

On the systematics of some *Colias cocandica*-like taxa (Lepidoptera: Pieridae)

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Summary. In the present paper the status of the closely related taxa *mongola*, *sidonia* and *ukokana* is discussed. For *ukokana* the original subspecific status is returned. It is shown, that the taxa *tamerlana* and *mongola* are young, separate species with different origin – the former has its origin in a *cocandica*-like ancestor, the latter in a *nastes*-like ancestor. The exact type localities of the taxa *mongola*, *sidonia*, *ukokana*, *maja*, and *tamerlana* are listed. The holotype (♀) of *Colias cocandica* Erschoff, 1874 is pictured here for the first time.

Резюме. В настоящей работе дискутируется статус близких таксонов *mongola*, *sidonia* и *ukokana*, таксону *ukokana* возвращается оригинальный подвидовой статус. Показано, что таксоны *tamerlana* и *mongola* являются молодыми самостоятельными видами с обособленным происхождением: первый происходит от *cocandica*-подобного предка, второй – от *nastes*-подобного. Приводятся точные данные о типовых местонахождениях таксонов *mongola*, *sidonia*, *ukokana*, *maja* и *tamerlana*. Публикуется изображение самки голотипа *Colias cocandica* Erschoff, 1874.

Samenvatting. Over de systematiek van enkele taxa die op *Colias cocandica* lijken (Lepidoptera: Pieridae)

De status van de nauw verwante taxa *mongola*, *sidonia* en *ukokana* wordt besproken. De laatste wordt teruggebracht naar zijn originele status van subspecies. Er wordt aangetoond dat de taxa *tamerlana* en *mongola* jonge, aparte soorten zijn van verschillende oorsprong – de eerste stamt af van een *cocandica*-achtige soort, de tweede van een *nastes*-achtige soort. De exacte type-locaties van de taxa *mongola*, *sidonia*, *ukokana*, *maja* en *tamerlana* worden aangegeven. Het holotype (♀) van *Colias cocandica* Erschoff, 1874 wordt hier voor het eerst afgebeeld.

Résumé. Sur la systématique de quelques taxa ressemblant à *Colias cocandica* (Lepidoptera: Pieridae)

Le statut des taxa apparentés *mongola*, *sidonia* et *ukokana* est discuté. Le dernier est réinstallé comme sous-espèce. Il est montré que les taxa *tamerlana* et *mongola* sont des espèces bien distinctes, jeunes, mais d'origine différente – *tamerlana* a son origine dans le groupe de *cocandica*, *mongola* origine d'une espèce dans le groupe de *nastes*. Les localités types des taxa *mongola*, *sidonia*, *ukokana*, *maja* et *tamerlana* sont précisées. L'holotype (♀) de *Colias cocandica* Erschoff, 1874 est figuré ici pour la première fois.

Key words: *Colias* – *mongola* – *tamerlana* – *ukokana* – *maja* – *sidonia* – taxonomy – systematics – closely related taxa.

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The closely related taxa of the *Colias cocandica*-group form a very interesting and very difficult taxonomic problem. In fact, the difficulty of this question depends on a human factor: we have two groups of scientists, with their own opinion. The first group is inclined to believe that the taxa *mongola*, *cocandica*, *tamerlana* and *nastes* are separate species, the second group makes a lot of hashing between these taxa. I will not enumerate all combinations which are listed in modern literature – but there are a lot of them. And, for sure, if there are a lot of combinations, it represents this question as unclear and unfinished at present.



Figs. 1–3. *Colias mongola mongola* Alphéraky, 1897. 1.– ♂ upperside (topotype of *sidonia*); 2.– ♂ underside (topotype of *sidonia*); 3.– ♀ upperside (topotype of *sidonia*); all in coll. A. V. Zvetaev (Zoological Museum of Moscow University).

Figs. 4–6. *Colias mongola ukokana* Korb & Yakovlev, 2000. 4.– ♂ upperside; 5.– ♂ underside; 6.– ♀ upperside; all South Altai, Severochuysky Mts., Kagan-Uzun, in coll. A. V. Zvetaev (Zoological Museum of Moscow University).

Fig. 7–9. *Colias cocandica* Erschoff, 1874. 7.– ♀ holotype, upperside; 8.– ♀ holotype, labels; 9.– ♀ holotype, underside; all in coll. N. G. Erschoff (Zoological Museum of Moscow University).

In November 2005, I studied the lepidopterological collections of N. G. Erschoff and A. V. Zvetaev which are currently deposited in the Zoological Museum of Moscow University. In the collection of N. G. Erschoff I found the holotype (by monotypy) female of *Colias cocandica* Erschoff, 1874; this specimen is figured here for the first time (figs. 7, 9). The second find was a series of *Colias* in the collection of V. A. Zvetaev; these are topotypes of *sidonia*. For the estimation of the correct taxonomic status and position of specimens from Southern Siberia, Mongolia, Dzhungaria and northern Central Asia, we need to clarify the systematics of *cocandica*-like *Colias*.

The taxa with an unclear status are:

maja Grum-Grshimailo, 1891 (Grum-Grshimailo 1891: 447), TL: "Thian Chan ... Богусъ-Зуслунъ [Bogus-Zuslun]" – by the lectotype designation (Grieshuber & Churkin 2003: 257).



Figs. 10–13. *Colias cocandica* Erschoff, 1874. 10.– ♂, Terskey Ala-Too Mts., Pokrovka; 11.– ♂, Kyrghyz Mts., Kara-Balta river basin; 12.– ♂, West Tian Shan, Talassky Mts., Kuygun-say; 13.– ♀, Inner Tian Shan, Dolon pass; all in coll. A. V. Zvetsev (Zoological Museum of Moscow University).

mongola Alphéraky, 1897 (Alphéraky 1897: 188–189), TL: "Urga" – by the lectotype designation (Grieshuber & Churkin, 2003: 267);

sidonia Weiss, 1968 (Weiss 1968: 112), TL: "Mongolia, Rincinlchumbe, 2000 m" – by the original description;

tamerlana Staudinger, 1897 (Staudinger 1897: 152; Taf. 5, Abb. 1, 3), TL: "...im östlichsten Tan-Schan-Gebirge (nördlich von Chamyl), etwa 2000 m hoch..." – by the subsequent designation (Staudinger, 1901: 16);

ukokana Korb & Yakovlev, 2000 (Korb & Yakovlev 2000: 3–4, fig. 1), TL: "Altaï méridional, Oukok, rivièrè Ak-Alakha, 2500 m" – by the holotype;

In fact, we can easily reconstruct only the type localities of *tamerlana*, *sidonia*, *ukokana* and *maja* without problems.

For *maja*: "The locality Bogus-Zuslun is an upper stream of the Utudzhin (Utudjin) River, a tributary of the Emnudzhin (Emnujin) River. The co-ordinates [sic !] where Grum-Grshimailo camped at '2862 m' are approximately 44°17'N, 83°18'E... The type locality may therefore be given as follows: China, Xinjiang, Boro-Horo Shan, the Bogus-Zuslun river valley at approximately 44°17'N, 83°18'E" (Grieshuber & Churkin 2003: 259).

For *sidonia*: Rincinlchumbe, or Rincin Lhumbe, is the old name of the village Dzöölön, situated 45 km W from lake Hövsgöl Nur (= Dood nur). Rincin Lhumbe is also a mountain ridge situated at the left side of this lake. The village Dzöölön (Rincin Lhumbe) is located in a depression where the high- and middle-mountainous taxa of the *cocandica*-group do not live; they are present in the mountains around this village. Close to this depression is a small mountain

ridge, also called Rincin Lhumbe. So, the exact coordinates of the type locality are: 51°10'N, 99°98'E.

For *tamerlana*: In the original description the type locality is stated as "Chamyl" in eastern Tian Shan. Only one locality is consonant to this: the name of the city Hami (in the literature also spelled as Kamil, Kamul, Komul, Khamil), situated in Chinese Turkistan (Sinczan-Ujgur Autonomic Region), on the southern slopes of Karlik Shan mountains (73,5 km SW from Karlik Shan peak (4925 m above sea level)), and on the northern verge of the Great Gobi desert, at 42°85'N and 93°51' E. The species from the *Colias cocandica*-group do not inhabit flat landscapes at low altitude (Hami is located at an altitude of 950–1100 m), thus the type locality lays in the mountains near Hami – on the way to Karlik Shan peak. So, the exact coordinates of the type locality are: 43°05'N, 93°90'E.

For *ukokana*: The type locality is indicated very clearly in the description and can be found without errors: Ak-Alakha river in Ukok plateau, coordinates: 49°75'N, 87°24'E.

It is very important to determine the correct type locality of *mongola*. As written in the paper of J. Grieshuber & S. Churkin (2003: 268): "Staudinger ... stated that Leder collected the specimens (since labelled Urga by Christoph) in the Changai Mountains, about half way between Urga and Uliassutai (Uliastay: 47°43'N, 96°50'E). It is impossible to restrict the type locality now, because trained Cossacks also collected for Leder in unknown localities". The Urga city was established in 1689 as a Buddha monastery, and a long time this was its only status. On the territory of the monastery and its vicinities from 1809 and until 1907 there existed a prohibition of hunting, fishing, felling and visiting for strangers, non-buddhists. So, the type series of *mongola* has not been collected in Urga itself. But the route of Leder's expedition passed through the Urga river basin and here existed no religious prohibition whatsoever. It can be assumed that the 5 type specimens known were collected in one locality, and this place is situated in the Urga river basin. The type locality of *mongola* can therefore be located at 47°82'N, 106°98'E.

The type material of almost all discussed taxa has been figured already, namely:

- *maja* – the lectotype figured by J. Grieshuber & S. Churkin (2003: pl. 16, fig. 3).
- *mongola* – the lectotype figured by J. Grieshuber & S. Churkin (2003: pl. 16, fig. 5).
- *sidonia* – the topotypes figured here (figs. 1–3).
- *tamerlana* – the syntype figured by V. Tshikolovets (2005: pl. 31, fig. 16).
- *ukokana* – the holotype figured by S. K. Korb & R. V. Yakovlev (2000: fig. 1).

For the best understanding of the interrelations between the taxa of the *cocandica*-group discussed in this paper, the holotype of *C. cocandica* is here also figured (figs. 7–9). The external morphological characters of these closely related taxa are summarized in table 1.

Table 1. External morphological characters in the taxa under consideration:

Character	<i>tamerlana</i>	<i>maja</i>	<i>mongola</i>	<i>sidonia</i>	<i>ukokana</i>	<i>cocandica</i>
Ground colour, upperside, male	dark-greenish-gray	lemon-yellow	greyish-white	greyish-white	dark-greenish-grey to greyish-white (fig. 4)	lemon-yellow to dark-grey-greenish (figs. 10 – 13)
Ground colour, upperside, female	greyish-white	greyish-white	greyish-white	greyish-white	greyish-greenish-white	greyish-white
Ground colour, hindwing underside, male	dark-greyish-green	dark-greenish-grey	green-white (not all surface)	green-white (not all surface)	green-white to grey-green (all surface)	greenish-grey to greyish-yellow-green
Ground colour, hindwing underside, female	greyish-green	greyish-yellowish-green	greyish-green (not all surface)	greyish-green (not all surface)	greyish-green (all surface)	greyish-green
Submarginal row of bright spots, upperside, male	full in hindwing, not full in forewing	full in forewing, not full in hindwing	full in forewing, full in hindwing	full in forewing, full in hindwing	full in forewing, full in hindwing	very variable
Bright stroke in hindwing upperside, male	not developed	not developed	hardly visible	hardly visible	well visible, full	not developed
Discal spot, hindwing underside	one pink dot with whitish centre	one pink spot with whitish centre	one pink spot with whitish centre	one whitish spot	two whitish spots with pink border	one whitish spot with pink border

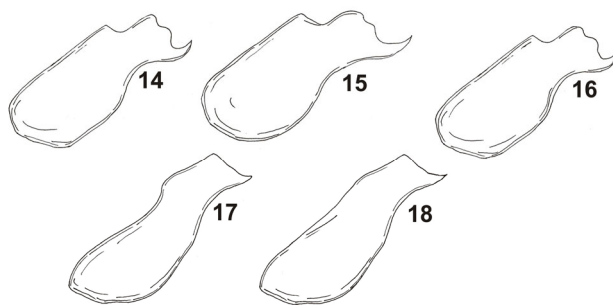


Fig. 14–18. Valva of *Colias*. **14.**– *Colias mongola mongola* Alphéraky, 1897, Ulan-Bator vicinities; **15.**– *Colias mongola ukokana* Korb & Yakovlev, 2000, South Altai, Ukok plateau, Dzhazator vicinities; **16.**– *Colias mongola mongola* Alphéraky, 1897, Dood-Nur lake; **17.**– *Colias cocandica maja* Grum-Grshimailo, 1891, Boro-Horo Mts.; **18.**– *Colias tamerlana tamerlana* Staudinger, 1897 (topotypus).

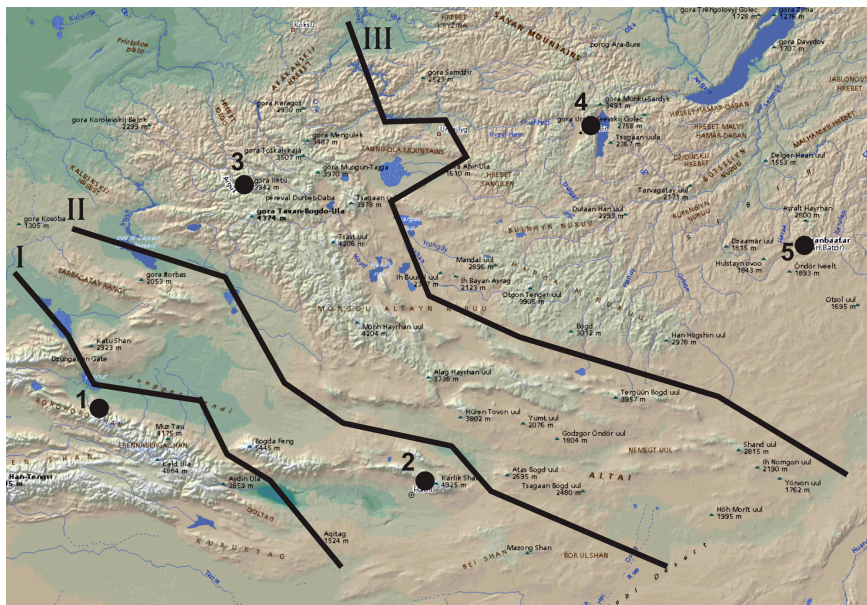


Fig. 19. Localities and borders of the *Colias cocandica*-like taxa from the East Tian Shan–Mongolian territory. Localities: **1.**– type locality of *Colias cocandica maja* Grum-Grshimailo, 1891; **2.**– type locality of *Colias tamerlana* Staudinger, 1897; **3.**– type locality of *Colias mongola ukokana* Korb & Yakovlev, 2000; **4.**– type locality of *Colias mongola sidonia* Weiss, 1968; **5.**– type locality of *Colias mongola mongola* Alphéraky, 1897. Borders: **I.**– border between the taxa *cocandica* and *tamerlana*; **II.**– border between the taxa *tamerlana* and *ukokana*; **III.**– border between the taxa *ukokana* and *mongola*.

As we can see from table 1, all listed taxa can be grouped into 3 complexes: *tamerlana*, *mongola-sidonia-ukokana*, *cocandica-maja*. By the development of the bright stroke on the hindwing underside and by the ground colour the *tamerlana*-complex is very close to *cocandica-maja*. It is very interesting, that taxon *ukokana* has a complete other type of discal spot on the hindwing underside; it consists of 2 spots like in *C. hyale* (Linnaeus, 1758) or *C. erate* (Esper, [1805]) which is not a characteristic feature for *cocandica*-like species.

But in fact we cannot make any reliable conclusion about the discussed taxa only on the basis of external morphology. Therefore the structures of the male genitalia of these taxa were studied. The most illustrative differences are found in the valvae structures (figs. 14–18). All examined taxa can easily be grouped into 2 complexes by the valvae structure: the complex of *mongola*-like taxa comprising *mongola*, *sidonia*, and *ukokana*, and the complex of *cocandica*-like taxa comprising *maja* and *tamerlana*. The taxon *maja* without doubt is a good subspecies of *cocandica* – it is the opinion of all authors including O. Staudinger (1901: 16). Using the table of external characters and the figures of the valvae, we can see, that *cocandica* and *tamerlana* are more close than *tamerlana* and *mongola*. In fact, *tamerlana* and *cocandica* are very close (valvae main form, submarginal pattern on wings upperside, etc.) but have good differences: valvae have different structure of ventral part; ground colour (in *tamerlana* constant, in *cocandica* very variable); discal spot in hindwing underside. Using these features the taxa *tamerlana* and *mongola* must be considered as young, but separate, species.

The taxa *sidonia*, *mongola* and *ukokana* represent another evolutionary branch in this group, which is very closely related to *C. nastes* Boisduval, 1832. This closeness can be seen in the wing pattern (especially in *mongola* and *sidonia*) and in the genitalia armatures (the valvae and subunci structure are typical for *nastes*-like taxa: a big tooth in the apical part of the valvae, a tooth-like ledge in its ventral part). With the combination of these characters the taxa *sidonia*, *mongola* and *ukokana* cannot be included into the *cocandica*-like group of *Colias*, they belong to the *nastes*-like group.

The taxa *sidonia* and *mongola* are identical in external characters (see table) and in valvae structure (figs. 14, 16). They are without doubt synonyms: *Colias mongola mongola* Alphéraky, 1897 = *Colias mongola sidonia* Weiss, 1968.

The taxon *ukokana* is very interesting in its external features: it has a wing pattern and coloration closer to *cocandica* than to *mongola* (see table), but in the valvae structure it belongs to *mongola*. Using the combination of external and internal differences *ukokana* should be returned to its subspecific status: *Colias mongola ukokana* Korb & Yakovlev, 2000, stat. rest.

All type localities discussed in this paper are shown in fig. 19. We can see, that insuperable borders are situated between the type localities (and, in fact,

between the areas) of the discussed taxa; there are large areas of low altitudes between the mountains (all discussed taxa inhabit altitudes of minimum 1800–2000 m). There are three of such borders: the first two are not only borders between *cocandica* and *tamerlana*, but also between *cocandica*-like and *nastes*-like taxa. From this map we furthermore see, that *ukokana* and *mongola* are well isolated geographically. Under these conditions *ukokana* is a young product of a *mongola*-like ancestor which has a divergent resemblance with *Colias cocandica* Erschoff, 1874 in external features because the area of *ukokana* is situated at the same altitudes and in similar biotopes like *cocandica* in Central Asia.

Conclusions:

- *sidonia* is a synonym of *mongola*;
- the taxon *ukokana* is a subspecies of *mongola*;
- the taxa *mongola* and *tamerlana* are young, but separate species with different origin.

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