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COMMUNICATION

A SECOND REPORT ON BUTTERFLIES (LEPIDOPTERA) FROM LADAKH UNION TERRITORY AND LAHAUL, HIMACHAL PRADESH, INDIA

Sanjay Sondhi, Balakrishnan Valappil & Vidya Venkatesh

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A second report on butterflies (Lepidoptera) from Ladakh Union Territory and Lahaul, Himachal Pradesh, India

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Abstract: Additional butterfly records and natural history observations are reported from a two-week survey of butterflies in Ladakh and Lahaul in the inner Himalaya in Ladakh Union Territory, and Himachal Pradesh in August 2018. These records follow an earlier report from a two-week survey in June–July 2016, and reports 10 species not sighted during the previous survey. Observations on early stages of *Pieris deota*, *Aglais ladakensis*, and *Papilio machaon ladakensis* are reported, as well as a mass emergence of *Parnassius epaphus*.

Keywords: Himalayas, Lepidoptera, mass emergence, palearctic.

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Author contribution: All the three authors participated in the field survey in Ladakh. Sanjay Sondhi drafted the manuscript and prepared some of the plates and the tables. Balakrishnan Valappil prepared some of the plates, provided inputs to and edited the manuscript. Vidya Venkatesh provided inputs to and edited the manuscript.

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INTRODUCTION

Sondhi et al. (2017) reported on butterflies sighted during a 12-day survey in Ladakh in June and July 2016, during which 42 species were recorded. In August 2018, the authors undertook another two week survey in Ladakh Union Territory (LUT). Species not sighted in 2016 are reported here, and a checklist of all butterflies recorded is provided with details of locations, altitudes and number of individuals sighted. Other interesting natural history observations are mentioned.

MATERIALS AND METHODS

A survey was conducted 3–15 August 2018 with the aim of covering as many habitats and altitudes as possible in Ladakh, making it necessary to use a vehicle throughout the survey period. The route (Table 1) extended through most parts of Leh District, covering its central, northern, eastern, and southern parts, as well as the exit through the Lahaul region in Lahaul and Spiti District of Himachal Pradesh (HP).

The methodology consisted primarily of visual encounter surveys in suitable habitats for butterflies, such as alpine meadows, grasslands, crop fields, and edges of stream and lakes. As we did not have permission to collect specimens, we relied primarily on photographs for identification. In addition to the date and location of sightings, we also noted the times at which individuals were encountered. Altitudinal elevations were recorded using a Garmin Etrex 10.

Existing literature was consulted for species identification and distributions (Marshall & de Nicéville 1882–1890, Bingham 1905–07; Swinhoe 1912–13; Evans 1927, 1932; Talbot 1939, 1947; Wynter-Blyth 1957; Cantlie 1963; Mani 1986; Smith 1994, 2006; Kinyon 2004; Tshikolovets 2005; Kehimkar 2008; Varshney & Smetacek, 2015; van Gasse 2017). Online sources were also consulted as aids to taxonomy and identification (Kunte et al. 2019; Savelle 2019).

RESULTS

The 12-day survey resulted in the record of 42 species of butterflies from five families in 11 subfamilies (Table 2). Many of these species are rare and found in Palearctic habitats in the inner Himalaya. Seven species are protected under Schedule II of the Indian Wildlife (Protection) Act, 1972. A checklist of the species

Table 1. Route taken during butterfly surveys

	Date	Route taken
1	03.viii.2018	Leh City outskirts (Spituk, Choklamsar) Leh District, LUT
2	04.viii.2018	Leh City outskirts (Sabu village & Chushut) in Leh District, LUT
3	05.viii.2018	Leh-Ganglas-South Pullu-Khardung La-North Pullu-Khardung village in Leh District, LUT
4	06.viii.2018	Khardung village-Khalsar-Hundar-Skuru-Turtuk in Leh District, LUT
5	07.viii.2018	Turtuk and surrounds in Leh District, LUT
6	08.viii.2018	Turtuk-Skuru-Hundar-Khema-Kinru in Leh District, LUT
7	09.viii.2018	Kinru-Khema-Warila Pass in Leh District, LUT
8	10.viii.2018	Warila Pass-Serthi-Sakti in Leh District, LUT
9	11.viii.2018	Sakti-Karu-Upshi-Miru-Latu-Rumste in Leh District, LUT
10	12.viii.2018	Rumste-Tanglang La-Debring-Pang in Leh District, LUT
11	13.viii.2018	Pang-Lachung La-Whiskey nala-Serchu in Leh District, LUT
12	14.viii.2018	Serchu-Baralacha Pass-Zing Zing Bar-Darcha-Jispa-Keylong in Lahaul Spiti District, HP
13	15.viii.2018	Keylong-Tandi-Sissu-Teling-Khoksar-Rohtang La-Kothi-Manali in Lahaul Spiti District, HP

Table 2. Species break up by family and subfamily

	Family	No of subfamilies	No of species
1	Hesperiidae	1	1
2	Lycaenidae	3	11
3	Nymphalidae	3	18
4	Pieridae	2	11
5	Papilionidae	1	1

recorded along with their locations, altitudinal range, and estimated number of individuals is listed in Table 3. The summary of photographic records of the species not recorded in Sondhi et al. (2017) is provided in Image 1–7.

DISCUSSION

The following section provides detailed information about the additional species recorded during the survey in August 2018 including dates/times at which they were recorded, locations, altitudes as well as relevant natural history observations and taxonomic notes, wherever necessary. The common names as well as alternative common names (ACN) in use are also mentioned (Evans 1932; Kunte et al. 2019). The legal protection accorded to these species, under the Indian Wildlife (Protection) Act, 1972, if any, is mentioned. Photographs of these



Image 1–7. Butterflies of Ladakh and Lahaul: 1—*Pieris rapae rapae* | 2—*Colias stolickzana stolickzana* | 3—*Lasiommata manava* (3a ♀ UP), (3b ♀ UN), (3c ♂ UP) | 4—*Paroeneis pumilus* | 5—*Karanasa* sp. | 6—*Lycaena aditya* (6a ♂ UN), (6b ♂ UP) | 7—*Parnassius epaphus* (7a UN), (7b UP), (7c crevice crawling). © Sanjay Sondhi.

butterfly species are included in Image 1–7. In these images, the upperside of species is only provided if this is essential for species identity. In addition, gender of the butterfly in image as male (♂) or female (♀), if known, is mentioned.

Notes on species recorded in Ladakh and Lahaul in August 2018.

Family Pieridae, Subfamily Pierinae, Tribe Pierini *Pieris rapae rapae* (Linnaeus, 1758) (Small Cabbage White)

During the previous survey, we searched extensively for *P. rapae rapae* (Linnaeus, 1758), but did not record any individuals. During this visit we recorded this species

(Image 1) in multiple locations. On 03 August 2018, 15.30h, Choklamsar near Leh, altitude 3,211m, at least half a dozen individuals recorded. Most individuals were worn. Distinctly smaller in size than Indian Cabbage White *Pieris canidia indica*; very much whiter above, with a much narrower border on FW apex, along with a small, sometimes indistinct spot on UPF disc. On 04 Aug 2018, 14.44h, Chushut, Leh outskirts, altitude 3,500m, about half a dozen individuals were recorded. On 06 Aug 2018, 12.00h, farm fields beyond Hundar, altitude 3,123m, a few individuals were recorded. On 06 August 2018, 17.34h onwards, Turtuk, altitude 2,857m at least 15 individuals were spotted in the farm fields above Turtuk and photographed roosting in the evening after 18.00h. On 07 August 2018, 07.39h, Turtuk., 08.15–12.00 h fields above Turtuk, altitude 2,918m, 120 individuals counted. 10 August 2018, 16.53h, Sakti Village, altitude 3,740m, one individual.

Pieris rapae rapae (Linnaeus, 1758) is a range-restricted pierid, which is known only from Kashmir and Ladakh Union Territory in India (Wynter-Blyth 1957; Tshikolovets 2005; Varshney & Smetacek 2015). While we recorded the butterfly at multiple locations in reasonable numbers, there are a few published records of this species from Kashmir. The Butterflies of India website (Kunte et al. 2019) has only a single record of this species from Pakistan, and no records from India. A report by Bhardwaj et al. (2012) reported this species from Har-ki-dun in Gangotri Pashu Vihar National Park but presented no evidence in the form of photographs or specimens; hence this record from Uttarakhand remains unverified (Sondhi & Kunte 2018). Going by the numbers we encountered during our visit, *P. rapae* is locally abundant, especially in flowering fields.

***Pieris deota* de Nicéville, 1884 (Kashmir White)**

09 August 2018, 10.06h. Spotted an individual near Khema. 09 August 2018, 10.50–12.45 h, Khema, altitude 3,628m. Numerous individuals spotted before, at and beyond Khema Village. We spotted an egg-laying female (Image 8a–c). The host plant, yet to be identified, had dozens of caterpillars of *Pieris deota*. 11 August 2018, 10.07h, Sakti-Rumste road, altitude 3,632m. A few individuals spotted in fields along the road. Numerous caterpillars of *Pieris deota* recorded on the host plant, which is yet to be identified. We reported this species during the survey undertaken in 2016 (Sondhi et al. 2017), and as during the earlier survey in 2016, the species was not common anywhere.

Family Pieridae, Subfamily Coliadinae

***Colias stolickzana stolickzana* Moore, 1882 (Orange Clouded Yellow)**

10 August 2018, 10.18–10.53 h, below Warila Pass, altitude 5,205m. About 3km beyond the Warila Pass, the meadows were teeming with activity of Clouded Yellows, but the butterflies were not sitting at all. At one point, we ended up chasing butterflies across the meadows for 30 minutes without getting a photograph. In flight, the butterflies were bright orange above. A few distant photographs revealed the UNH veins were not pale yellow, and dark discal spots usually present, thereby identifying them as *Colias stolickzana stolickzana* Moore, 1882 (Image 2) and separating them from the similar *Colias eogene* (Evans 1932; Talbot 1947; Tshikolovets 2005).

Family Nymphalidae, Subfamily Nymphalinae, Tribe Nymphalini

***Aglais ladakensis* Moore, 1878 (Ladakh Tortoiseshell)**

05 August 2018, 10.33h, South Pullu, altitude 4,663m. A solitary individual recorded at the edge of the stream before South Pullu. The individual flew swiftly over the grassy patch, settled and took to wing again. The butterfly did not return to the area, despite SS spending 30 minutes searching the area. 10 August 2018, just below Warila Pass, altitude 4,927m. Photographed by LV at the stream below Warila Pass. 12 August 2018, 07.00–08.00 h, Rumste, altitude 4,558m. A kilometer after Rumste, enroute to Tanglang Pass, lots of caterpillars and pupae found on nettle plants along side road. The plant was identified as the Himalayan or Northern Nettle *Urtica hyperborea* Jacquem. ex Wedd (Urticaceae), whose local name is ‘Dzatsutt’ or ‘Zozot’ (Chaurasia et al. 2008). The caterpillar and its pupae were successfully reared, and its early stages documented (Images 9–17). Interestingly, though the caterpillars and pupae were abundant on most *Urtica hyperborea* plants that we examined, we spotted only two adults during our two-week visit, leading us to believe that the emergence of this species had yet to occur in large numbers. We did not record *A. ladakensis* during our Ladakh survey in June and July 2016 (Sondhi et al. 2017).

***Nymphalis xanthomelas fervescens* Esper, 1781 (Large Tortoiseshell)**

09 August 2018, 10.33h, just beyond Khema, altitude 3,628m. A single individual spotted alongside the road just after village Khema. 11 August 2018, 09.20h, Sakti-Rumste road, altitude 3,604m. A single individual



Image 8. *Pieris deota* life cycle: a—♀ egg laying, b & c *Pieris deota* caterpillars. © Balakrishnan Valappil.

was recorded in rocky habitat with some shrubs, alongside the road, near a stream. We did not record *N. xanthomelas* during our Ladakh survey in June and July 2016 (Sondhi et al. 2017).

Family Nymphalidae, Subfamily Satyrinae, Tribe Satyrini

***Lasiommata menava* Moore, 1865 (Dark Wall)**

04 Aug 2018, 08.34h, Sabu Village, Leh outskirts, altitude 3,900m. Solitary sighting of the female. 07 August 2018, 09.24h, fields above Turtuk, altitude 2,918m. Spotted a male and a worn female amongst the rocks bordering the fields above Turtuk. While the male (Image 3c) is entirely dark brown above, the female has a bright tawny sub-apical patch on the upperside of the forewing (Image 3a, 3b). We did not record *L. menava* during our Ladakh survey in June and July 2016 (Sondhi et al. 2017). *Lasiommata menava*'s known range is from Baluchistan and Chitral in Pakistan east to Kashmir (Evans 1932; Talbot 1947; Tshikolovets 2005; Varshney & Smetacek 2015), however, a recent record by Abhay Soman and team from Himachal Pradesh extends its known range eastwards (Anonymous 2019).

***Paroeneis pumilus* (Felder & Felder, [1867]) (Ladakh Mountain Satyr)**

09 August 2018, 14.00h onwards, enroute to Warila Pass, altitude 4,139m. Spotted in a meadow, approximately 12km before Warila Pass. We counted at least 40–50 individuals. The butterfly (Image 4) had a very weak flight; never flying for long. The butterflies would settle amongst the grass blades, often hidden

from view. 10 August 2018, 11.00h, ~ 4km below Warila Pass. Two individuals spotted alongside the road. 11 August 2018, 15.52–16.30 h, Rumste, altitude 4,379m. Spotted at least 40–50 individuals in the meadow alongside a stream, approximately 3km beyond Rumste. 12 August 2018, 07.30h, Rumste. Some individuals were active at 07.30h the next morning in the same meadow. We did not record *P. pumilus* during our Ladakh survey in June and July 2016 (Sondhi et al. 2017). This little-known species, whose distribution extends from Kashmir eastwards to Nepal (Smith 2006; Sondhi & Kunte 2018), was surprisingly common locally. Tshikolovets (2005) recorded it from Rupshu in 1998 and this remains the only recent published record of this species from India.

***Karanasa* sp.**

05 August 2018, 15.07h, North Pullu, altitude 4,658m. A solitary individual (Image 5) was recorded at the stream edge; only its underside was photographed. It was not possible to identify this to the species level without collecting specimens and molecular phylogeny and/or genitalia dissection.

Family Lycaenidae, Subfamily Theclinae

***Satyrrium (Superflua) deria* (Moore, 1865) (Indian White-line Hairstreak)**

15 August 2018, 10.13–10.37 h, Tandi, altitude 2,992m. On a dry hill slope, 4km from Tandi Village, we spotted a large number of *Satyrrium deria*. On a particular flower species, a small shrub with pinkish-purple flowers, there were always hairstreaks to be found; sometimes up to five individuals on a single bush.



Image 9–17. *Aglais ladakensis* life cycle: 9 & 10—Imago | 11,12(a,b)—Early instar caterpillar | 13—Final instar caterpillar | 14—Pupation | 15—Hostplant *Urtica hyperborea* | 16(a–c)—Pupa | 17—Pupal leaf cell. 9–16 © Balakrishnan Valappil, 17 © Sanjay Sondhi.



Table 3. Checklist of butterflies recorded during the August 2018 survey along with locality, altitude range, and abundance.

	Common name	Scientific name	Locations seen at	Altitude range in m	Estimated number of adults
Hesperiidae, Hesperinae, Hesperini					
1	Chequered Darter	<i>Hesperia comma dimila</i>	Below Warila Pass, below Tanglang Pass, below Baralacha Pass	4,900	3
Lycaenidae, Lycaeninae					
2	Ladakh Copper	<i>Lycaena aditya</i>	South Pullu	4,348	1
3	Common Copper	<i>Lycaena phlaeas</i>	Below Baralacha Pass, Patsio, Keylong, Tandi, Kokhsar	2,900–4,900	15–20
Lycaenidae, Polyommatae					
4	Common Mountain Blue	<i>Albulina lehanus</i>	Khardung, Khema, Kinru, Sakti	3,700–4,130	10
5	Bright Green Underwing	<i>Pamiria chrysopsis</i>	Keylong	3,000	6–8
6	Dusky Green Underwing	<i>Pamiria omphisa omphisa</i>	Sabu (near Leh), South Pullu, North Pullu, Warila Pass	3,900–4,800	20
7	Lahaul Meadow Blue	<i>Polyommatus ariana</i>	South Pullu, Ganglas, Hundar, Turtuk, Zing Zing Bar, Keylong, Kokhsar	3,000–4,600	85–90
8	Ladakh Meadow Blue	<i>Polyommatus stolickiana</i>	Spituk, Choklamsar, Sabu (all near Leh), Turtuk, Keylong, Sisoo, Kokhsar	2,800–3,200	10–12
9	Sea Jewel Blue	<i>Plebejus samudra samudra</i>	Spituk (near Leh), Turtuk	3,000	5–7
10	Eastern Baton Blue	<i>Pseudophilotes vicrama vicrama</i>	Ganglas, Turtuk	2,900–3,200	2
11	Hill Hedge Blue	<i>Celastrina argiolus kollari</i>	Choklamsar, Chushut (near Leh), Hundar, Turtuk	2,900–3,200	15
Lycaenidae, Theclinae, Theclini					
12	Indian Whiteline Hairstreak	<i>Satyrium deria</i>	Tandi	3,000	15–20
Nymphalidae, Nymphalinae, Nymphalini					
13	Indian Tortoiseshell	<i>Aglais caschmirensis caschmirensis</i>	Below Baralacha Pass	4,900	1
14	Ladakh Tortoiseshell	<i>Aglais ladakensis</i>	Before South Pullu, below Warila Pass. Larvae near Rumste.	3,600–4,300	2
15	Large Tortoiseshell	<i>Nymphalis xanthomelas fervescens</i>	Khema, between Sakti & Rumste	3,600 m	2
16	Painted Lady	<i>Vanessa cardui</i>	Between Khardung & Khalsar, Turtuk, between Sakti & Rumste, Miru, below Baralacha Pass	3,500–4,290	4–5
Nymphalidae, Nymphalinae, Melitaeini					
17	Blackvein Fritillary	<i>Melitaea amoenula</i>	Near Khema & Kinru	3,600–4,100	10–12
Nymphalidae, Heliconiinae, Argynnini					
18	Highbrown Silverspot	<i>Argynnis jainadeva persephone</i> IWPA, SCH II	South Pullu, beyond Khardung, Khema, Kinru, enroute to Warila Pass	3,800–4,400	17–20
Nymphalidae, Satyrinae, Satyrini					
19	Common Satyr	<i>Aulocera swaha garuna</i>	Patsio, Keylong, Tandi,	3,000–3,700	35–40
20	Narrow-banded Satyr	<i>Aulocera brahminus brahminus</i> IWPA, SCH II	near Khokhsar, below Rohtang La	3,000–3,600	4–5
21	Scarce Mountain Argus	<i>Callerebia kalinda kalinda</i> IWPA, SCH II	Tandi	3,200	1
22	Short-branded Meadowbrown	<i>Hyponephele brevistigma brevistigma</i>	Khema, between Sakti & Rumste, Miru	3,600–3,800	5
23	Dusky Meadowbrown	<i>Hyponephele pulchra</i>	Keylong, Tandi, Kokhsar	3,000–3,200	15–20
24	Tawny Meadowbrown	<i>Hyponephele pulchella pulchella</i>	Ganglas, South Pullu	4,200	2
25	Tawny Satyr	<i>Karanasa cf. huebneri</i>	25 km before Serchu, after Serchu	4,400	8–10
26	Satyr sp.	<i>Karanasa sp.</i>	North Pullu	4,658	1
27	Yellow Argus	<i>Paralasa mani mani</i> IWPA, SCH II	Ganglas, near South Pullu,	4,200–4,500	4
28	Tawny Rockbrown	<i>Pseudochazara lehana</i>	Sabu (near Leh), beyond Khardung village, Khema, near Serchu	3,600–4,400	12–15
29	Dark Wall	<i>Lasiommata menava</i>	Sabu (near Leh), Turtuk	2,900–3,900	3

	Common name	Scientific name	Locations seen at	Altitude range in m	Estimated number of adults
30	Ladakh Mountain Satyr	<i>Paroeneis pumilus</i>	Enroute to Warila Pass, below Warila Pass, near Rumste	4,100–4,340	>100
Pieridae, Pierinae, Pierini					
31	Large Cabbage White	<i>Pieris brassicae nepalensis</i>	Spituk, Choklamsar, Sabu, Chushut (all near Leh), Hundar, Khalsar, Turtuk, Khema, Sakti, Rumste, Miru, Keylong, Tandi	2,900–3,800	>200
32	Indian Cabbage White	<i>Pieris canidia indica</i>	Choklamsar (near Leh), Hundar, Turtuk, Kokhsar	2,900–3,200	15–20
33	Small Cabbage White	<i>Pieris rapae rapae</i>	Choklamsar & Chushut (near Leh), Hundar, Turtuk, Sakti	2,800–3,800	>150
34	Kashmir White	<i>Pieris deota</i> IWPA, SCH II	Khema, Sakti	3,600	8–10
35	Lofty Bath White	<i>Pontia callidice kalora</i>	Below Tanglang Pass. Below Baralacha Pass	4,900	3
36	Lesser Bath White	<i>Pontia chloridice</i> IWPA, SCH II	Khema, Miru	3,600–3,800	3
37	Bath White	<i>Pontia daplidice moorei</i>	Miru	3,800	6–7
Pieridae, Coliadinae					
38	Pale Clouded Yellow	<i>Colias erate erate</i>	Spituk, Choklamsar, Sabu, Chushut (all near Leh), Hundar, Turtuk, Sakti	2,900–3740	~20
39	Dark Clouded Yellow	<i>Colias fieldi fieldi</i>	Turtuk, below Baralacha Pass, Serchu Keylong, Tandi, Kokhsar	2,800–4,900	10–15
40	Ladak Clouded Yellow	<i>Colias ladakensis ladakensis</i> IWPA, SCH II	Kinru, below Tanglang Pass	4,100–4,900	10–12
41	Orange Clouded Yellow	<i>Colias stolickzana stolickzana</i>	Below Warila Pass	5,205	5–7
Papilionidae, Parnassiinae, Parnassiini					
42	Common Red Apollo	<i>Parnassius epaphus epaphus</i>	Before South Pullu, between Ganglass and Khardung La, near North Pullu, before Warila Pass, before Tanglang Pass	4,600–5,400	>300

Many individuals were worn. We estimated between 15–20 individuals on that particular hill slope alone, leading us to believe that the species is locally common in appropriate nectaring habitat. We had sighted just two individuals of this species in June and July 2016 (Sondhi et al. 2017). SS had also spotted a few individuals of this species in Gangotri National Park, Uttarakhand (Sondhi 2019) on 25 June 2018. These previous sightings in Ladakh and Uttarakhand always consisted of one or two individuals; hence the large numbers of *S. deria* spotted at a single location near Tandi was unusual. This species was reported as *Superflua deria* Moore, 1865 during the last survey, and now stands revised to *Satyrium deria* (Moore, 1865) (Krupitsky et al. 2018).

Family Lycaenidae, Subfamily Lycaeninae *Lycaena aditya* (Moore, [1875]) (Ladakh Copper)

05 August 2018, 09.35h, near Ganglas, altitude 4,348m. A solitary male of *Lycaena aditya* (Image 6a, 6b) was sighted amidst short shrubs before South Pullu. The butterfly was observed basking. When it took to wing, it flew rapidly and did not re-appear. There are few

recent published records of this species from India. We did not record *L. aditya* during our Ladakh survey in June and July 2016 (Sondhi et al. 2017). Tshikolovets (2005) reported only three records of this species from Stok, Dras Valley and Namika La from northwestern Ladakh confirming that it is an extremely rare species. *L. aditya* has a narrow distribution from Chitral District (Pakistan) to Kashmir (India) (Evans 1927, 1932; Tshikolovets 2005; Varshney & Smetacek 2015).

Family Lycaenidae, Subfamily Polyommatainae, Tribe Polyommataini

Pamiria chrysopsis (Grum-Grshimaïlo, 1888) (Bright Green Underwing)

15 August 2018, 08.30–09.03 h, Keylong, altitude 2,993m. 4–5 individuals recorded. 15 August 2018, 12.38h, Kokhsar, altitude ~3,200m. 2–3 individuals recorded. Two species of Underwings *Albulina metallica* and *Albulina omphisa* were recorded during our previous survey (Sondhi et al. 2017). These species are now listed under the genera *Pamiria* based on revised classification using molecular data (Talavera et al. 2012). In addition,



Image 18–24. *Papilio machaon* life cycle: 18—Imago | 19(a,b)—Hostplant *Heracleum candicans*, plant and flowers | 20(a,b) & 21—Early instar caterpillar | 22, 23(a–c)—Final instar caterpillar | 24(a–c)—Pupa. © Balakrishnan Valappil.

the individuals spotted at Keylong and Kokhsar were incorrectly identified as *omphisa* in the 2016 survey, whereas they are actually *Pamiria chrysopis*. These corrections are now made in the updated checklist (Table 3).

Family Papiliononidae, Subfamily Papilioninae, Tribe Papilionini

Papilio machaon ladakensis Moore, 1884 (Common Yellow Swallowtail)

05 Aug 2019, 09.51h, near Ganglas, altitude 4,348m. Numerous caterpillars of *P. machaon* in early and late instars were spotted on its larval host plant *Heracleum candicans* Wall (Apiaceae). An incomplete life cycle of the butterfly was recorded, as the adult did not emerge (Images 18–24).

Family Papilionidae, Subfamily Parnassiinae, Tribe Parnassiini

Parnassius epaphus Oberthür, 1879 (Common Red Apollo)

05 August 2018, 10.33h, before South Pullu, altitude 4,600m. Two individuals at the edge of the stream. 05 August 2018, 12.00–13.00 h, between Ganglas and Khardung La. At altitude between 4,700–5,174 m on the stretch of road leading up to Khardung La, till up to about a kilometer from the pass, we witnessed a mass emergence of *P. epaphus*. We estimated between 100–200 individuals flying on the road and in the meadows surrounding the road. Everywhere we looked, we could see *Parnassius* species on the wing. Some *Parnassius* individuals were victims of road kills on account of passing vehicles. 05 August 2018, 13.20–14.45 h, between Khardung La and North Pullu, altitude 4,824m. On passing Khardung La, we observed very few individuals of *Parnassius*. 05 August 2018, 14.46h, 5km beyond N. Pullu, after Khardung La, altitude 4,824m, one individual. 10 August 2018, 09.47–10.20 h, before Warila Pass, altitude 5,200m, 30–40 individuals. After Warila Pass, 2–3 individuals. 12 August 2018, 09.32h, before Tanglang Pass, altitude 5,343m, 15–20 individuals. After Tanglang Pass, no sightings. Our observations of the swarms of *P. epaphus* at numerous locations had some patterns. All the swarms at Khardung La, Warila Pass and Tanglang Pass were in meadows around the road, about a kilometer below the pass, on the south-facing slopes. In each of the passes, we recorded a very small number of *Parnassius* individuals (0–5), on the north-facing hills slopes. In contrast, the south facing hill slopes of Khardung La, Warila Pass and Tanglang Pass, we observed large numbers of *Parnassius* (20–200

individuals) (Image 7a,b). Some of the individuals we observed we worn, while others were very fresh, and we also spotted quite a few mating pairs. Older literature does mentions swarming *Parnassius* (Wynter-Blyth 1957), but there are few recent published records of this phenomenon from India. On occasion, the butterflies would sit on the ground and attempt to crawl into a crevice formed by rocks on the ground (Image 7c), making it difficult to photograph.

These new records reveal that much needs to be studied across seasons in high altitude cold deserts of India. The impact of unbridled tourism, climate change and other anthropogenic factors are yet to be quantified and urgent assessments of Lepidoptera in these regions are needed across the country.

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