

RE-DESCRIPTION OF CLOUDED YELLOW BUTTERFLIES, *COLIAS ERATE* (ESPER, 1805) AND *COLIAS FIELDII* MENETRIES, 1855 FROM INDIA

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ABSTRACT

In the present research study, the morphological features including genitalic attributes and distribution of two commonly found clouded yellow butterflies i.e. *Colias erate* (Esper) including its polymorphic form *glicia* and *Colias feildii* Menetries have been studied and illustrated. The key is updated for both the species by including their genitalic attributes.

Keywords: *Colias erate*, *Colias feildii*, Female genitalia, *Glicia*, Male genitalia.

INTRODUCTION

The genus *Colias* was proposed by Fabricius in 1807 on its type species *Papilio hyale* Linnaeus. This genus comprises 81 species widely distributed in Afrotropical region, Holarctic region, South America, China and India. There are 12 species known from India, so far. This genus was studied by various eminent workers like Bingham (1907), Evans (1932), Talbot (1939) and Korb & Bolshakov (2011). Evans (1932) devised a key for the identification of the members of the genus *Colias* on the basis of their morphological characters and distribution. Talbot (1939) described the morphological features, male genitalic attributes and distribution of *Colias erate* (Esper, 1805) and described the morphological features of *Colias feildii* Menetries, 1855 as subspecies of *C. electo* (Linnaeus). Qureshi *et al.* (2013) conducted random field surveys from 2006 to 2008 during different months/seasons to study the butterfly diversity of Gulmarg, Kashmir, Jammu and Kashmir and reported *Colias erate* (Esper, 1805) as the frequently traceable species in the months of April to October and *Colias feildii* Menetries, 1855 in the months of April to November. Hazroon (2016) conducted research work at Tehsil Tangi, Khyber Pakhtunkhwa, Pakistan from August 2014 to May 2015 to describe various characteristics of the adults belonging to family Pieridae and found *C. Erate* (Esper) and *C. feildii*, Menetries as the

dominant species from Tehsil Tangi Roy *et al.* (2021) conducted regular field surveys in the varied landscapes of the Dinajpur district from April 2020 to March 2021 and reported *Colias feildii* Menetries, 1855 as a new record from Mahadebpur, in Birganj upazila, Dinajpur district, Bangladesh. Parveen *et al.* (2023) studied the diversity of butterflies in and around the Himalayan Botanical Garden of Western Himalayan Region, Nainital, Uttarakhand from January 2019 to December 2019 and found *Colias erate* (Esper, 1805) as uncommon species and *Colias feildii* Menetries, 1855 as common species in the mentioned locality. In the current study, the morphological attributes including genitalic features and distribution of *Colias erate* (Esper, 1805) including its polymorphic form *glicia* and *Colias feildii* Menetries, 1855 are re-described and illustrated. The key is updated for both the species by including their genitalic attributes.

MATERIALS AND METHODS

During present research work the specimens of *Colias erate* (Esper) and *Colias feildii* Menetries were studied from the collections lying in the National Museum, Zoological Survey of India, Kolkata. The images of dorsal and ventral sides of the specimens were obtained with a digital camera (Nikon D7000 18-105 mm). The dissections of genitalia

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have been done by adopting the method proposed by Robinson (1976). The photography of the male and female external genitalia has been done by using Leica binocular microscope equipped with a photographic unit.

RESULTS AND DISCUSSION

Genus *Colias* Fabricius, 1807

Common name: Clouded Yellows

Colias Fabricius, 1807; *Mag. f. Insektenk.* 6: 284.

Eurymus Horsfield, 1829; *Descr. Cat. lep. Ins. Mus. East India Coy* (2): 134.

Colias Godman & Salvin, 1889; *Biol. centr.-amer., Lep. Rhop.* 2: 151.

Colias Winhard, 2000; *Butterflies of the World* 10: 9.

Colias Korb & Bolshakov, 2011, *Eversmannia Suppl.* 2: 21.

Colias Pelham, 2008; *J. Res. Lepid.* 40: 140.

Type species: *Papilio hyale* Linnaeus, 1758

Papilio hyale Linnaeus, 1758; *Syst. Nat.* (Edn 10) 1: 469.

Diagnosis

Dorsal side of both the wings lemon-yellow. Forewing dorsal side with black apex and termen; submarginal black bar; minute discocellular dot. Hindwing dorsal side with slightly large discocellular dot. Ventral side of both the wings yellow.

Distribution

Afghanistan, Afrotropical region, Alaska, Altai, Amur, Arabia, Asia Minor, Austria, Bulgaria, Canada, China, Ethiopia, Europe, Finland, Germany, Greece, Greenland, Holarctic region, Hungary, India, Iran, Israel, Japan, Kazakhstan, Korea, Lebanon, Macedonia, Middle Asia, Mongolia, Nepal, Norway, Pamirs, Poland, Romania, Russia, Siberia, South America, Sudan, Sweden, Taiwan, Turkey, Turkey, Turkmenistan, Ukraine, Ukraine, Uzbekistan

Key to species of the genus *Colias* Fabricius

1. Both wings dorsal side lemon-yellow. Distal end of the valve strongly concave; thecal appendage of aedeagus long and linear.....*erate* (Esper)
- Both wings dorsal side orange. Distal end of the valve less concave; thecal appendage long and slightly curved.....*fieldii* Menetries

Colias erate (Esper, 1805)

Common name: Eastern Pale Clouded (Plates: 01-02)

Papilio erate Esper, 1805; *Die Schmett., Th I, Suppl. Th.2* (11): 13.

Colias erate Grun-Grshimailo, 1890; *Mem. Lep.* 4: 292.

Colias erate Yakovlev, 2012; *Nota lepid.* 35 (1): 64. *Colias erate* Korb & Bolshakov, 2011; *Eversmannia Suppl.* 2: 22.

Adult (Male)

Forewing dorsal side lemon-yellow with thin black costa; apex, termen and tornus broadly blackish-brown with irregular inner margin; a submarginal lemon-yellow spot; a blackish discocellular spot. Ventral side lemon-yellow; small blackish-brown submarginal spots; a small blackish discocellular spot. Hindwing dorsal side lemon-yellow; two light-orange discocellular spots; blackish-brown marginal border from vein Rs to Cu₂. Ventral side lemon-yellow; two creamish-white discocellular spots encircled with light-brown; black costal spot in area Sc+R₁; series of small light brown submarginal spots.

Adult (Male form *glicia*)

Similar to normal male but lemon-yellow submarginal spots are present in form *glicia*. Forewing ventral side with two submarginal spots in areas Cu₂ and Cu₁. Hindwing dorsal side dusted with blackish scales; black spots at the vein ends. Ventral side without submarginal spots.

Adult (Female)

Forewing dorsal side white; proximal part of the wing and costal margin dusted with blackish scales; apex, termen and tornus blackish-brown; series of white submarginal spots; a blackish discocellular spot. Ventral side white with greenish-yellow apex; small submarginal black spots in areas Cu₂, Cu₁ and M₃; a minute white discocellular spot encircled broadly with blackish-brown. Hindwing dorsal side white with marginal black spots; a white spot in area Rs; two orange discocellular spots. Ventral side greenish-yellow; two creamish-white discocellular spots encircled with light-brown.

Wing expanse: 50-55 mm.

Male Genitalia

Male genitalia higher than broad, uncus narrow, slightly longer than tegumen, distal tip downcurved with apex sharp, in dorsal perspective the proximal part slightly broad and distal part narrow; tegumen broad and short, narrow, basal lobe of tegumen present, narrow finger-like with blunt tip; vinculum straight; saccus broad, distal end broadly rounded; valve longer than broad, costa strongly convex, distal end strongly concave apex of valva squarish, ridge-like, with upper angle rounded, lower sharp; aedeagus narrow, rounded, strongly arched, thecal appendage extremely long and almost linear, ductus ejaculatorious enters dorsally.

Female Genitalia

Corpus bursae spherical, possess small pinules; signum slightly broad, long, margins denticulate and sclerotized;

appendix bursae large and globular; ductus bursae moderately long and slightly broad, basal half sclerotized; papilla analis ovoid and pilosed; posterior apophysis long with sclerotized distal tips; anterior apophysis small and narrow mushroom-like.

Material examined

ZSI, Kolkata, National Museum Collections.

4♂, 2♀, Ladakh; 2♂, 12.iv.1916, Sukha, Nainital, Uttarakhand.

Distribution in India

Jammu and Kashmir, Uttarakhand, West Bengal.

Global Distribution

Afghanistan, Austria, Bulgaria, Hungary, Macedonia, Romania, Turkey, Ukraine, Uzbekistan.

Remarks

Colias erate (Esper) is commonly found in the different areas of Jammu and Kashmir, Uttarakhand and West Bengal. Evans (1932) devised a key on the basis of its morphological characters and distribution. Talbot (1939) described its morphological features, male genitalic attributes and distribution including its seasonal forms. In this present work, the morphological features including genitalic attributes and distribution of *C. erate* (Esper) have been studied. The female genitalic attributes have been studied and illustrated for the first time in this work.

Colias fieldii Menetries, 1855

Common name: Himalayan Dark Clouded Yellow (Plates: 03-04)

Colias fieldii Menetries, 1885; *Cat. lep. Petersb.* 2:79.

Colias fieldii Grun-Grshimailo, 1890; *Mem. Lep.* 4: 302.

Colias fieldii Korb & Bolshakov, 2011; *Esversmannia Suppl.* 2: 23.

Adult (Male)

Forewing dorsal side orange with apex, termen, and tornus blackish-brown; a blackish-brown discocellular spot. Ventral side light orange-yellowish; dorsal side markings visible through; creamish-white discocellular spot ringed with blackish-brown; small blackish-brown spots in areas Cu₂, Cu₁ and M₃. Hindwing dorsal side orange with blackish-brown marginal border upto vein 1A; inner margin greenish-black. Ventral side light orange-yellowish; two creamish-white discocellular spots encircled with light-brown.

Adult (Female)

Forewing dorsal side orange; proximal part of the wing dusted with blackish scales; apex, termen and tornus blackish-brown with irregular inner margin; yellow

submarginal spots; a blackish-brown discocellular spot. Ventral side light-orange yellowish with apex, termen and tornus greenish-yellow; a small white discocellular spot broadly encircled with blackish-brown; blackish-brown submarginal spots in areas Cu₂, Cu₁ and M₃. Hindwing dorsal side orange-yellowish; proximal part of wing, costal margin, termen dusted with blackish-scales; four yellow submarginal spots; a orange discocellular spot; inner edge greenish-black. Ventral side greenish-yellow with small blackish-brown spot on the costal margin; two creamish-white discocellular spots encircled with light-brown.

Wing expanse: 50-65 mm.

Male Genitalia

Male genitalia higher than broad; uncus narrow, slightly longer than tegumen, distal tip downcurved, in dorsal perspective the proximal part slightly broad and distal part narrow with blunt tip; tegumen broad and short, extremely narrow, sclerotized and upturned basal lobe of tegumen present, with blunt tip; vinculum slightly convex; saccus broad, slightly concave in the middle, distal end broadly rounded; valve longer than broad, costal margin irregular and protrudes to form a small, sclerotized distal process, distal end concave; aedeagus narrow, rounded, strongly arched, thecal appendage long and curved, ductus ejaculatorious enters dorsally.

Female Genitalia

Corpus bursae spherical and possess small pinules; signum slightly broad, somewhat sickle-shaped, covered with dense and sclerotized spines; appendix bursae large, slightly smaller than corpus bursae; ductus bursae moderately long and slightly broad, sclerotized in basal half; posterior apophysis extremely thin and long; anterior apophysis small, bud-like.

Material examined

6♂, 5.iii.1916, Kosi Range, Nainital; 4♀, vi.1925, Jakhama, Naga hills.

Distribution in India

Arunachal Pradesh, Assam, Himachal Pradesh, Jammu and Kashmir, Meghalaya, Nagaland, Sikkim, Uttarakhand, Uttar Pradesh, West Bengal.

Global Distribution: China, Iran, Nepal, Yunnan, Bangladesh.

Remarks

Colias fieldii Menetries is a common species occurring in the above said regions. Bingham (1907) described its morphological features as race of *C. croceus* (Geoffroy). Evans (1932) devised its key as *C. croceus* (Geoffroy) including its subspecies on the basis of their morphological features and distribution. Talbot (1939) described its morphological features as subspecies of *C. electo*

(Linnaeus). In this present work, the morphological features including genitalic attributes and distribution of *C. fieldii* Menetries have been studied. The female genitalic attributes have been studied and illustrated for the first time in this work. The morphological and genitalic attributes of *C. fieldii* Menetries have been compared with *C. erate* (Esper). In *C. fieldii*, Menetries the dorsal side of both the wings is orange whereas in *C. erate* (Esper), the dorsal side of both the wings is lemon-yellow. In *C. fieldii* Menetries, the mid-dorsal lobe on the tegumen is upturned and sclerotized, costal margin irregular, distal end of the valve weakly concave and thecal appendage of the aedeagus is slightly curved whereas in *C. erate* (Esper), the mid-dorsal lobe on the tegumen is linear, costa strongly convex, distal end of the valve is strongly concave and thecal appendage of the aedeagus is linear. In female, the signum is almost sickle-shaped, appendix bursae large and anterior apophysis bud-like in *C. fieldii* Menetries whereas in *C. erate* (Esper) the signum is almost rectangular, appendix bursae slightly small and anterior apophysis narrow mushroom-like.

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