



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2018; 6(4): 538-544

© 2018 JEZS

Received: 19-05-2018

Accepted: 20-06-2018

Avtar Kaur Sidhu

Department of Entomology and
Agricultural Zoology,
Institute of Agricultural
Sciences, Banaras Hindu
University Uttar Pradesh, India

Akhil Nair

High Altitude Regional Centre,
Zoological Survey of India,
Solan, Himachal Pradesh, India

T Kubendran

High Altitude Regional Centre,
Zoological Survey of India,
Solan, Himachal Pradesh, India

Range extension of five species of hawkmoths (Lepidoptera: Sphingidae) from high altitude areas of Indian Himalaya with additions to the Hawkmoth fauna of Himachal Pradesh

Avtar Kaur Sidhu, Akhil Nair and T Kubendran

Abstract

In the present study the range extension in distribution of five species of moths of family Sphingidae has been recorded in high altitude areas of North-west Indian Himalaya in the states of Jammu & Kashmir and Himachal Pradesh. In the species *Smerinthus kindermannii* Lederer, 1853 by distance 296 kms; in species *Hyles gallii* (Rottemburg, 1775) & *Hyles hippophaes* (Esper, 1789) by distance 216 kms; *Hyles livornica* (Esper, 1780) by distance 162 kms and *Hyles nervosa* (Rothschild & Jordan, 1903) by distance 148 kms, in Himachal Pradesh from their known distributions (aerial distances in mountainous terrain). The paper also reports first time record of three species of hawkmoths from the state of Himachal Pradesh.

Keywords: Sphingidae, range extension in distribution, North-west Himalaya, Himachal Pradesh and first record

1. Introduction

High altitude areas of Indian Himalaya includes the Ladakh division and Kashmir division in state of Jammu & Kashmir, and Lahaul & Spiti, parts of Chamba district and Kinnaur district in state of Himachal Pradesh. The Ladakh and Lahaul & Spiti together constitute the Trans-Himalayan cold desert region. The region scarce in precipitation and vegetation is the habitat of several peculiar fauna, some of which are very less studied due to the difficult terrain. The hawk-moths or sphingids are among the fast flying insects and are important pollinators. Under the family Sphingidae, there are 1354 species and subspecies on a world basis, out of which 204 species belong to India ^[1, 2, 3, 9]. Six species of hawkmoths have been reported so far from Ladakh, which includes *Hemaris ducalis* (Staudinger, 1887), *Hyles gallii* (Rottemburg, 1775), *Hyles nicaea* (Rothschild & Jordan, 1798), *Hyles hippophaes* (Esper, 1789), *Hyles nervosa* (Rothschild & Jordan, 1903) and *Smerinthus kindermannii* Lederer, 1853 ^[10]. From various altitudes of the North West Himalaya (in Jammu & Kashmir, Himachal Pradesh and Uttarakhand) 30 species belonging to 20 genera of family Sphingidae has been recorded ^[6]. In the present study, range extension of five species of Hawkmoths viz., *Smerinthus kindermannii* Lederer, 1853, *Hyles gallii* (Rottemburg, 1775), *Hyles hippophaes* (Esper, 1789), *Hyles livornica* (Esper, 1780) and *Hyles nervosa* (Rothschild & Jordan, 1903) from the higher altitude areas of Himalaya and addition of three species namely, *Smerinthus kindermannii* Lederer, 1853, *Hyles gallii* (Rottemburg, 1775) and *Hyles hippophaes* (Esper, 1789) to the Hawkmoth fauna of Himachal Pradesh are being reported.

The collections were made under the various faunal surveys to the high altitude regions of Himalaya including Ladakh (J&K) and various localities of Chamba, Lahaul & Spiti and Kinnaur districts of Himachal Pradesh during the span of year 2008 to 2016. In Ladakh, the collections were made in Chushul (4360 m), Nyoma (4180 m) and Nubra (3048 m) areas in which two species of sphingids i.e. *Hyles hippophaes* (Esper, 1789) and *Hyles gallii* (Rottemburg, 1775) have been identified among the collections. In Himachal Pradesh, collections were made at various high altitudinal localities viz. Sural (3234 m) and Sahali (3212 m) in Pangi valley (district Chamba), localities of Kalpa (2960 m) and Sangla (2593 m) (district Kinnaur) and Tabo (3340 m), Lossar (4138 m), Rangrik (3673 m) (district Lahaul & Spiti). Three species viz., *Smerinthus kindermannii* Lederer, 1853, *Hyles gallii* (Rottemburg, 1775) and *Hyles hippophaes* (Esper, 1789) have been identified from these collections and are

Correspondence

Avtar Kaur Sidhu

Department of Entomology and
Agricultural Zoology,
Institute of Agricultural
Sciences, Banaras Hindu
University Uttar Pradesh, India

being reported for the first time from Himachal Pradesh, along with the additional distribution records of two species namely, *Hyles livornica* (Esper, 1780) and *Hyles nervosa* (Rothschild & Jordan, 1903). From India, the species *Hyles nervosa* (Rothschild & Jordan, 1903) is being reported for first time, since after Bell & Scott in 1937 and is the second instance of reporting adult specimens of *Smerinthus kindermannii* Lederer, 1853 after Bell & Scott in 1937 and Kitching & Cadiou in 2000.

2. Materials and Methods

The surveys were conducted from years 2008 to 2018 by first the author and scientists of Zoological Survey of India, in the High Altitude areas of North-west Himalaya of Indian region. The collections were made with the help of light trap equipped with 160 watt mercury vapour lamp along with a white screen at background. The trapped moths were killed using ethyl acetate vapours, thereafter stretched and preserved as per standard techniques in Lepidopterology. Later the specimens were identified with the help of various relevant literatures (Bell and Scott, 1937) [1]. High resolution photographs of whole specimens were taken prior to dissection, using high end DSLR camera and flash system

Table 1: Distribution of *Smerinthus kindermannii* in High Altitude areas of North-west Indian Himalaya from the present studies.

S.no.	Locality	Tehsil	District	Latitude N (Degree)	Longitude E (Degree)	Altitude (m asl.)	No. of specimens	NZC Voucher Number
1.	Rangrik	Spiti	Lahaul & Spiti (H.P.)	32.25061	78.03395	3673	06	I-3171
2.	Tabo	Spiti	Lahaul & Spiti (H.P.)	32.04566	78.25001	3340	03	I-3172 & I-3173
3.	Lossar	Spiti	Lahaul & Spiti (H.P.)	32.2852	77.41099	4138	02	I-3174
4.	Sahali	Pangi	Chamba (H.P.)	33.084014	76.40698	3212	01	I-3175
5.	Kalpa	Kalpa	Kinnaur (H.P.)	31.53358	78.25586	2960	01	I-3176

The species *Smerinthus kindermannii* Lederer, 1853 (Figure 1), has been reported from the countries of central Palaearctic region and including Kuwait, Israel, China, Mongolia and Pakistan (Pittaway, 2018; Pittaway and Kitching, 2018) [7, 8]. The first reporting of this species from Indian subcontinent was made by Bell & Scott in 1937 [1] from Chitral (now in Pakistan), thereafter Kitching & Cadiou in 2000 [4] reported this species based on a single specimen collected from Lotsun, Ladakh. Subsequently, this species from Leh (Ladakh) was reported by Smetacek & Kitching (2012) [10], based on a single fifth instar larva. So far, the known distribution of *Smerinthus kindermannii* from India is from Ladakh only based on a single adult specimen from Lotsun (3000 m; Kitching & Cadiou Loc. cit.) and a single fifth instar larva from Leh (3500 m; Kitching & Cadiou Loc. cit.). In the present surveys conducted in high altitude areas of the Indian North-west Himalaya, this species *i.e.* *Smerinthus kindermannii* has been found to be widely distributed in these areas (Table-1), ranging from an altitude of 2960 m asl. (Kalpa) to 4138 m asl. (Lossar). Though from previous reports of literature, this species appears to be quite rare in Ladakh (as the reporting is based on single specimen), but during present studies it has been found to be fairly distributed in the cold desert of Spiti (H.P.). The distribution is extending into dense Kayal (*Pinus wallichiana*) & Deodar (*Cedrus deodara*) forests of Sahali (Pangi) and Kalpa (Kinnaur). In the present studies, the species *Smerinthus kindermannii* is being reported from the state of Himachal Pradesh for the first time with extended distribution from Lotsun, Leh (in Ladakh) to the Pangi valley by 288 km (in Chamba), Kalpa by 296 km (in Kinnaur), Tabo by 239 km, Rangrik by 216 km and Lossar by 193 km (all three in Spiti)

available. All the specimens are registered and preserved in the National Zoological Collections of Zoological Survey of India at High Altitude Regional Centre, Solan (H.P.).

3. Results and Discussion

Genus: *Smerinthus* Latreille, [1802]

[1802], *Smerinthus* Latreille, in Sonnini, *Hist. nat. gén. particulière Crustacés Insectes* 3: 401.

Type-Species: *Sphinx ocellata*, Linnaeus 1758.

Smerinthus kindermannii Lederer, 1853

(Southern eyed Hawkmoth)

1853, *Smerinthus kindermannii* Lederer, *Verh. zool-bot. Ver. Wien (Abhandlungen)* 2: 92.

Wing Expanse: 65-78 mm.

Material examined: 6 exs, 05.vii.2012, Rangrik, Lahaul & Spiti (H.P), coll. A. K. Sidhu & party. 2 exs, 11.vii.2012, 1 ex, 12.vii.2012 Tabo, Lahaul & Spiti (H.P), coll. A. K. Sidhu & party. 2 exs, 14.vii.2014, Lossar, Lahaul & Spiti (H.P), coll. A. K. Sidhu & party. 01 ex, 20.vii.2009, Sahali, Pangi, Chamba (H.P.), coll. A.K. Sidhu & party. 01 ex, 05.vi.2016, Kalpa, Kinnaur, coll. A.K. Sidhu & party.

and also upto an altitude of 4138 m (Figure 6A). The present study is also the second instance of collecting the adult specimens from India since year 1937 & 2000, more importantly from Trans-Himalayan landscape to remote dense forests of Kayal (*Pinus wallichiana*) & Deodar (*Cedrus deodara*) in various new high altitudinal localities of Himachal Pradesh, making an addition in the hawkmoth fauna of the state. In total 13 adult specimens of *Smerinthus kindermannii* were collected from 5 new localities across three districts of Himachal Pradesh as given in the Table 1. The presence of this rare hawkmoth species in good numbers across the new localities of various high altitudinal ranges indicates the need of potential for reviewing the distribution range of the species in the Himalayan region as scope finding new localities for the species.

Genus: *Hyles* Hubner, 1819

1819, *Hyles* Hübner, *Verz. bekannter Schmett.*: 137.

Type-Species: *Sphinx euphorbiae* Linnaeus, 1758.

Hyles gallii (Rottemburg, 1775)

(Bedstraw Hawkmoth)

1775, *Sphinx gallii* von Rottemburg, *Naturforscher, Halle* 7: 107.

Wing Expanse: 65-75 mm.

Material examined: 2 exs, 24.vii.2008, Chushul, Leh (J&K), coll. A. K. Sidhu & party. 4 exs, 19.vii.2008, 2 exs, 21.vii.2008, Nyoma, Leh (J&K), coll. A. K. Sidhu & party. 1 ex, 27.vii.2013, 1 ex, 28.vii.2013, Rangrik, Lahaul & Spiti (H.P), coll. A. K. Sidhu & party.

Table 2: Distribution of *Hyles gallii* in High Altitude areas of North-west Indian Himalaya from the present studies.

S.no.	Locality	Tehsil	District	Latitude N (Degree)	Longitude E (Degree)	Altitude (m asl.)	No. of specimens	NZC Voucher Number
1.	Chushul	Leh	Leh (J&K)	33.556	78.722	4360	02	I-3103
2.	Nyoma	Leh	Leh (J&K)	33.20591	78.648384	4180	06	I-3104 & I-3105
3.	Rangrik	Spiti	Lahaul & Spiti (H.P.)	32.25061	78.03395	3673	02	I-3101 & I-3102

The genus *Hyles* Hübner, (1819) (Figure 2), includes 42 subspecies and 29 species (Kitching & Cadiou, 2000) [4] distributed throughout the world. So far, the species *Hyles gallii* (Rottemburg, 1775) has been reported from Himalayan region of Afghanistan, Bhutan & Tibet, China and Pakistan (Pittaway, 2018; Pittaway and Kitching, 2018) [7, 8]. Bell & Scott (1937) [1] reported the species as *Celerio gallii* from the Gurais valley (now in Pakistan) and Chumbi valley (Tibet) from British India. Smetacek & Kitching in 2012 [10] have reported *Hyles gallii* from Chumbi, Leh in Ladakh (J&K) from an altitude of 4500 m. In the various surveys to the Trans-Himalayan cold desert region of Ladakh and Lahaul & Spiti (H.P.), 10 specimens were identified from three different localities, as given in the Table 2 as *Hyles gallii*. The collections of *Hyles gallii* from Rangrik (3673 m) (in Spiti valley of Lahaul & Spiti district of Himachal Pradesh) is the first time record of the species from the state. The new locality Rangrik being 216 km apart from its previous known

locality (Figure 6B). The similarity in the bio-geographical conditions of various localities from where *Hyles gallii* has been reported so far from India, indicates the confinement of the distributional range of this species to the Trans-Himalayan cold desert region only.

Hyles hippophaes (Esper, 1789)

(Seabuckthorn Hawkmoth)

1789, *Sphinx hippophaes* Esper, *Die Schmetterlinge* (Suppl.), Abschnitt 2: 6.

Wing Expanse: 65-80 mm.

Material examined: 1 ex, 08.vii.2008, Nubra Valley, Leh (J&K), coll. A. K. Sidhu & party. 1 ex, 05.vii.2012, 2 exs, 08.vii.2012, 1 ex, 31.vii.2013, 3 ex, 23.vii.2014, Rangrik, Lahaul & Spiti (H.P.), coll. A. K. Sidhu & party.

Table 3: Distribution of *Hyles hippophaes* in High Altitude areas of North-west Indian Himalaya from the present studies.

S.no.	Locality	Tehsil	District	Latitude N (Degree)	Longitude E (Degree)	Altitude (m asl.)	No. of specimens	NZC Voucher Number
1.	Nubra valley	Leh	Leh (J&K)	34.55121	77.54847	3048	01	I-3111
2.	Rangrik	Spiti	Lahaul & Spiti (H.P.)	32.25061	78.03395	3673	07	I-3107 to I-3110

Hyles hippophaes (Esper, 1789) (Figure 3), has two sub-species viz. *Hyles hippophaes hippophaes* (Esper, 1789) and *Hyles hippophaes bienerti* (Staudinger, 1874) among which later sub species is found to be distributed in the middle east and the north west Himalayan region, whereas the sub-species *Hyles hippophaes hippophaes* (Esper, 1789) has its distribution in Europe. From India, *Hyles hippophaes* (Esper, 1789) species has not been reported so far. However, Smetacek & Kitching (2012) [10] mentioned the presence of a specimen of the sub-species *Hyles hippophaes bienerti* (Staudinger, 1874) in BMNH collections where it has been collected from Panomik, Nubra Valley, Ladakh way back in VIII.1912 by A. Avinoff. It is a single locality from where this species has been reported. In the present studies, the collections were made in Ladakh & Spiti from 2008 to 2014 and among the collections kept at the Zoological Survey of India, Solan (H.P.) one specimen of *Hyles hippophaes bienerti* (Staudinger, 1874) from the Nubra valley (3048 m), Ladakh and 07 specimens of the same species from Rangrik (3673 m) (in Spiti valley of the Lahaul & Spiti district of Himachal Pradesh) have been identified (Figure 6C). The collection of this species from Rangrik (Spiti) makes it a new addition to the fauna of Himachal Pradesh. The locality is also

the second in India after Nubra Valley, Ladakh where the species has been found. The species *Hyles hippophaes* has been recorded from India after more than 100 years. Further both the areas i.e. Rangrik & Nubra valley are 216 km (aerial distance in mountainous terrain) apart and with an altitudinal difference of 625 m. However, both are similar in bio-geographical conditions as being part of trans-himalayan region. The geographical details of the localities are given in the Table 3. The number of specimens collected encourages the possibility of finding the species in other areas of the trans-himalaya as well.

Hyles livornica (Esper, 1780)

(Stripped Hawkmoth)

1780, *Sphinx livornica* Esper, *Die Schmetterlinge*, Th. 2: 87, 88, 196.

Wing Expanse: 58 mm.

Material examined: 1 ex, 10.vi.2016, Sangla, Sangla Valley, Kinnaur (H.P.), coll. A. K. Sidhu & party.

Table 4: Distribution of *Hyles livornica* in High Altitude areas of North-west Indian Himalaya from the present studies.

S.no.	Locality	Tehsil	District	Latitude N (Degree)	Longitude E (Degree)	Altitude (m asl.)	No. of specimens	NZC Voucher Number
1.	Sangla, Sangla Valley	Sangla	Kinnaur (H.P.)	31.42191	78.27047	2593	01	I-3112

In India, *Hyles livornica* (Esper, 1780) (Figure 4), is more widely distributed species of the genus *Hyles* Hübner, (1819) than the others. Bell & Scott (1937) [1] reported its distribution

in British India from Quetta, Karachi & Campbellpore (now in Pakistan), Mohw (Madhya Pradesh), Calcutta (West Bengal) and South India. Pathania, *et al.* (2014) [6] have

reported the species from various localities of Punjab & Himachal Pradesh but the altitudinal ranges limited to moderate only (350 m to 2000 m). One specimen of *Hyles livornica* was identified from a new locality of Himachal Pradesh in district Kinnaur (Figure 6C), details given in Table-4. This new locality being 109 km apart from Shimla (H.P.) & 162 km apart from Hamirpur (H.P.), other known localities for the species in the state. Therefore the Sangla valley is being reported as an additional distributional range for the species from the high altitude region of Himachal Pradesh.

Hyles nervosa (Rothschild & Jordan, 1903)

(Ladakh Hawkmoth)

1903, *Celerio euphorbiae nervosa* Rothschild & Jordan, *Novit. Zool.(Suppl.)* 9: 721.

Wing Expanse: 70-80 mm.

Material examined: 4 exs, 24.vii.2009, Sural, Pangi Valley, Chamba (H.P.), coll. A. K. Sidhu & party.

Table 5: Distribution of *Hyles nervosa* in High Altitude areas of North-west Indian Himalaya from the present studies.

S.no.	Locality	Tehsil	District	Latitude N (Degree)	Longitude E (Degree)	Altitude (m asl.)	No. of specimens	NZC Voucher Number
1.	Sural	Pangi	Chamba (H.P.)	33.084014	76.40698	3234	04	I-3106

The Holarctic species *Hyles nervosa* (Rothschild & Jordan, 1903) (Figure 5), has type locality Sabathu in Solan district of Himachal Pradesh. Bell & Scott (1937) [1] reported breeding of this species near Zoji-la pass (Kashmir), Ladakh, Sabathu (H.P.) and Changla Gali (now in Pakistan) of British India. Smetacek & Kitching (2012) [10] in their study of the hawkmoth fauna of Ladakh, has discussed in details about the distribution of *Hyles nervosa* in Ladakh and have mentioned about the possibility of species being present in the limited area of western Ladakh and not in the higher regions of Ladakh. But, no collections of the species were made in their studies. In the present studies, 04 adult specimens of the *Hyles nervosa* were collected & identified from Sural (3234 m),

Pangi Valley of Chamba district in Himachal Pradesh, details given in Table-5. The adult specimens of the same species are being reported for the first time from India after 81 years since 1937 by Bell & Scott. This record is also an additional distributional range for the species from the alpine region of Sural in Pangi, Chamba district of Himachal Pradesh (Figure 6C). This locality is very different from previously reported localities for the species in terms of vegetation and climatic conditions, which boost the possibility of the distribution of this species in much vast area of the high altitude regions of the Northwest Indian Himalaya.

Plate 1



Fig 1A: *Smerinthus kindermannii* (Dorsal view)



Fig 1B: *Smerinthus kindermannii* (Ventral view)



Fig 2A: *Hyles gallii* (Dorsal view)



Fig 2B: *Hyles gallii* (Ventral view)



Fig 3A: *Hyles hippophaes* (Dorsal view)



Fig 3B: *Hyles hippophaes* (Ventral view)

Plate II



Fig 4A: *Hyles livornica* (Dorsal view)



Fig 4B: *Hyles livornica* (Ventral view)



Fig 5A: *Hyles nervosa* (Dorsal view)



Fig 5B: *Hyles nervosa* (Ventral view)

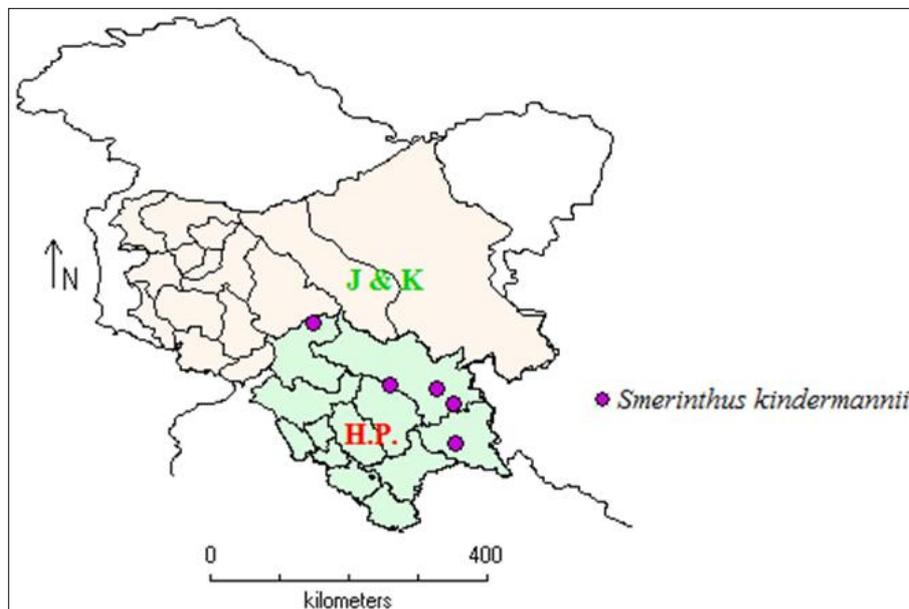


Fig 6A: Distribution of *Smerinthus kindermannii* in High Altitude areas of North-west Himalaya in India.

Plate III

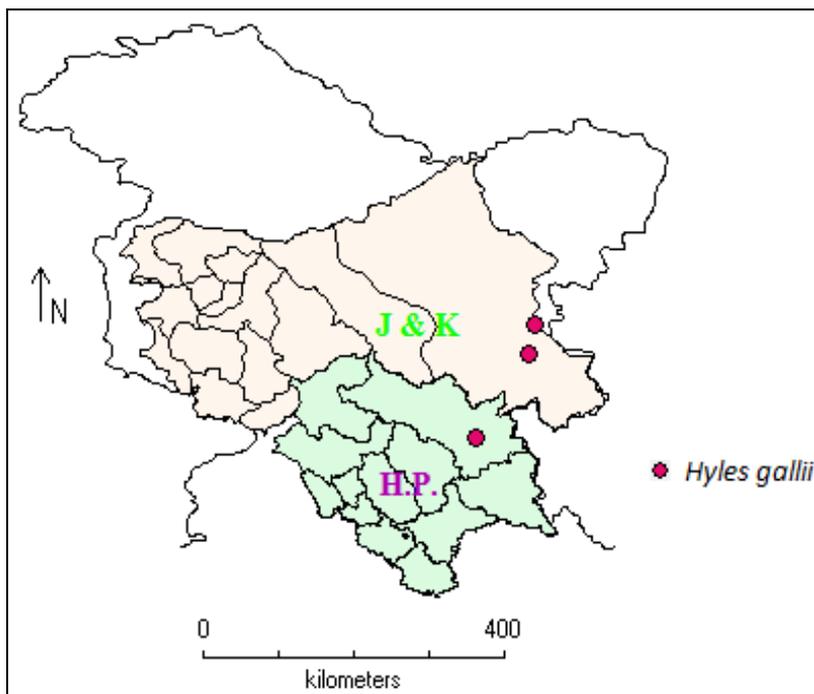


Fig 6B: Distribution of *Hyles gallii* in High Altitude areas of North-west Himalaya in India.

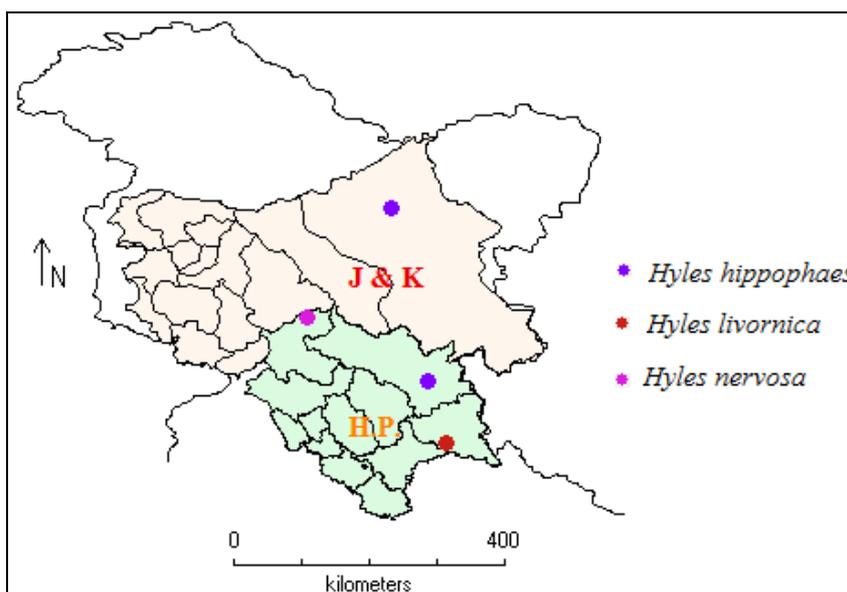


Fig 6C: Distribution of *Hyles hippophaes*, *Hyles livornica* & *Hyles nervosa* in High Altitude areas of North-west Himalaya in India.

5. Acknowledgements

Authors are grateful to the Director, Zoological Survey of India for giving permission, facilities and encouragement to undertake the present studies. The PCCF, Wildlife, Shimla (Himachal-Pradesh) & PCCF, Wildlife, Jammu (Jammu & Kashmir) are greatly acknowledged for giving the permission to survey the various areas of Himachal Pradesh & Ladakh (J&K).

6. References

1. Bell TRD, Scott FB. The Fauna of British India including Ceylon and Burma, Moths Sphingidae. Taylor and Francis Ltd., London, 1937; V:18-537. 15 pls.
2. D’Abrera B. Sphingidae Mundi Hawk Moths of the World. EW Classey Ltd., Faringdon, 1986, 1-256.
3. Hampson GF. The Fauna of British India including

Ceylon and Burma. Taylor and Francis Ltd., London. 1892; I:65-122.

4. Kitching IJ, Caidou JM. Hawkmoths of the world: an annotated and illustrated revisionary checklist (Lepidoptera: Sphingidae). London (The Natural History Museum) & Ithaca (Cornell University Press). 2000; 30-580. 128 pls.
5. Muhammad AR, Sultan A, Kitching IJ, Pittaway ARPN, Markhasiov M, Khan MR *et al.* The Hawkmoth fauna of Pakistan (Lepidoptera: Sphingidae). Zootaxa. 2014; 3794(3):393-418.
6. Pathania PC, Sharma S, Gill AS. Hawk moths (Lepidoptera: Sphingidae) from North-West Himalaya along with collection housed in National PAU Insect museum, Punjab Agricultural University, Ludhiana, India. Biological Forum-An International Journal. 2014;

6(1):120-127.

7. Pittaway AR. Sphingidae of the Western Palaearctic (including Europe, North Africa, the Middle East, western Siberia and western Central Asia), 2018. <http://tpittaway.tripod.com/sphinx/list.htm>. [Site accessed: May 15, 2018]
8. Pittaway AR, Kitching IJ. Sphingidae of the Eastern Palaearctic (including Siberia, the Russian Far East, Mongolia, China, Taiwan, the Korean Peninsula and Japan). <http://tpittaway.tripod.com/china/china.htm>. 2018, [Site accessed: May 15, 2018]
9. Roonwal ML, Mathur RN, Bhasin GD, Chatterjee PN, Sen-Sharma PK, Singh B *et al.* A systematic catalogue of the main identified entomological collection at the Forest Research Institute, Dehradun, 1964, 197-537.
10. Smetacek P, Kitching I. The hawkmoths of Ladakh, Jammu & Kashmir, India (Lepidoptera: Sphingidae). *Nachr. Entomol. Ver. Apollo*. 2012; 32(3/4):113-115.
11. Younus MF, Kamaluddin S, Attique T. Revision of the genus *Hyles* Hübner (Lepidoptera: Sphingidae: Macroglossinae) from Pakistan and its cladistic relationship. *Fuuast J Biol*. 2014, 4(2):173-180.