

# About Some Features of the North Ossetian Populations of Greek Clouded Yellow (*Colias aurorina* Herrich-Schäffer, 1850)

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**Abstract:** In North Ossetia populations of Greek Clouded Yellow which features and differences from other known populations were not studied so far were revealed. The purpose of this study was to learn the features of North Ossetia populations and their differences from the known populations in other parts of the area. It was used the reference practical standard of entomological material's collecting - catching by air entomological net and registration – writing of field labels; of visual observations: route inspections, expeditions, maintaining the field diary and images taken with cameras. Geographical coordinates and absolute heights were measured by means of the Garmin etrex 20x GPS navigator. Determination of butterflies was carried out on external diagnostic signs the method of the comparative analysis was applied. It is established that North Ossetia populations of Greek Clouded Yellow differ from other North Caucasian populations in existence of yellow coloring females. This fact together with geographical isolation from other Caucasian populations of the species has confirmed the assumption that butterflies from North Ossetia fall into to special subspecies. Studying of one species features in various populations inhabiting different parts of the area is very important for the best knowledge of biological diversity.

**Keywords:** Greek Clouded Yellow, *Colias aurorina*, Populations, Northern Jurassic Depression, Route Inspections, Expeditions, Republic of North Ossetia-Alania

## 1. Introduction

Greek Clouded Yellow *Colias aurorina* Herrich-Schäffer, [1850] is a butterfly in the family Pieridae. It is found in Near East, Mediterranean, Caucasus, Kopet-Dagh and West Transcaspia.

By consideration of the English name of *Colias aurorina* H.-S., it is found some discrepancy in the modern data sources. So, Paolo Mazzei, Daniel Morel, Raniero Panfili on website "Moths and Butterflies of Europe and North Africa" calls this butterfly Balkan Clouded Yellow [1]. Matt Rowlings on website "Eurobutterflies" [2], Bernard Watts [3], Rudi Verovnik and Miloš Popović [4] and other [5] call it Greek Clouded Yellow. Following the last sources the name Balkan Clouded Yellow fall into to a species *Colias caucasica* Staudinger, 1871.

The following subspecies are the part of species *Colias aurorina*: *aurorina* Herrich-Schäffer (Armenia, Georgia, Azerbaijan, Talysh, Northern Iran, Turkey); *libanotica*

*Lederer*, 1858 (Israel, Lebanon, Turkey); *heldreichi* Staudinger, 1862 (Greece); *sovarensis* Blom, 1979 (Iran); *kermana* Eckweiler, 1979 (Iran); *rosei* Gross & Ebert, 1975 (Northern Iran); *taurica* Rebel, 1901 (Turkey); *transcaspica* Christoph, 1889 (Turkmenistan); *anna* Gerhard, 1882 (Daghestan, Armenia, North Ossetia ?); *lauta* Morgun, 2010 (Kabardino-Balkaria) [1-7].

The first records of *Colias aurorina* H.-S. in North Ossetia were given by Mikhail Ryabov [6]. Dmitry Morgun [7] in Anatoly Tsvetaev's collection (Zoological Museum of Moscow State University, Moscow) have listed two specimens: a male and a female of a white form in the neighborhood of the village Lars (collecting of Mikhail Ryabov in 1922); 5 specimens from the same area are available in the collection of Zoological institute of Russian Academy of Science, St. Petersburg (are collected on July 12, 1922 by Mikhail Ryabov). Specimens from North Ossetia were marked by Anatoly Tsvetaev as ssp. nova. In Yuri Nekrutenko's publication, there are some female's forms of

this species noted, in particular: white form – f. *alba* Rühl and whitish-yellow form – f. *neuschuldi* Röber, with the further instruction on “that on Greater Caucasus only white females meet; on Lesser Caucasus and on the Javakheti-Armenian Highlands – only orange; in the Talysh Mountains (Zuvand) both color forms fly together” [8]. Also it has been noted by Pavel Gorbunov that the species has an essential geographical variability [9].

The analysis of all collection material's systematic features available to him, including from North Ossetia, with allocation of new central Caucasian subspecies of *Colias aurorina lauta*, has been carried out by Dmitry Morgun [7].

## 2. Material and Methods

The purpose of this study is to studying the features of North Ossetia populations of Greek Clouded Yellow and their differences from the known populations in other parts of the area.

It is used the reference practical standard of entomological material's collecting (catching by air entomological net) and registration (writing of field labels), of visual observations (route inspections, expeditions, maintaining the field diary) and images taken with “Zenit-E” and “Sony Cyber-shot DSC-H300” cameras. Photography is carried out as in field, and laboratory conditions. Geographical coordinates and absolute heights were measured by means of the Garmin etrex 20x GPS navigator (frame WGS-84).

Determination of butterflies was carried out on external diagnostic signs. As in the research tasks of taxon's systematics were not set and only faunistic problems were solved, the structure of copulative devices was not considered. The method of the comparative analysis of butterflies on external signs was applied.

The collected specimens are stored in the collection of the National museum of the Republic Northern Ossetia-Alania (*NM RNO-A*), the finished shooting photos – in personal archive of the author (both in Vladikavkaz). We also studied recorded butterflies from the personal collection of the entomologist Vladimir Berezov (*VB*) from Vladikavkaz.

The researches were conducted in 1988-2013 in the mid-mountain forest belt of the Republic Northern Ossetia-Alania (*RNO-A*), in Dzherakhovskaya, Dargavskaya, Verhne-Fiagdonskaya, Sadono-Unalskaya and Donifars-Zadaleskaya hollows of the Northern Jurassic depression, during route inspections and expeditions. These hollows are stretched by the almost continuous strip between Rocky and Main ridges of Greater Caucasus through all territory of the republic in the direction the East - the West and separated from each other by the crossing points connecting the Main and Rocky ridges. Intermountain hollows fall into to the mid-mountain climatic area and are characterized anomalously by a low rainfall. The type of vegetation is mountain-xerophytic consisting of dilute thickets of prickly bushes and herbs with tragacanth [10].

Reconnoitering inspections: Vitaly Dobronosov, North Ossetia, 24.06.1991, 14.08.–28.08.1992, the neighborhood of the village Dargavs (median point - 42°51'33.58"N;

44°26'8.73"E; 1350 m); 27.07.1993, 30.07. – 01.08.2002, the neighborhood of the village Lezgor (median point - 43°0'47.09"N; 43°46'14.21"E; 1500 m); 19.07.1991, the neighborhood of the village Zintsar (median point - 42°53'8.38"N; 44°10'16.34"E; 920 m); 31.05.1990, 19.06.1990, 28.07.1991, 27.05.2002, the neighborhood of the settlement Verhnij Fiagdon (median point - 42°49'40.70"N; 44°16'31.24"E; 1480 m); 21.06.2011, 12.05.2013, the neighborhood of the village Chmi (median point - 42°50'15.29"N; 44°37'26.53"E; 1100 m).

Material examined. Collections: *NM RNO-A* - Vitaly Dobronosov, North Ossetia, the neighborhood of the village Chmi (42°50'5.26"N; 44°37'44.13"E; 1000 m), 28.06.1989, 2 males, 08.07.1989, 2 females, 10.07.1990, 1 female; *VB* - Vladimir Berezov, North Ossetia, the surrounding village of Chmi (42°50'6.55"N; 44°37'41.45"E; 1000 m), 15.06.1991, 2 males, 05.07.1988, 2 females.

Fees: Vitaly Dobronosov, North Ossetia, the neighborhood of the village Chmi (median point - 42°50'1.33"N; 44°37'30.94"E; 1050 m), 05.06.1989, 3 males, 23.06.1989, 4 males, 1 female, 10.07.1989, 5 males, 2 females, 22.06.1991, 6 males, 2 females, 10.06.1999, 4 males, 1 female, the neighborhood of the village Unal (median point - 42°51'12.99"N; 44°8'48.80"E; 1100 m), 24.07.1991, 1 male.

Advice for the North Ossetia: Mikhail Ryabov, Ossetia: Unal, Lars, 1926.

## 3. Results and Discussion

As a result of our researches it was established that the species (as well as at the time of Mikhail Ryabov's collecting in 1922) is presented to *RNO-A* by 2 populations: in Daryal and Alagir gorges (the neighborhood of the village Unal). In the neighborhood of the villages Nizhnij and Verhnij Lars, butterflies are not recorded by us, but in the neighborhood of the village Chmi (5 km to N.) – were recorded out regularly throughout all time of observations (Figure 1).

In the North Ossetia Greek Clouded Yellow inhabits mountain slopes covered with tragacanth astragalus (*Astracantha*), in the neighborhood of the village Chmi on slopes of the southern and southeast exposure (Figure 2 a-d.), in the neighborhood of the village Unal – western, northwest (Figure 3 a, b.).

According to Valentin Tikhonov's data [11] butterflies develops in one generation, and flight occurs from the beginning of June to the middle of August. According to our fees, in the conditions of North Ossetia the flight rather often begins with the middle of May and lasts to the middle of August.

Butterflies meet in the range of absolute heights at 1000-1100 m above sea -level.

The North Ossetia populations are geographically isolated from each other; the distance between them on a straight line makes about 40 km. In the Dargavskaya and Verhne-Fiagdonskaya hollows which are between them, despite presence the tragacanth astragalus, butterflies are not feed, also as well as in the west in Zadalesk-Donifarskaya hollow.

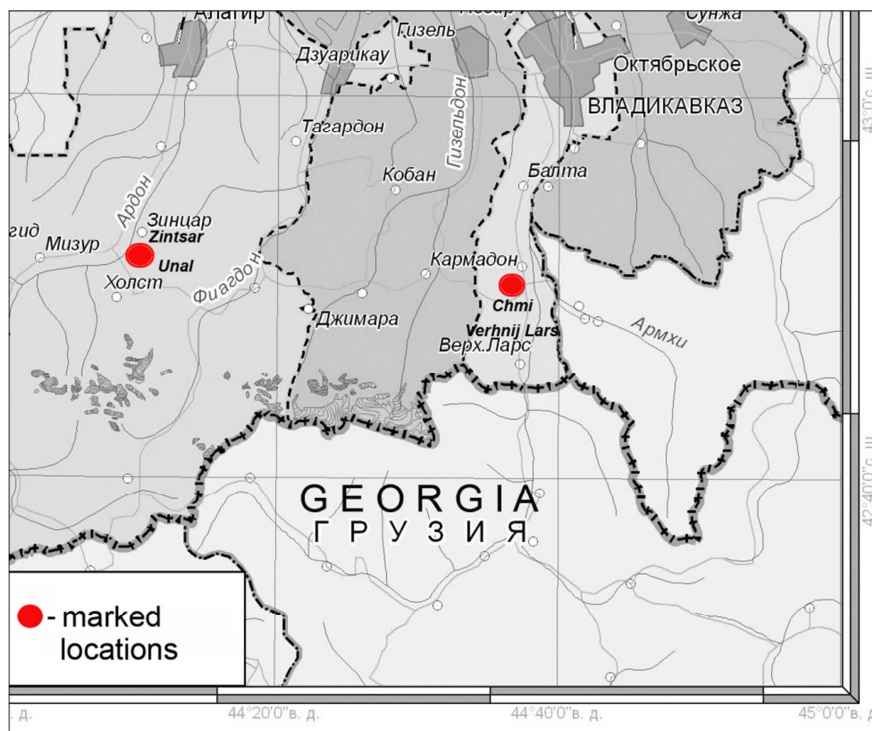


Figure 1. Distribution of Greek Clouded Yellow in RNO-A.

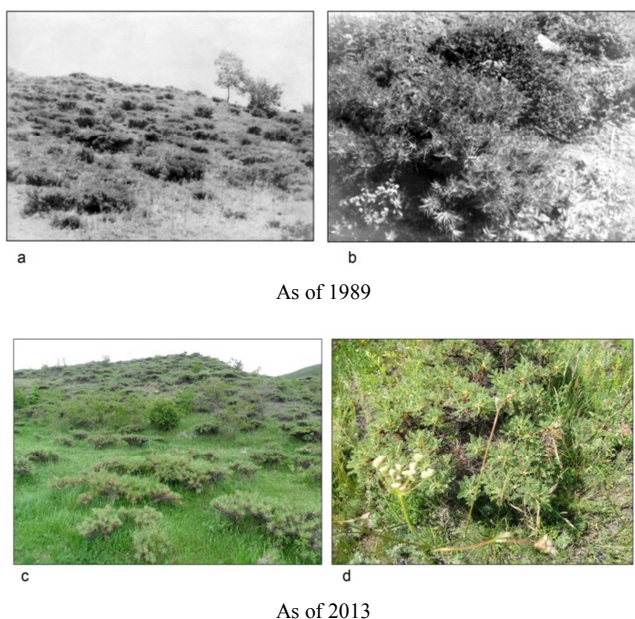


Figure 2. The neighborhood of the village Chmi, habitat of Greek Clouded Yellow.

Thus, the nearest known North Caucasian populations of the species are situated: in the East – in the Republic of Ingushetia, in the neighborhood of the village Torgim (on some topographic maps - Targim) (median point -  $42^{\circ}48'41.03''\text{N}$ ;  $44^{\circ}55'34.61''\text{E}$ ; 1200 m) [11], in the West – in the Tyrnauzsky District of Kabardino-Balkaria in the neighborhood of the settlements Elbrus (median point -  $43^{\circ}15'37.10''\text{N}$ ;  $42^{\circ}38'45.98''\text{E}$ ; 2100 m) and Verhnij Baksan (median point -  $43^{\circ}17'47.62''\text{N}$ ;  $42^{\circ}46'15.20''\text{E}$ ; 2200 m) [7].

The distance between Chmi and Torgim on a straight line makes about 25 km to southeast; between Unal and Elbrus – 130 km to northwest.

The interesting fact is that the most western records of the species in Kabardino-Balkaria (North Caucasus) are also presented by two local populations.

According to data of some authors [2, 3] variability at males is almost not expressed “little varies yellow saturation of veins on the rand and development of gray pollination on the lower side of wings”. According to the same authors, populations in the east of Greater Caucasus (ssp. *anna* Gerhard, 1882) contain females of a white form only, in the western populations (ssp. *lauta* Morgun, 2010) flying females of red and white forms.

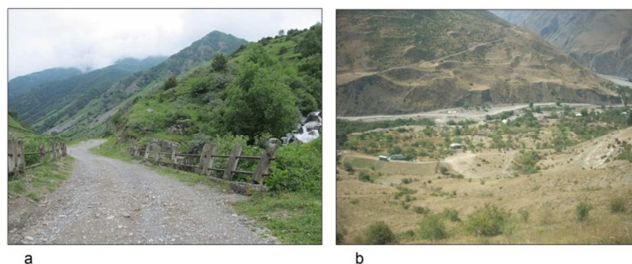


Figure 3. The neighborhood of the village Unal, habitat of Greek Clouded Yellow.

The males recorded during our researches, in general, had little variability, generally vary expressiveness of yellow veins on the wings rand – from the total absence, before crossing by sharp yellow veins (Figure 4 a-c).

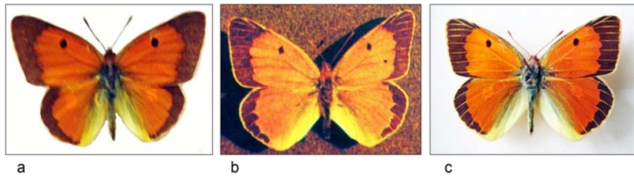


Figure 4. Males of *Colias aurorina* from the North Ossetian populations.

At females, the variability is well expressed in the background coloring of wings varying from white (f. *alba* Rühl), whitish-yellow (f. *neuschuldi* Röber) and hazy-yellow – to bright yellow; quantity and sizes of spots on the wings rand; a form, coloring and sizes of androconia spots on back wings (Figure 5 a-c).

Proceeding from the above, it is possible to conclude that the North Ossetia populations of Greek Clouded Yellow differ from other North Caucasian populations in existence of yellow coloring females. This fact together with geographical isolation from other Caucasian populations of the species is confirmation of the assumption of A. V. Tsvetaev that butterflies from North Ossetia fall into to special subspecies.

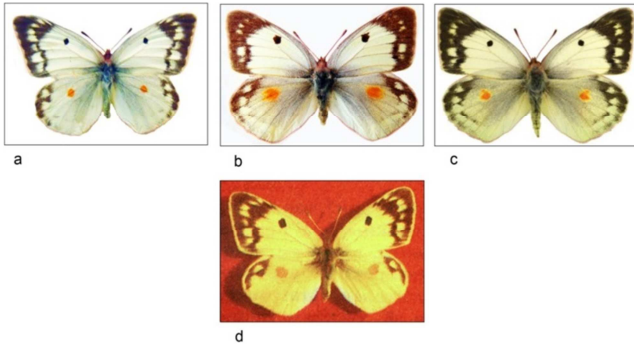


Figure 5. Females of *Colias aurorina* from the North Ossetian populations.

Yellow coloring females are recorded earlier by ssp. *heldreichii* Staudinger, 1862 in the mountains of Greece (Achaia, Chelmos mountains, Kalavrita, 1800 m above sea-level) [12]; they differ from the Ossetia's yellow females in androconia spots, pale, almost distinctive against the background of a wing.

The analysis of Greek Clouded Yellow population's features in North Ossetia and the differences from known populations in other parts of the area is carried out for the first time.

## 4. Conclusions

By result of the conducted studies it is made the conclusion that the species is presented to RNO-A by 2 isolated populations: in Daryal and Alagir gorges since discovery about the present days.

The males in general, have had little variability, generally vary expressiveness of yellow veins on the wings rand – from

the total absence, before crossing by sharp yellow veins.

At females, the variability is well expressed in the background coloring of wings varying from white – to bright yellow; quantity and sizes of spots on the wings rand; a form, coloring and size of androconia spot on back wings.

The North Ossetia populations of Greek Clouded Yellow are differed from other North Caucasian populations in existence of yellow coloring females, founded any more in other Caucasian populations testifies to belonging of the North Ossetia populations to special subspecies anywhere.

Studying of one species features in various populations inhabiting different parts of the area is very important for the best knowledge of biological diversity.

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