madras ; Sikkim ; Gujerat : Dangs ; Uttar Pradesh : Mussoorie.

Remarks : This moth is a abundant in years of heavy rainfall.

90. **Theretra boisduvali** Bugnion

1839. *Sphinx boisduvali* Bugnion, *Ann, Soc. Ent. Fr.*, viii : 115.
1903. *Theretra boisduvali*, Roths. & Jord., *Rev. Sphing.* 767.

Material examined: 2 exs. : 8.vii.87 FS (Coll. H.) ; 1 ex. data lost (Coll. S.).

Forewing Length : 38-45 mm.

Distribution : Sri Lanka, westward to Turkey (as a straggler) and eastward to Sundaland. India : Maharashtra : Bombay ; Gujerat : Dangs ; Uttar Pradesh : Mussoorie ; Meghalaya : Khasi Hills ; Sikkim.

Remarks : Never abundant. Not recorded by Bell & Scott (1937) from the Western Himalaya.

91. **Theretra clotho** Drury

1773. *Sphinx clotho* Drury, *Illus. Exot. Ins.*, ii : 48.
1903. *Theretra clotho*, Roths. & Jord., *Rev. Sphing.* : 769.

Material examined : 10 exs. : 30.ix.80 AH ; 24.ix.90 AH ; 2.viii.80 AH ; (Coll. H.) ; 24.vi. 92 PS ; 30.vi.90 PS ; 6.iv.91 PS ; 4.iv.91 PS ; 26.vi.90 PS ; 7.v.81 FS ; (Coll. S.) ; 29.vi.90 PS (Coll. B.M.) ;

Forewing Length : 38-44 mm.

Distribution : The Oriental Region to Australia. Solomon Is., Vanatu and Lifu. India : Tamil Nadu : Madras ; W. Bengal ; Sikkim ; Maharashtra : Bombay, Belgaum ; Andamans ; Karnataka : Kanara ; Gujerat : Dangs ; Uttar Pradesh : Mussoorie.

Remarks : The pale and dark (greenish) forms occur together. A common insect.

92. **Theretra alecto** Linnaeus

1758. *Sphinx alecto* Linnaeus, *Syst. Nat.* x : 492.
1898. *Theretra alecto,* Dudgeon, *Journ. Bom. Nat. His. Soc.* ix : 412.

Material examined : 11 exs. : 7.vi.81 AH ; 25.vii.80 AH ; 25.ix.77 AH ; 24.viii.80 AH (Coll. H.) ; 9.viii.83 FS ; 30.viii.83 FS ; 27.ix.83 FS ; 13.iv.91 PS ; 15.vii.89 PS ; 5.ix.89 PS ; 8.x.83 FS (Coll. S.).

Forewing Length : 38-45 mm.

Distribution : Greece, Egypt to Taiwan. Kai and Tanimbar Is.

Remarks : Pale and dark forms have been recorded. Generally a common insect.

93. **Theretra lycetus** Cramer

1775. *Sphinx lycetus* Cramer, *Pap. Exot.* i : 96.
1898. *Theretra lycetus,* Dudgeon, *Jou. Bom. Nat. His. Soc.,* ix : 412.

Material examined : Nil.

Distribution : Sri Lanka to Java. India : "Bengal" ; "Coromandel" ; Sikkim ; Uttar Pradesh : Mussoorie ; Gujerat : Dangs ; Karnataka : Kanara.

Remarks : Occurs in the area but appears to have been overlooked among *Theretra oldenlandiae* Fab.

94. **Theretra oldenlandiae** Fabricius

1775. *Sphinx oldenlandiae* Fabricius, *Syst. Ent.* 542.
1898. *Theretra oldenlandiae*, Dudgeon, *Bourn. Bom. Nat. His. Soc.*, ix : 412.

Material examined : 13 exs. : 24.viii.80 AH x 6 (Coll. H.); 10.vii.90 PS ; 14.vii.83 FS ; 24.v.81 FS ; 25.ix.83 FS ; 31. vii. 92 PS ; 16.viii.91 PS ; 31.vii.92 PS (Coll. S.).

Forewing Length : 28-33 mm.

Distribution : The Oriental Region to New Guinea. India : Madhya Pradesh : Mhow ; Maharashtra : Pune, Bombay, Belgaum ; Sikkim ; Gujerat : Cutch, Dangs ; Uttar Pradesh : Mussoorie.

Remarks : Among the commonest Hawkmoths in the Bhimtal valley. Also recorded from Katarmal, Almora on July 4 ; Binsar, Aug. 27.

95. **Theretra griseomarginata** Hampson

1898. *Chaerocampa griseomarginata* Hampson, *Journ. Bomb. Nat. Hist. Soc.*, xi : 281.
1903. *Theretra griseomarginata*, Roths. & Jord., *Rev. Sphing.*, 786.

Material examined : 9 exs. : 21.vii.80 AH ; 19.vi.82 AH ; 23.vi.78 AH ; 7.vii.77 AH ; 17.vii.89 PS ; 19.vi.78 AH ; 17.vi.81 AH (♀) (Coll. H.) ; 28.vi.80 FS ; 11.vii.89 PS (Coll. S.).

Forewing Length : 26-27 mm.

Distribution : India : Sikkim (1,800 feet).

Remarks : This rare moth occurs sporadically during the rainy season. Usually visits light in the early hours of the morning, between 1 and 3 a.m. . New record for the Western Himalaya.

96. **Theretra pallicosta** Walker

1856. *Chaerocampa pallicosta* Walker, *List. Lep. Ins. B. M.* viii : 145.
1903. *Theretra pallicosta*, Roths. & Jord., *Rev. Sphing.* 788.

Material examined : 2 exs. : 2.v.74 FS ; 1 ex. data lost (Coll. S.).

Forewing Length : 36-38 mm.

Distribution : Sri Lanka, India : Karnataka : Kanara ; Tamil Nadu : Top Slip, Anaimalais (PS) ; Meghalaya : Khasi Hills. Burma to South Eastern China, ? Taiwan.

Remarks : Not recorded since 1974. Not recorded by Bell & Scott (1937) from the Western Himalaya.

97. **Rhyncholaba acteus** Cramer

1779. *Sphinx acteus* Cramer, *Pap. Exot.*, iii. 93.
1903. *Rhyncholaba acteus*, Roths. & Jord., *Rev. Sphing.* : 789.

Material examined : 8 exs. : 24.viii.80 AH x 5 ; 28.viii.76 AH (Coll. H.) ; 6.vi.81 FS ; 25.vii. 90 PS (Coll. S.)

Forewing Length : 30-33 mm.

Distribution : Sri Lanka, India : "Bengal" ; Andamans ; Maharashtra : Pune, Bombay, Belgaum ; Sikkim ; Uttar Pradesh : Mussoorie ; Karnataka : Kanara.

Remarks : Abundant in years of heavy rainfall.

98. **Rhagastis velata** Walker

1866. *Pergesa velata* Walker, *List. Lep. Ins. B. M.* xxxv : 1853.
1903. *Rhagastis velata*, Roths. & Jord., *Rev. Sphing.* 793.

Material examined : 27 exs. : 29.viii.79 AH ; 3.vii.76 AH ; 7.vi.80 AH ; 27.vii.85 FS ; 4.vi.81 FS ; 20.vi.81 AH ; 17.vii.87 FS ; 24.vi.89 PS ; 8.vi.80 AH ; 1.vii.89 PS ; 7.vii.87 FS ; 23.vii.85 FS ; 27.viii.87 FS ; 29.viii.79 AH ; 13.viii.87 FS ; 19.viii.80 AH (Coll. H.) ; 9.viii.83 FS ; 1.vii.83 FS x 2 ; 28.viii.90 PS ; 12.viii.91 PS ; 29.iv.92 PS ; 2.x.83 FS ; 27.vi.92 PS ; 16.viii.90 PS ; 26.vi.90 PS x 2 (Coll. S.).

Forewing Length : 26-30 mm.

Distribution : India : "Northern India" (D' Abrera 1986) ; Sikkim ; W. Bengal : Darjeeling ; "Assam" (Bell & Scott 1937). ? Burma.

Remarks : The commonest *Rhagastis* Roths. & Jord. and among the commoner Hawkmoths in the Bhimtal valley. Also at Kilbury, May 28. A variable insect. Unusual that it was not recorded by Bell &

Scott (1937). It has perhaps established itself in the area during the past half century.

99. **Rhagastis acuta** Walker

1856. *Zonilia acuta* Walker, *List. Lep. Ins. B. M.*, viii : 195.
1903. *Rhagastis acuta*, Roths. & Jord., *Rev. Sphing.* 794.

Material examined : 16 exs. : 13.viii.76 AH ; 28.vii.77 AH ; 2.vi.84 FS ; 7.viii.77 AH ; 6.iv.85 FS ; 26.vii.85 FS (Coll. H.) ; 5.vii.83 FS ; 8.v.92 PS ; 13.vii.90 PS ; 12.vii.90 PS ; 17.vii.90 PS ; 24.vi.90 PS ; 14.vii.83 PS ; 20.ix.73 FS ; 19.vii.88 PS 15.vii.88 PS (Coll. S.)

Forewing Length : 23-29 mm.

Distribution : India : "Northern India" (D' Abrera 1986) ; Sikkim ; "Assam" (Bell & Scott 1937). To Java and Sumatra.

Remarks : Appears to be well established in the Bhimtal valley. Difficult to distinguish from the next species, *Rhagastis hayesi* Diehl, which might account for the apparent abundance of this species. Appears to have two or three annual broods. Also recorded from Okhalkanda on July 3. Not recorded by Bell & Scott from the Western Himalaya.

100. **Rhagastis hayesi** Diehl

1980. *Rhagastis hayesi* Diehl, *Het. Sumatrana* 1 : 71.

Material examined : Nil.

Forewing Length : Not measured.

Distribution : India : Sikkim ; "Assam" (D' Abrera 1986). Burma, Sumatra, Java.

Remarks : The groundcolour on the forewing *recto*, particularly in fresh specimens, differs from *R. acuta* Walker in being olivaceous brown, rather than the reddish brown characteristic of *R. acuta*. Otherwise indistinguishable from *R. acuta* except in the genitalia. Although there are no definite records of this insect from Kumaon, it has been included as there is every likelihood that it occurs here but has been overlooked so far.

101. **Rhagastis castor** Walker

1856. *Zonilia castor* Walker, *List. Lep. Ins. B. M.* viii : 153.
1903. *Rhagastis castor*, Roths. & Jord., *Rev. Sphing.* 795.

Material examined : 14 exs. : 17.viii.77 AH ; 16.vi.90 PS Sama (Coll. H.) ; 17.ix.84 PS ; 17.ix.73 FS ; 20.ix.84 FS ; 26.iv.89 PS ; 19.vi.90 PS Jageshwar ; 7.ix.83 FS ; 23.vi.90 PS (Coll. S.) ; 24.vi.90 PS x 2 ; 23.vi.90 PS x 2 ; 20.viii.90 PS (Coll. B. M.).

Forewing Length : 30-33 mm.

Distribution : India : "Northern India" (D' Abrera 1986) ; Sikkim ; Meghalaya : Khasi Hills. To Sumatra, Java and Borneo.

Remarks : The sub-species *aurifera* Butler 1875 occurs in this area. Not recorded by Bell & Scott (1937) from the Western Himalaya.

102. **Rhagastis confusa** Rothschild & Jordan

1903. *Rhagastis confusa* Roths. & Jord., *Rev. Sphing.* 795.

Material examined : 6 exs. : 15.v.90 AH x 5 (Coll. H.) ; 13.vi.90 PS Binsar (Coll. B. M.).

Forewing Length : 30-35 mm.

Distribution : India : Uttar Pradesh : Mussoorie ; Sikkim ; Meghalaya : Khasi Hills. To Southern China.

Remarks : Not as frequently met as *R. castor*, *R. velata* and *R. acuta*.

103. **Rhagastis olivacea** Moore

1872. *Pergesa olivacea* Moore, *Proc. zool. Soc. Lond.* 566.
1903. *Rhagastis olivacea*, Roths. & Jord., *Rev. Sphing.* 797.

Material examined : 9 exs : 9.iv.85 FS ; 19.vi.90 PS Jageshwar ; 16.vi.90 PS Sama x 2 (Coll. H.) ; 19.vi.90 PS Jageshwar x 2 ; 16.vi.90 PS Sama ; 22.vii.90 PS (Coll. S.) ; 22.vi.91 PS (Coll. Cadiou).

Forewing Length : 31-35 mm.

Distribution : India : Himachal Pradesh : Simla ; to Sikkim and "Assam", (D' Abrera 1986). ? Burma, ? S. China.

Remarks : Rarely met at Jones Estate although it appears to be commoner at slightly higher elevation.

104. **Cechenena mirabilis** Butler

1875. *Chaerocampa mirabilis* Butler, *Proc. zool. Soc. Lond.* 248.
1903. *Cechenena mirabilis*, Roths. Jord., *Rev. Sphing.* 800.

Material examined : 5 exs. : 18.v.90 AH Kilbury ; 29.v.90 AH Nainital (Coll. H.) ; 16.vi.90 PS Sama x 2 ; 22.v.74 FS (Coll. S.).

Forewing Length : 39-42mm.

Distribution : India : Himachal Pradesh : Simla ; Kashmir ; Meghalaya : Khasi Hills. Afghanistan, Pakistan.

Remarks : Commoner in dense forests of Himalayan Oak (*Q. lanata* and *Q. floribunda*). Rare in Jones Estate. The specimens recorded from Jones Estate are probably stragglers from higher elevation.

105. **Cechenena aegrota** Butler

1875. *Pergesa aegrota* Butler, *Proc. zool. Soc. Lond.* 246.
1903. *Cechenena aegrota*, Roths. & Jord., *Rev. Sphing.* 800.

Material examined : Nil.

Forewing Length : Not measured.

Distribution : India : "Northern India" (D' Abrera 1986). Bangladesh to Sundaland and the Philippines.

Remarks : I am not certain that this insect occurs in Kumaon. It is included tentatively on the basis of D' Abrera (1986).

106. **Cechenena minor** Butler

1875. *Chaerocampa minor* Butler, *Proc. zool. Soc. Lond.* 249.
1903. *Cechenena minor*, Roths. & Jord., *Rev. Sphing.* 802.

Material examined : 12 exs. : 15.v.90 AH ; 30.v.90 AH (Coll. H.) ; 15.v.91 PS ; (Coll. Ox. U. M.) ; 24.vii.90 PS ; 12.vii.90 PS ; 25.ix.82 FS ; 4.v.92 PS ; 9.viii.83 PS ; 3.vii.83 FS (Coll. S.) ; 6.vi.91 PS ; 4.viii.91 PS ; 10.vii.91 PS (Coll. Cadiou).

Forewing Length : 37-39 mm.

Distribution : India : Himachal Pradesh : Dharamsala, Simla ; Uttar Pradesh : Mussoorie ; Sikkim ; Khasi Hills, Meghalaya. Bhutan to Thailand, China, Taiwan and Japan.

Remarks : There appear to be two or three annual broods of this moth in Jones Estate. Common in years of heavy rainfall.

107. **Cechenena lineosa** Walker

1856. *Chaerocampa lineosa* Walker, *List. Lep. Ins. B. M.* viii : 144.
1903. *Cechenena lineosa*, Roths. & Jord., *Rev. Sphing.* 803.

Material examined : 2 exs. : 16.vi.90 PS Sama (Coll. S.) ; 19.vi.90 PS Jageshwar (Coll. Cadiou).

Forewing Length : 46 mm.

Distribution : India : Sikkim ; Meghalaya : Cherrapunji, Khasi Hills ; W. Bengal : Darjeeling. Bhutan to Sumatra, ? Borneo.

Remarks : Occurs in areas slightly higher than Jones Estate. Some stragglers have been recorded from Jones Estate. Not recorded from the Western Himalaya by Bell & Scott (1937).

108. **Cechenena scotti** Rothschild

1920. *Cechenena scotti* Rothschild, *Ann. Mag. Nat. Hist.* (9) v : 481.

Material examined : 21 exs. : 9.vii.83 FS ; 5.vii.84 FS ; 14.vi.82 FS ; 13.vii.85 FS ; 4. viii.83 FS ; 11.vii.85 FS ; 2.v.76 AH ; 22.viii.89 PS ; 18.v.90 AH Kilbury ; 2.vii.86 FS (Coll. H.) ; 26.vi.90 PS ; 16.vi.90 PS Sama x 4 ; 13.vi.90 PS Binsar x 2 ; 19.vi.90 PS Jageshwar x 3 ; 22.vi.85 FS (Coll. S.).

Forewing Length : 37-42 mm.

Distribution : India : Himachal Pradesh : Simla, Dharamsala ; Uttar Pradesh : Mussoorie. Nepal.

Remarks : Among the commonest Hawkmoths in forests of Himalayan Oak (*Quercus floribunda*). This species was separated from *Cechenena lineosa* Walker by Dierl, W., (1970) *in Khumbu Himal Ergebn. Forsch.-Unternehmens Nepal Himalaya* 3 : 335.

DISCUSSION

There has been only a little work carried out on Indian Hawkmoths since the publication of Bell & Scott's work in 1937. With reference to the Himalayan range, most of their work was carried out around Mussoorie in Tehri Garhwal, west of Kumaon. On the basis of data that emerged there, and from Sikkim and the Khasi Hills, they divided the Himalaya into an eastern and western faunal zone, with Nepal appearing to be the dividing line between these two zones, although little data had been collected from Nepal at that time. Thus, speaking broadly, the Himalaya east of central Nepal was considered to be the western limit of typical Malayan fauna, while the drier western Himalaya, with fewer species, predominantly supported a temperate zone fauna, with only a sprinkling of typically sub-tropical species.

This division, again speaking broadly, was supported by floral data, since many groups of plants, such as *Rhododendron* Linnaeus (*Ericaceae*) and members of *Primulaceae* have speciated profusely east of Central Nepal, From their work with Hawkmoths, groups such as *Eupanacra* Cadiou & Holloway, *Rhagastis* Rothschild & Jordan, *Marumba* Moore and *Acosmeryx* Boisduval appeared to be, in general, restricted to the eastern zone, while typically Palaearctic groups, such as *Hyles* Hübner and *Hemaris* Dalman were generally restricted to the Western Zone.

Work on the other moth families (except the Saturnids and Bombycids) was and is still too sketchy, (most of the known species being represented by only a handful of specimens) to draw geographical demarcations as clearly as Bell & Scott were able, for the distribution

of Indian hawkmoths appears to be governed to a large extent by climatic factors, such as soil humidity, temperature and seasons and by environmental factors, such as topography ; the condition of the floral canopy ; or the total area of background relevant to the camouflaging pattern on the larva and adult moth, and predator pressure.

Hence, a stable population of a rare, local species in an area is directly related to the relative stability of diverse components of the energy flow system in that area, acting as a means of monitoring environmental changes. A stable population would imply not a population that remains the same from year to year, but one that is resilient enough to survive years of drought and other natural calamities and capable of rapidly taking advantage of favourable years. In other words, a population capable of withstanding the extremes of its chosen habitat.

The Bhimtal valley is a particularly rich faunal locality. There are probably other sites in Kumaon which, if consistently monitored, would be found to support an equally varied representation of hawkmoths as well as other fauna.

In species-rich locations, the application of the concept of ecological niches implies the existence of a plethora of species-specific environmental pre-requisites. High soil humidity appears to be a rather general one, as does the corollary of high soil moisture levels in the hills, that is, dense forests. Kumaon is a relatively rich area in terms of species, wiih over a hundred species and stands roughly between the Himalaya west of Mussorie, which has approximately sixty two species (Bell & Scott 1937) and the Himalaya east of Nepal, with over one hundred and thirty five species, (Bell & Scott 1937).

It is stressed that little work has been carried out in the Terai belt and low riverine forest types, where, doubtlessly, there exist populations of species included in this list on the basis of information in Sphingidae Mundi (D'Abrera 1986), and perhaps even some not recorded from this area, such, as *Marumba indicus* Walker, *Polyptychus dentatus* Cramer and *Theretra pinastrina* Martyn, which would increase the total number of species recorded from Kumaon.

Mussoorie is situated near the western most tributary of the Ganga river system. Further west lies the headwaters of the Indus river system,

Although, as the crow flies, it is merely approximately 120 miles (192 km.) from Jones Estate to Mussoorie, this zone is apparently the transition zone between typically Indo-Malayan and dry temperate zone hawkmoth fauna.

It is possible that species not recorded by Bell & Scott from Mussoorie and Dehra Dun during the second quarter of the century, such as *Marumba cristata* Butler, *Ambulyx liturata* Butler, *Marumba spectabilis* Butler, *Cypa decolor* Walker, *Anambulyx elwesi* Druce, members of the *Eupanacra* Cadiou & Holloway group as well as several *Theretras* Hübner have moved into this area recently and had, in fact, not colonised Kumaon half a century ago, when Bell & Scott completed their studies. This would seem probable, considering the relative abundance of *M. cristata* and the *Ambulyx* species in Kumaon and *Eupanacra mydon* Walker and *Cypa decolor* in Jones Estate. In the context of these two latter species, it is reasonable to assume that they occur in wellforested areas at a similar elevation in other parts of Kumaon.

Of the 108 species, 77 have been recorded in the present study. Of the remaining species, 17 are included on the basis of information in Sphingidae Mundi (D' Abrera 1986). I have further tentatively added five species, four of which probably do occur in Kumaon but have not been recorded, while the identity of one (*Eupanacra radians* Gehlen) pends confiramation. The four are *Hemaris fuciformis* Linnaeus, *Hyles euphorbiae* L.. *Deilephila elpenor* L. ,and *Rhagastis hayesi* Diehl. Fifty three species on this list were not recorded by Bell & Scott (1937) and 12 were not recorded from this area by D' Abrera (1986). Some of these, such as *Sphinx ligustri* L. and *Hayesiana triopus* Westwood, are probably stragglers, but others such as *Marumba cristata* are well established.

Of relevance is the fact that Hampson (1892) notes that *Hyles nicaea lathyrus* Walker, a typically drier zone species, occurs as far east as Nainital. Recent field work around Nainital has failed to locate this insect, although its larval host plant, belonging to the genus *Euphorbia* L., was present at several of the locations.

Since this is the only hawkmoth for which a definite eastern limit of its range had been established, it is worthy of note that there

are no recent records of its capture from this area. This possibly indicates that this species has actually moved out of the area, conforming to the apparent faunal drift westwards, which causes not only the introduction of Indo-Malayan species but also the moving out of species associated with the drier climate of the western Himalaya.

The only hawkmoth species previously recorded west of Kumaon which oceurs in the outer ranges is *Thamnoecha uniformis* Butler which has only been recorded from three locations, i.e. Subathu near Simla, Jones Estate and Katarmal. It is a very rare, local species and appears to have been established in Kumaon for some time, for females from the Jones Estate population are slightly different from the Simla population, and males from Jones Estate differ from the male specimen from Katarmal. The larvae of this species have been bred on *Pinus roxburghii* Sarg. (Chir Pine). However, *P. roxburghii* occurs from Afghanistan to Bhutan, where this hawkmoth has not been recorded.

Climatic models indicate that among the impacts of global warming, soil humidity along the Himalaya may be expected to increase with an increase in global temperature, (Myers 1985).

In birds, a vertical faunal drift has been observed in the Bhimtal and Sattal valleys over the past forty years, with typically low elevation species such as the Cattle Egret (*Bulbulcus ibis*), the Paddybird (*Ardeola grayii*), the Crow Pheasant (*Centropus sinensis*) among others having taken up residence near lakes in the area, as opposed to their previous status as mere summer visitors from the plains (Smetacek, V 1975).

Of relevance in this context is the apparent withdrawal of the Western Tragopan (*Tragopana melanocephalus*) from Kumaon, where it was observed to be "abundant about Almorah" (Murray 1889) a century ago, to its presently acknowledged range westward of Garhwal (Ali, 1983). This bird is known to prefer the drier ecotype characteristic of the western Himalaya.

In butterflies, distributional records compiled a century ago by Hannyngton (Peile 1937) are still relevant, with only a few new records, such as *Pazala glycerion garhwalica* Katayama 1988 from the main rynge, *Neptis cartica* Moore from Sattal, *Polyura agraria* Swinhoe and *Plebejus eversmanni* Stgr.. The former two species had previously been

recorded from the Eastern Himalaya, the *Polyura* from South India and the *Plebejus* is from the rainshadow area of Garhwal, an area which has still not been comprehensively covered.

Taking into consideration the possibility that, in the case of birds and hawkmoths at least, the observed distributional changes are in fact recent phenomena rather than the result of incomplete data compilation between 50-150 years ago, it would seem that the climate of the hills of Uttar Pradesh has undergone a change which has encouraged low elevation bird species to colonise suitable habitats at higher elevation as well as species of insects such as hawkmoths, which occured in the sub-tropical Eastern Himalaya to colonise parts of the Western Himalaya, at least as far west as the location of the main study site in Jones Estate.

Faunal drift is usually a precursor to changes in floral regimes and long term climatic changes in a region. The projected increase in global temperature and soil humidity in certain regions of the globe caused by global warming seems to be apparent in this faunal drift in the region during this century.

It would therefore seem that the western hills of Uttar Pradesh, which constitute the headwaters of the Ganga river system, are probably in the process of developing an ecotype closer to the moist Indo-Malayan type.

This is relevant to re-afforesting the region as part of efforts to stabilise groundwater systems and thereby reduce the magnitude of floods in the Gangetic plain.

CONCLUSION

The westward extension in the geographical distribution of numerous hawkmoth species observed over the past twenty years in the hill districts of Uttar Pradesh seems to be indicative of a modification of the general climatic pattern of the region.

Since the region under consideration is part of the headwaters of the Ganga river system, a long term climatic drift towards a wet, sub-

tropical ecotype might possibly influence the pattern of seasonal release of the annual water budget of the Ganga river system.

The changes in floral regimes towards a wet sub-tropical ecotype suggested by the influx and colonisation of the region by hawkmoth species characteristic of a wet sub-tropical biotype will probably affect productiveness of traditional land-use patterns in the hill districts of Uttar Pradesh.

SUMMARY

This list extends the known range of a number of Hawkmoth (*Sphingidae*) species to Kumaon, all except one of which have previously been recorded east of Kumaon. The possibility and implications of faunal drift during the past half-century are examined.

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