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

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

Taxonomic studies of the species *Deilephila rivularis* (Boisduval, 1875) (Lepidoptera: Sphingidae) with additional distribution records from India

Avtar Kaur Sidhu and Akhil Nair

Abstract

Deilephila rivularis Boisduval, also known as Chitral elephant hawk moth of family Sphingidae has been treated taxonomically. During present study the diagnostic characters and the male genitalia of the species have been described in details, and the female genitalia have been studied for the first time. Sural, Shour (Pangi valley, Chamba), Chail (Solan), Sangla, Rackcham and Kalpa (Kinnaur) in Himachal Pradesh have been reported as additional distributional records of this species.

Keywords: *Deilephila rivularis*, additional distribution, Chitral hawk moth, male genitalia, female genitalia

1. Introduction

The hawk- moths or sphinxes or moths of family Sphingidae are among the most familiar and best known Lepidoptera, categorized by streamlined adults and horned larvae. Sphingids are among the fast flying insects and are important pollinators. They are represented by as many as 1354 species and subspecies on world basis, out of which 204 species belong to India [1-2, 4, 10]. The genus *Deilephila* Laspeyres of family Sphingidae consists of three Palearctic species with common names involving the phrase "Elephant hawk moth". These are, the Elephant hawk moth, *Deilephila elpenor* Linnaeus, the Small Elephant hawk moth *Deilephila porcellus* Linnaeus and the Chitral Elephant hawk moth *Deilephila rivularis* Boisduval. Among the three species of the genus *Deilephila*, the two species viz., *Deilephila elpenor* and *Deilephila rivularis* are morphologically very much similar to each other [5]. The latter species has been treated taxonomically in the present studies. *Deilephila rivularis* has been reported to be distributed in eastern and central Afghanistan, Pakistan (as far south as Karachi), Chitral to Sikkim [1, 5]. The female genitalia of this species has not been studied so far. During present studies besides describing the morphological diagnostic characters and the details of male genitalia of the species *D. rivularis*, the female genitalia is being reported for the first time. Some additional distributional records of the species are also highlighted in the present work.

2. Materials and Methods

In order to collect specimens of *D. rivularis*, various localities of Himachal Pradesh were surveyed during 2009 to 2016. The collections were made with the help of light trap using 160 watt mercury lamp along with a white cloth behind it. While making collections in various localities of Himachal Pradesh, the specimens were collected from Pangi valley (district Chamba), Chail (district Solan), and Kalpa and Sangla valley (district Kinnaur). The collected moths were killed by putting them in cyanide bottle and stretched as per standard techniques in Lepidopterology. Later the specimens were identified with the help of relevant literature [1]. The study of genitalia was performed by following standard Lepidopteran genitalia dissection techniques. The dissected out genitalic parts were stained in Cholorazal black stain (1% in 70% alcohol) and later photographed by using high end Lieca photographic microscope system. The nomenclature for describing various genitalic parts has been followed from Klots [7].

Correspondence
Avtar Kaur Sidhu
High Altitude Regional Centre,
Zoological Survey of India,
Solan, Himachal Pradesh, India

3. Results and Discussion

Genus : *Deilephila* Laspeyres, 1809

Deilephila Laspeyres 1809, *Jenaische allg. Literatur-Zeit* 4 (240):100.Type-Species: *Sphinx elpenor* Linnaeus, 1758

Deilephila rivularis (Boisduval, 1875)

Chaerocampa rivularis, 1875, *Hist. nat. Ins., Spec. gen. Lepid. Heteroceres* 1: 280.

Diagnostic characters (Photos 1-2)

Medium sized moths, body and underside of wings rosy red; broad crimson subdorsal and lateral stripes on thorax; abdomen crimson with a broad bronze-green subdorsal stripe, and a pink and a black lateral side patch; fore wing with an oblique pink band from beyond cell to inner margin and another parallel with it from apex to inner margin, a white discoidal spot; hind wing with basal half black, marginal area of hind wing red shaded with cinnamon.

Wing Expanse: 60-80 mm.

Male genitalia (Plate I, Photos 3-7): Uncus undivided, slender, down-curved, apex rounded, with small hook-like projections on either side mid-laterally; gnathos paired, down-curved, apices rounded; tegument broad; vinculum large, broad; saccus broad, flattened, large, apex rounded; juxta v-shaped, arms broad, flattened; aedeagus rounded, small, suprazone longer than subzone, ductus ejaculatorius entering caudo-dorsad, apical dentate process of aedeagus bears strong, sub-apical serrated ridge, the latter bears apical hook and strong dentate projections on the upper portion of the ring; valva triangular, costa arched, harpe with upwardly curved apical hook, distal half of the valva pilose, numerous stridulatory scales present on the dorsal margin of the valva.

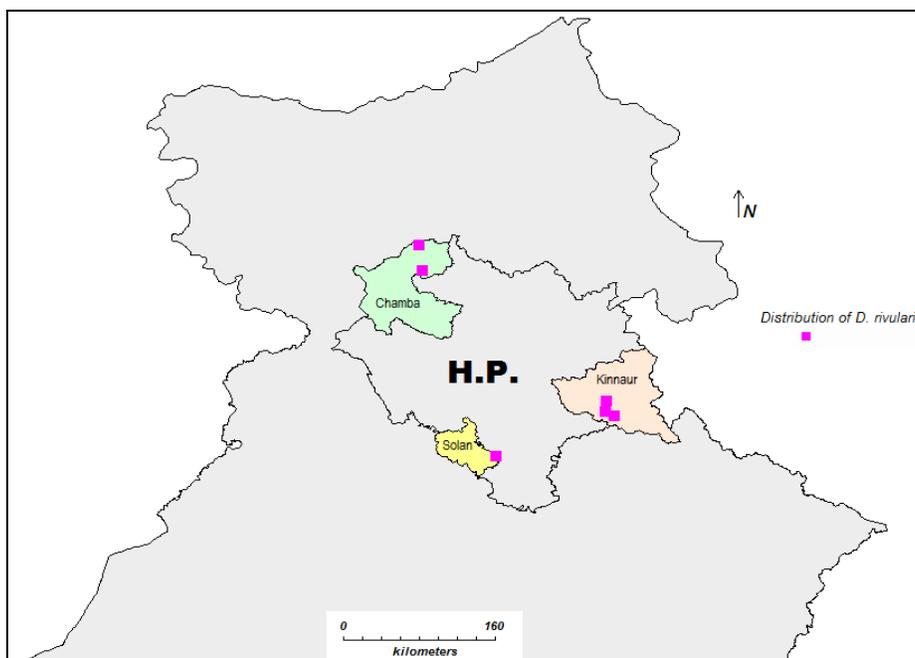
Female genitalia (Plate II, Photos 8-12): Corpus bursae very large, cylindrical, imperceptibly goes into ductus bursae; signum long, elongated, present on the ventral side of corpus bursae longitudinally, weakly sclerotized, strip-like with a median line; ductus bursae membranous, strongly sclereotized at 1/3 part at base, membranous part zig-zag; ductus seminalis originates from the junction of sclerotised and membranous part of ductus bursae; genital plate ring like, ventral part of the ring strongly sclerotised, narrow, dorsal part broader, weakly sclereotised, from lateral sides of ring originates apophyses anterioris, the latter long, flattened with apices rounded; papilla analis trapezoidal, weakly sclereotized, densely pilose; apophysis posterioris very long, rod-like with apices spindle-shaped, pointed.

Old Distribution: *Deilephila rivularis* is distributed in North western region of Indian subcontinent, in eastern and central Afghanistan, as far south as Karachi in Pakistan and from Chitral to Sikkim. In India it has been reported from Shimla in Himachal Pradesh [1, 5-6, 8, 9].

Material examined: 4 exs, 18.vii.2009, Shour, Pangi, Chamba, coll. A. K. Sidhu & party. 1 ex, 24.vii.2009, Sural, Pangi, Chamba, coll. A. K. Sidhu & party. 1 exs, 19.vii.2011, Chail, Kandaghat, Solan, coll. A. K. Sidhu & party. 02 exs, 05.vi.2016, Kalpa, Kinnaur, coll. A. K. Sidhu & party. 02 exs, 06.vi.2016, 02 exs, 07.vi.2016, 04 exs, 08.vi.2016, 09 exs, 11.vi.2016, Sangla, Kinnaur, coll. A. K. Sidhu & party. 01 ex, 09.vi.2016, Rackcham, Kinnaur, coll. A. K. Sidhu & party.

Altitudinal Distributional range of *Deilephila rivularis* in Himachal Pradesh

| S. no. | Locality | Tehsil | District | Altitude (m asl.) | No. of specimens | Average wing span (mm.) |
|--------|----------|-----------|----------------|-------------------|------------------|-------------------------|
| 1. | Sural | Pangi | Chamba (H.P.) | 3234 | 01 | 80 |
| 2. | Shour | Pangi | Chamba (H.P.) | 2460 | 04 | 77 |
| 3. | Chail | Kandaghat | Solan (H.P.) | 2250 | 01 | 70 |
| 4. | Sangla | Sangla | Kinnaur (H.P.) | 2594 | 17 | 70 |
| 5. | Rackcham | Sangla | Kinnaur (H.P.) | 3122 | 01 | 78 |
| 6. | Kalpa | Kalpa | Kinnaur (H.P.) | 2594 | 02 | 72 |



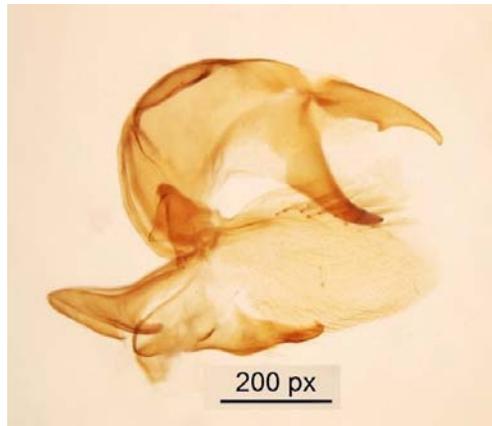
Map 1: Distribution of *Deilephila rivularis* in Himachal Pradesh



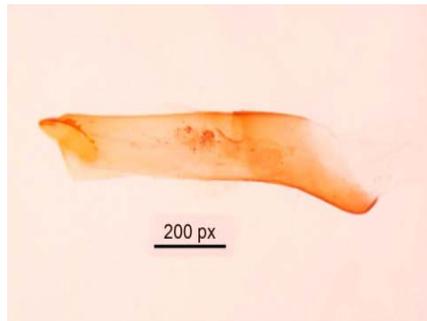
1. Male (Dorsal side)

2. Male (Ventral side)

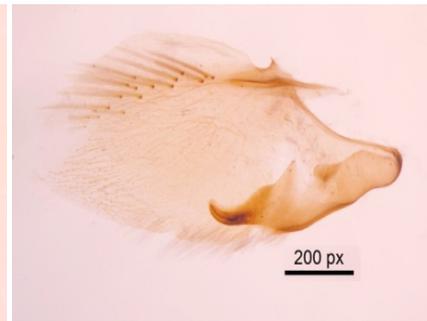
Deilephila rivularis



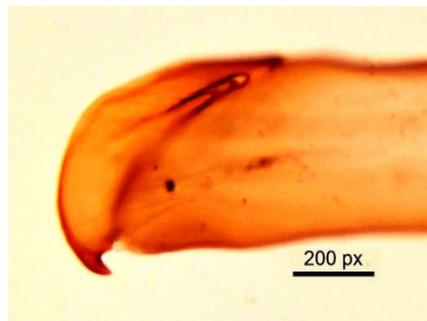
3.



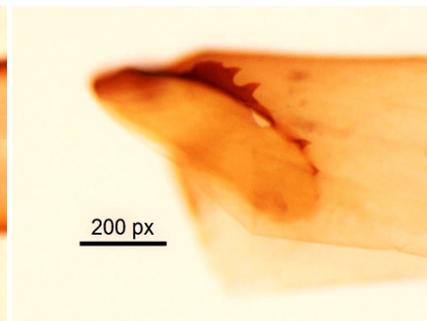
4.



5.



6.



7.

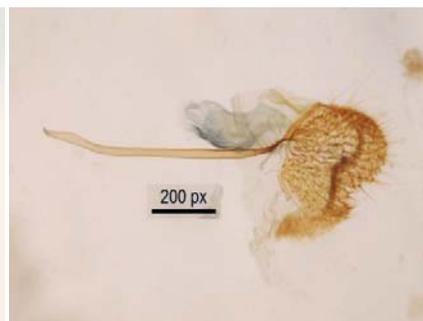
Plate I: Male genitalia of *D. rivularis*: 3. Male genitalia (Lateral View), 4. Aedeagus (Lateral view), 5. Valve (inner view), 6. Apex of Aedeagus (Ventro-lateral view), 7. Apex of Aedeagus (lateral view).



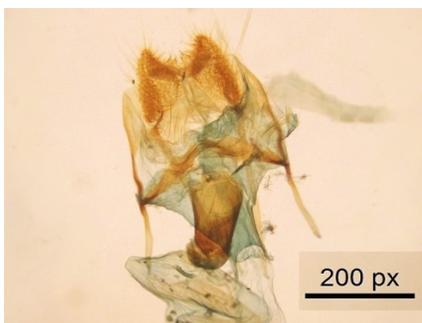
8.



9.



10.



11.



12.

Plate II: Female genitalia of *D. rivularis*: 8. Female genitalia (Lateral View), 9. Base of ductus bursae and genital plate (Lateral view), 10. Papilla analis (Lateral view), 11. Genital plate (Dorsal view), 12. Signum

4. Discussion

The species *Deilephila rivularis* Boisduval was reported under genus *Pergesa* Walker, 1856 and treated as sub species, *Pergesa elpenor rivularis* Boisduval [1]. Later it was upgraded to the status of species level, i.e. *rivularis* under the genus *Deilephila* Laspeyres [3]. Accordingly the nomenclature *Deilephila rivularis* is being followed in present communication. The wing span of *D. rivularis* has been recorded between 66 to 82 mm [1] and between 64 to 82 mm [5]. During present studies the wing span of *D. rivularis* has been observed between 60 to 80 mm from various localities of Himachal Pradesh located between altitude of 2250 to 3234 m asl as given in the Table 1.

The distribution of species *Deilephila rivularis* has been reported from Afghanistan and Pakistan whereas from India it has been recorded from Shimla [1]. During present studies the additional distribution record for the specie *D. rivularis* are

from. Sural, Shour (Pangi valley, Chamba), Chail (Solan), Sangla, Rackcham and Kalpa (Kinnaur) in Himachal Pradesh as given in Map 1.

The male genitalia of *D. elpenor* and *D. rivularis* has been very briefly compared [5] wherein, aedeagus of *D. rivularis* carries strong sub apical serrated ridge which is not so in *D. elpenor*. During present studies the strong sub apical serrated ridge has been observed on the aedeagus of *D. rivularis*. Beside in present communication, all the parts of male genitalia have been described in details, supported by illustrations. The female genitalia of the species *D. rivularis* has been described for the first time. It is characterized by single elongated signum, very large cylindrical corpus bursae, basal portion of ductus bursae sclereotised, ductus *seminalis* arising from junction of sclereotized and membranous part of ductus bursae.

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