

A detailed study of the variations found in the chrysalises of *Aglais caschmirensis* Kollar, 1844 (Lepidoptera: Papilionoidea, Nymphalidae)

Lovish Garlani

Abstract

Ninety larvae of *Aglais caschmirensis* Kollar, 1844 were studied in September 2022 in Dharamshala, Himachal Pradesh, India. All the larvae were fed on the host plant *Urtica dioica*. The study reveals that the larvae of *Aglais caschmirensis* Kollar, 1844 produce chrysalises of four different colors i.e., Golden, Red, Green, and Brown. This study found that Golden is the most dominant color of chrysalises with the highest survival rate while Green is the rarest color in chrysalises. The survival rate of Brown colored chrysalises is moderate while interestingly all the red chrysalises were affected by parasitoids and did not survive which shows that Parasitoidism is somehow responsible for phenotypic variations in the chrysalises of *Aglais caschmirensis* Kollar, 1844.

Keywords: Lepidoptera, Nymphalidae, Parasitoidism, Himachal Pradesh, India.

Un estudio detallado de las variaciones encontradas en las crisálidas de *Aglais caschmirensis* Kollar, 1844 (Lepidoptera: Papilionoidea, Nymphalidae)

Resumen

Noventa larvas de *Aglais caschmirensis* Kollar, 1844 fueron estudiadas en septiembre de 2022 en Dharamshala, Himachal Pradesh, India. Todas las larvas se alimentaron de la planta nutricia *Urtica dioica*. El estudio revela que las larvas de *Aglais caschmirensis* Kollar, 1844 producen crisálidas de cuatro colores diferentes, es decir, dorado, rojo, verde y pardo. Este estudio encontró que el dorado es el color más dominante de las crisálidas con la tasa de supervivencia más alta, mientras que el verde es el color más raro en las crisálidas. La tasa de supervivencia de las crisálidas de color pardo es moderada, mientras que todas las crisálidas rojas se vieron afectadas por parasitoides y no sobrevivieron, lo que demuestra que el parasitismo es de alguna manera responsable de las variaciones fenotípicas en las crisálidas de *Aglais caschmirensis* Kollar, 1844.

Palabras clave: Lepidoptera, Nymphalidae, parasitoidismo, Himachal Pradesh, India.

Introduction

Aglais caschmirensis Kollar, 1844 is common in the Himalayas and flies throughout the year from foothills up to 4500 m (Sondhi & Kunte, 2018). This butterfly can be seen on wings in urban, natural, agroecosystems, and all types of terrains (Haribal, 1990). *Aglais caschmirensis* Kollar, 1844 hibernates from December to late February (Qureshi & Bhagat, 2015). The author observed that *Aglais caschmirensis* Kollar, 1844 hibernates in the chrysalis stage and its chrysalises can be seen in nearby household buildings, tree hollows, and even on the rocks. Although sometimes the adults of *Aglais caschmirensis* Kollar, 1844 are also active during winters. The author observed an adult of this species on 16-I-2022 in Garli, Kangra, Himachal Pradesh at an altitude of 410m which reveals that *Aglais caschmirensis* Kollar, 1844 tends to migrate to low elevations during winters. In a rare case an adult of

Aglais caschmirensis Kollar, 1844 was found in a sub-zero temperature of -15.1 degrees Celsius (Hassan, 2021). Two subspecies of *Aglais caschmirensis* Kollar, 1844 are found in the Himalayas i.e., *Aglais caschmirensis caschmirensis* Kollar, 1844 and *Aglais caschmirensis aesis* Fruhstorfer, 1912. The subspecies *caschmirensis* is found from Kashmir east to Kullu while the subspecies *aesis* is found from Shimla east to Arunachal Pradesh (Varshney & Smetacek, 2015; Kehimkar, 2016; Sondhi & Kunte, 2018). The present study is based on *Aglais caschmirensis aesis* Fruhstorfer, 1912.

Materials and Methods

On 22-IX-2022 ninety larvae of different instar stages of *Aglais caschmirensis* Kollar, 1844 were collected from the host plant *Urtica dioica* L. (Figure 1). These larvae were reared in a glass container with proper ventilation and a good supply of sunlight. They were fed on the leaves of *Urtica dioica*. The larvae of *Aglais caschmirensis* Kollar, 1844 are voracious feeders and actively feed during the day and night and they form a congregation around a single leaf usually coiling the leaves with silky threads (Figure 2). The collected larvae and chrysalises were carefully studied, and every detail was noted.

Results and Discussions

The study found that out of 90 larvae, only 68 turned to the chrysalis stage. Some of the larvae were affected by parasitoids. These larvae were carefully studied and removed from the rearing container. It was interesting to observe that the remaining larvae produced chrysalises of four different colors i.e., Green, Red, Golden, and Brown (Figure 3). Such great phenotypic variation among the chrysalises of a single species is an interesting and new phenomenon to witness in nature. It is worth mentioning that chrysalis pictures of *Aglais caschmirensis* Kollar, 1844 given on the Butterflies of India website do not show any such color variations (Kunte et al. 2022).

Among 68 Chrysalises, 32 were Golden in color, 18 were Brown, 12 were Red, and 06 were Green in color which further provides that Golden is the most dominant color while Green is the rarest color among the chrysalises of *Aglais caschmirensis* Kollar, 1844. A detailed study of the chrysalis types and their survival rate is given in Table 1.

Table 1. Details of different types of Chrysalises and their Survival rate.

Chrysalis Color	Number of Chrysalises	Number of Chrysalises survived	Survival Rate
Golden	32	25	78.12%
Brown	18	13	72.22%
Red	12	00	00.00%
Green	06	04	66.66%
	Total= 68	42	61.76%

The above details provide that Golden colored chrysalises are the most common type among the chrysalises of *Aglais caschmirensis* Kollar, 1844 and they also have the highest survival rate of 78.12% (Figure 4). The Brown colored chrysalises are moderate in number and their survival rate is 72.22%. It was fascinating to observe that all the red-colored chrysalises of *Aglais caschmirensis* Kollar, 1844 were affected by parasitoids and none of them survived and no adult butterfly emerged from them (Figure 5). Especially Tachinid flies and Chalcid flies lay their eggs on caterpillars or chrysalises of *Aglais caschmirensis* Kollar, 1844. It was also observed that Green is the rarest color in the chrysalises with a survival rate of 66.66%.

Conclusion

Hence, this study proves that Parasitoidism may be responsible for the red coloration in the chrysalises of *Aglais caschmirensis* Kollar, 1844. The color change from red to dark brown after a few

days of pupation and a small hole can be seen on the lateral side of the affected chrysalis. It is also possible that other color variations in the chrysalis are interlinked with the sex of the chrysalis. Sometimes genetic factors also lead to variations in a chrysalis. As in this study, it was found that green-colored chrysalises were the rarest, which may be due to the expression of a Recessive gene. As only 61.76% of chrysalises survived, it is possible that either the caterpillars before pupation did not eat enough or they were affected by some disease, causing a lack of appetite which led to the reduction in survival rate.

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Lovish Garlani
Village & P. O: Garli
Tehsil: Rakkar, District: Kangra
Himachal Pradesh, 177108
INDIA / INDIA
E-mail: lovishgarlani.natgeo123@gmail.com
<https://orcid.org/0000-0002-0663-9775>

y / and

Himachal Pradesh University
Summerhill
Shimla Himachal Pradesh, 171005
INDIA / INDIA

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Figures 1-2. 1. Larvae of *Aglais caschmirensis* Kollar, 1844 feeding on *Urtica dioica*. © Lovish Garlani. 2. Congregation of *Aglais caschmirensis* Kollar, 1844, larvae, coiling leaves with silky threads. © Lovish Garlani

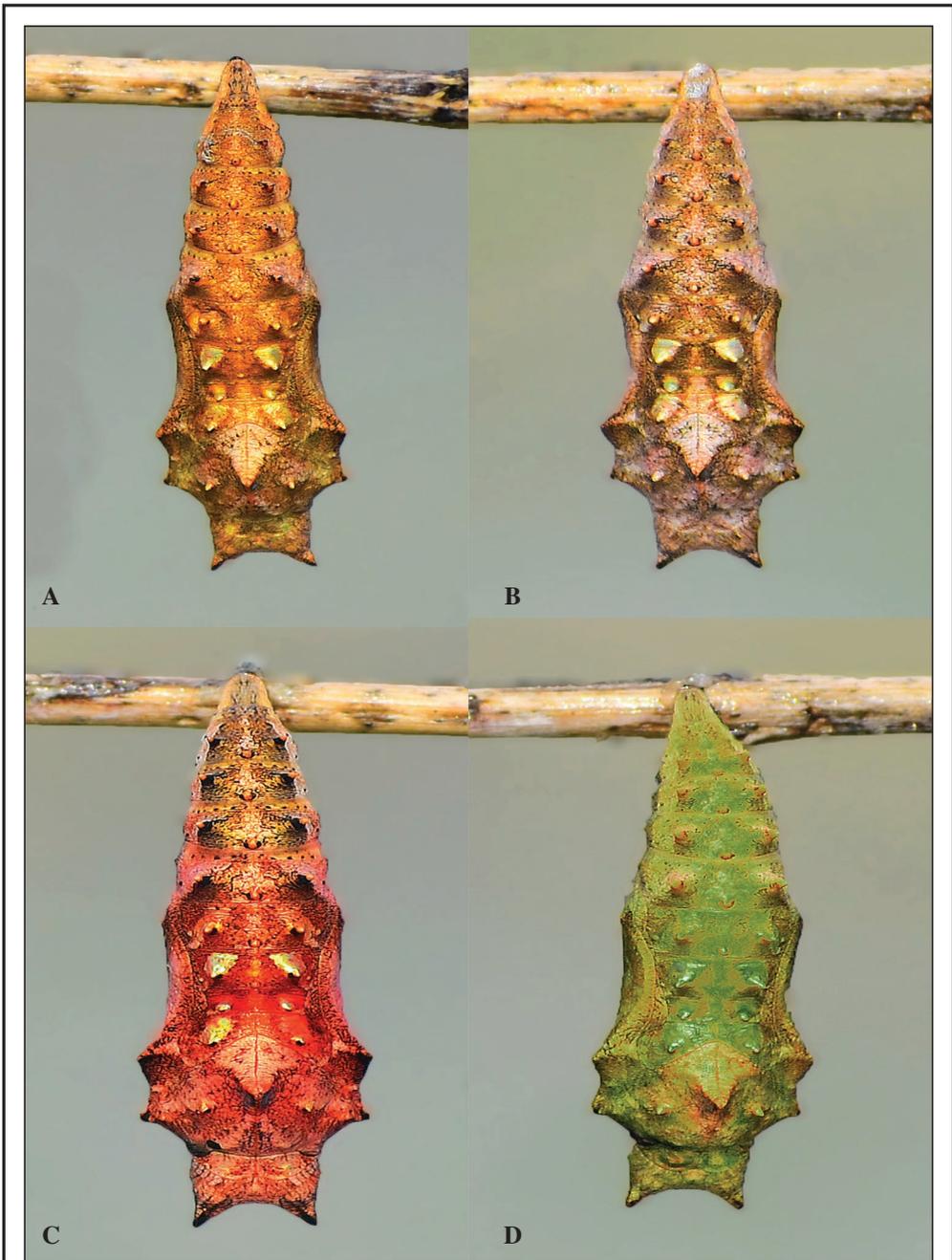


Figure 3. Variations in color of the chrysalis of *Aglais caschmirensis* Kollar, 1844 (A: Golden, B: Brown, C: Red, D: Green) © Lovish Garlani



Figures 4-5. 4a-b. The golden-colored; most common and abundant type of chrysalis of *Aglais caschmirensis* Kollar, 1844 with the highest rate of survival. © Lovish Garlani. 5a-b. Red-colored chrysalis of *Aglais caschmirensis* Kollar, 1844 affected by Parasitoid, changed its color to dark brown after a few days of pupation. © Lovish Garlani