

Remarkable new genus and new species of the geometrid moths from Central Asia, related to the genus *Desertobia* Viidallepp, 1989 (Lepidoptera, Geometridae, Ennominae) with notes on the taxonomy of the Desertobiini

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Abstract *Semidesertobia ubinica* Beljaev, gen. et sp. n., is described from Central Asia. Relationships between the new genus and the genus *Desertobia* Viidallepp within the Ennominae are discussed.

The new species of the Ennominae described below is remarkable by its similarity with the geometrid moths from subfamily Larentiinae habitually and especially in the wing venation, which is characterized by having the long joining of veins $Sc+R_1$ and R_s and presence of the well developed vein M_2 in the hindwing. However, the male genitalia clearly show that the species belongs to the subfamily Ennominae. The new species is clearly closely related to the genus *Desertobia* Viidallepp, 1989, described based on two species from the deserts of Central Asia, in the wing venation. But the notable differences from the mentioned genus in the wing venation and especially in the structure of the male genitalia allow to erect a new genus for the new species.

The holotype of the newly described species is housed in entomological collection of the Siberian Zoological Museum, Institute of Animal Systematics and Ecology, Novosibirsk, Russia. The nomenclature of veins is given following Scoble (1992).

***Semidesertobia* Beljaev, gen. n.**

Type species: *Semidesertobia ubinica* Beljaev, sp. n.

Male. Palpi simple, very short; proboscis obsolete. Antennae filiform, their flagellums with two pairs of outwardly directed tufts of long setae, which are placed on the small prominences at the middle and at distal end of every segment (Fig. 2). Frons flattened, wider than eye diameter. Eye rounded, heavily prominent. Chaetosema small, knobble-like, with few long setae. Fore- and hindwings (Fig. 3) narrow, as result of strong reduction of cubital-anal area of wing in comparison with typical state for Geometridae. Apices of both wings rounded, forewing with outer margin slightly concave between veins M_3-Cu_2 , and with hind margin prominent. Fringe comparatively long, up to 1 mm in length. Forewing with veins R_1 and R_2 arising separately at 3/5 and 9/10 of discal cell length, R_1 near its base anastomosed with vein Sc , R_2 anastomosed with stalk of veins R_{3-5} , stalk of veins R_{3-5} arising from apex of discal cell; Sc and R veins along costal margin of forewing running very close to each other; discal cell large, long, approximately 3/5 of forewing length; M_2 arising from the cross-vein, closer to M_1 than M_3 ; CuP obsolete, instead of it well developed plica placed; $1A+2A$ well developed, almost straight; basal hollow indistinct. Hindwing with veins $Sc+R_1$ anastomosed with R_s near its base; R_s and M_1 arising from discal cell separately; vein M_2 well developed, but thinner than veins M_1 and M_3 ; CuP obsolete, instead of it well developed plica placed; $1A+2A$ normal, $3A$ not found. Legs normally developed, long, slender; foretibia simple, with epiphysis moderately long, leaf-like; hindtibia weakly inflated distally, with two pairs of short spurs, without hair pencil. Head, thorax and abdomen tightly covered with wide scales. In

addition to the wide scales, abdomen dorsally covered with numerous firm fork-like scales over all segments, but without strong spines. Tympanal organs (Fig. 4) complete, but tympanal cavity small. Ansa long, slender, slightly arched laterally in basal half, with long narrow lobes running from the base to near apex of ansa along both its sides; tympanum rounded. Setal comb on 3rd abdominal sternite absent.

Male genitalia (Figs 5, 6). Annulus moderately broad, with a large dorsal triangular plate reaching anterior margin of annulus and with large trapezoidal saccus. Uncus triangular, pointed at apex; socia present, membranous, bearing a few long setae, placed laterally on ventral side of uncus near its base. Gnathos horseshoe, thin, well sclerotized, without medial extension, with a row of the short teeth medially. Valva long, narrow, slightly tapering from base to rounded apex, with large, heavily spinose roundish swelling (ampulla) medially and below ampulla with triangular sclerotized extension on sacculus bearing several strong spines on the top; cucullus membranous, indistinctly separable from valvula, not densely covered with long moderately strong setae. Juxta simple, large, broad, heavily concave basally and slightly bifurcated distally. Aedeagus long, narrow, in length a little longer than costal margin of valva, slightly tapering from base to apex; with large basal process flattened dorso-ventrally and curved on apex dorsally; with a large, spoon-shaped, heavily sclerotized ventro-apical process; and with single strong thorn-like cornutus, having long narrow basal extension fused with the wall of aedeagus laterally.

Female. Unknown.

Diagnosis. The new genus is morphologically closely related to the genus *Desertobia* Viidalepp, 1989. This is supported by the stalked veins $Sc+R_1$ and R_s and well developed vein M_2 in the hindwing, the shape of the uncus and gnathos, presence of the spined ampulla and spines on the sacculus, and by the long narrow aedeagus with the well developed basal process. However, it differs from the latter in the shape of forewing by having the narrower costal area before the discal cell, concave outer margin and prominent hind margin of the wing; and in the wing venation by presence of two joinings R_1 with Sc and R_2 with the common stalk of R_{3-5} on forewing, and by absence of veins CuP in fore- and hindwings. (It should be noted that original description of the wing venation of the genus *Desertobia* (Viidalepp, 1989), obviously, contains some errors. In the figure of the wing venation (page 95, fig. 1, *loc. cit.*) the vein R_5 evidently is missed; anyhow in the diagnosis of the genus the author did not mention the being of the four R veins only, as it is shown in the figure. Then, the author of the genus treated the two anal veins on the hindwing as " A_2 " and " A_3 " ($1A+2A$ and $3A$ after Scoble, 1992), when based on the original figure of the wing venation they undoubtedly need to be considered as CuP and $1A+2A$. And what is more, in the newly described genus the plica lying in the place of CuP on the fore- and hindwings is too well appeared, regular and covered with the black scales similarly to the normal vein, that it can be confused with the real vein). Abdomen dorsally without the strong spines, with fork-like scales only. In the male genitalia the new genus is easily distinguishable from the *Desertobia* by the valva longer and much narrower in its base, the ampulla larger and covered with long spines, presence of the ventral spined extension on the sacculus, and by presence of the well developed cornutus in the aedeagus.

Remarks. Only the type species is included in this genus.

***Semidesertobia ubinica* Beljaev, sp. n.** (Figs 1–6)

Material examined. Holotype: ♂, Kazakhstan, Eastern-Kazakhstanian Province, 25 km NW of Ust'-Kamenogorsk, Glubokoe village, on light, 4. IV. 1994, coll. V. K. Zinchenko.

Male. Wingspan 32 mm, length of forewing 17.5 mm. Forewing dark greyish-brown with medial area slightly lighter than basal and distal areas. Basal line invisible; antemedial line

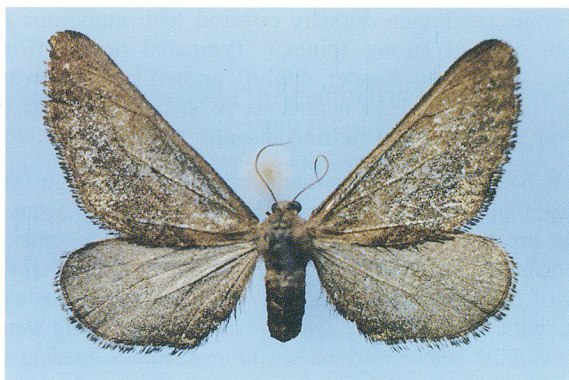


Fig 1. *Semidesertobia ubinica* sp. n., holotype, ♂.

black, thin, running obliquely from middle of costal margin to base of hind margin and outlining dark basal area; medial line black, thin, indistinct, runs from middle of costal margin to middle of hind margin; postmedial line black, thin, almost straight, arising from costal margin near apex and running obliquely to middle of hind margin, bordered outwardly by a thin brown line and adjoining inwardly with medial line behind median plica in cubital-anal cell; light sinuous line in distal area of wing more or less distinct, excepting area near wing apex, widely and evenly waved; fringe brownish basally and blackish distally; discal spot absent. Hindwing brownish-grey, lighter than forewing, with discal spot, postmedial and subterminal lines indistinct. Under surface of fore- and hindwings almost unicolour, blackish-brown with slight fat lustre.

Male genitalia as in description of the genus.

Distribution. North-eastern Kazakhstan: south-western Altai.

Bionomics. The collecting site of the single specimen of the new species is located in the steppe zone.

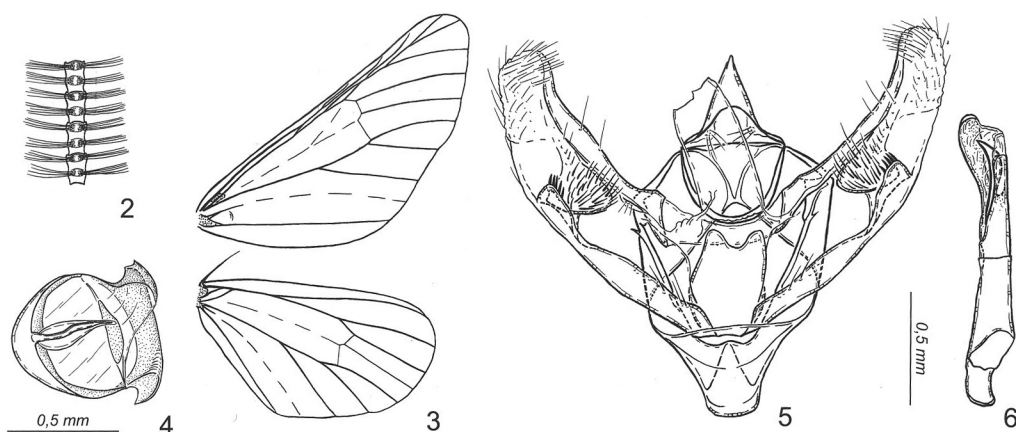
Etymology. The species is named after the name of the Ubinski range, on the foothills of which the type specimen was collected.

Systematic position and phylogeny

Close relationship between the new genus and *Desertobia* Viidalepp, 1989, is evident, therefore the systematic position of the genus complex consisting of these two genera is discussed below. Describing the genus *Desertobia*, Viidalepp (1989) made a wide morphological and phylogenetic investigation of the genera of the Ennominae, which were included in the tribe Bistonini by different authors. As a result, he concluded a strong morphological deviation of *Desertobia* from the Bistonini and allied tribes, and he erected a new monotypic tribe, Desertobiini, treated by him as sister taxa to the tribe group Bistonini + Boarmiini ("Cleorini" after Viidalepp).

Really, the both species of the genus *Desertobia* are too much specialized morphologically, that its relationships are established with difficulties. The species, belonging to the described new genus, is less specialized morphologically and it allows to review a systematic position of the discussed genus group.

As to the apomorphies underlied by Viidalepp (1989) in the cladistic relationships in the tribe group Desertobiini + Bistonini + Boarmiini, they are not watertight. A monophyly of this tribe group is confirmed by him based on the apomorphy "the ring of the IX segment [*i.e.* annulus]



Figs 2-5. *Semidesertobia ubinica* sp. n., holotype. 2. Middle segments of the male antenna, ventral view. 3. Wing venation. 4. Left tympanal organ, ventral view. 5. Male genitalia. 6. Aedeagus.

normal ring-like" (character number 1 in the Viidalepp's "A cladogramm of the morphological characters...", page 104, fig. 6, and in the table "Plesiomorphic and apomorphic state of the characters...", page 105). On my opinion, it is quite doubtful to treat this character as apomorphic state, apposite to the plesiomorphic state "the ring of the IX segment very massive". The most of geometrid moths from the all subfamilies have more or less narrow anellus, especially laterally, resulting easily distinguishable tegumen and vinculum. Only in the part of genera belonging to the Boarmiini, Gnophini, Semiothisini, Bistonini and some other groups related with enumerated tribes we can show the annulus looking as wide massive ring. Probably, in the mentioned tribes it developed independently from the "normal ring-like" annulus, and wide massive one needs to be considered as apomorphy relative to the annulus of the latter type. Accordingly, Erraniini having "the ring of the IX segment very massive" can not be separable from the group Desertobiini + Bistonini + Boarmiini based on this character, as Viidalepp (*loc. cit.*) made it.

The apomorphy, using by Viidalepp for the contraposition of Desertobiini to the sister group Bistonini + Boarmiini, the "uncus strongly modified" is inapplicable based on its wording already, because it does not contain an indication of the type of modification. Even if not taking into account this wording, the character "uncus wide triangular", treated by Viidalepp as plesiomorphy associating strictly with Desertobiini in the discussed bifurcation, is also distributed in many taxa of the Boarmiini. Thus, this pair of character states can not be used for the discrimination of the Desertobiini, Bistonini and Boarmiini.

Consequently, published cladistic arguments of the phylogenetic relationships of the Desertobiini are not available. However, close relationships of this taxon with Bistonini, Erraniini (*sensu* Viidalepp) and Boarmiini are undoubted. This is supposed by the wide triangular uncus with short distal process, the transtilla having the short round dorsal lobe and long narrow ventral one, by the valva with ampulla shaped as setose swelling, the aedeagus with the single flattened cornutus (in the new genus) joined with the wall of aedeagus, almost like as in the genus *Alcis*.

Morphologically Desertobiini has many characters that are common with the American genus *Paleacrita* Riley, 1876. They have similar antennae, enlarged discal cell on the wings, tapering valva with setose swelling (that in the new genus looks and placed very similar to that in *Paleacrita*), long narrow aedeagus with the well developed basal process, large slightly

trapezoidal saccus. But, the genera of the discussed tribe can be related to *Cryopega* Dumont, 1925, and *Erannis* Hübner, [1825], based on the structure of the antenna segments, bearing two pairs of the tufts of setae, and in the male genitalia – on the shape of uncus with single ventral point and on the flat horseshoe gnathos with medial part not curved caudally. A lobe-like, spined process on sacculus in the new genus resembles that in *Apocheima cinerarium* (Erschov, 1874), and more or less developed vein M_2 in the hindwing is in some species of *Lycia* Hübner, [1825]. Thus, the most characters of the Desertobiini are distributed mosaically through the Bistonini and the Eranniini *sensu* Viidalepp (1989, 1996).

However, none of the enumerated characters can be considered undoubtedly as synapomorphy for the compared taxa. More likely most of these characters are plesiomorphies or homoplasies developed on the common morphologic and genetic basis inherited from the ancestor. On the other hand, the two unique characters of the Desertobiini, the joining of the veins $Sc+R_1$ and R_s in the hindwing and strongly shortened cubital-anal area in the fore- and hindwings, on my opinion, are insufficient for the erection of *Desertobia* and *Semidesertobia* as separate tribe. For example, in the genus *Alsophila* Hübner, [1825] (Alsophilinae) veins $Sc+R_1$ and R_s in the hindwings are both jointed and free. It should be noted, structure of the wings in the Alsophilinae generally is similar to that in *Desertobia* and *Semidesertobia*. Probably, this similarity is developed as a result of the possession of the common strategy of adaptation to the environment of the cool season when their imago is flying.

As to the tribe Bistonini *sensu* Forbes (1948), Povolny et Nosek (1955), Herbulot (1963), Rindge (1975, 1985), McGuffin (1977), Leraut (1980, 1997), Ferguson (1983), *i. e.* including Eranniini, none well established autapomorphy of this taxon is found yet. Quite possibly, this tribe in the consideration by the cited authors can be formed based on the symplesiomorphic and homoplastic characters only, in agreement with the Holloway's (1993) opinion. The last is supposed by the genital musculature, that in the genera with robust-bodied moths (*Biston* Leach, 1830; *Lycia* Hübner, [1825]) and in the genera with slender bodied ones (*Agriopis* Hübner, [1825]; *Phigalia* Duponchel, 1829) is markedly differed (Razowski & Wojtusiak, 1981; Stekolnikov, Kuznetsov, 1982). Thus, *Biston* and *Lycia* have the plesiotypic inner flexor of valva (m_7 after Stekolnikov and Kuznetsov, m_{13a} after Razowski and Wojtusiak) attached basally to the sacculus, when in *Agriopis* and *Phigalia* this muscle completely or in the large portion is attached to the juxta, that is possible synapomorphy with the most Boarmiini.

These reasons, and indistinct morphological border between Bistonini and Boarmiini in the South-East Asian fauna allow to support the broad concept of the Boarmiini including Bistonini and Eranniini (Holloway, 1993). As a result, I propose to consider the name Desertobiini Viidalepp, 1989, as a junior synonym of Boarmites Duponchel, 1845, **syn. n.** In the tribe Boarmiini, the genera *Desertobia* and *Semidesertobia* can be treated as sister pair or genus group, possibly, related to the slender bodied Bistonini *sensu* authors cited above (*Erannis* Hübner, [1825]; *Cryopega* Dumot, 1925; *Paleacrita* Riley, 1876; *Agriopis* Hübner, [1825]; *Phigaliohybernia* Inoue, 1942; *Pachyerannis* Inoue, 1982; *Protalcis* Sato, 1983; *Larerannis* Wehrli, 1935; *Pterotocera* Staudinger, 1882; *Phigalia* Duponchel, 1829).

The last point of view can be supported by the two reasons. Firstly, juxta in the *Semidesertobia*, that is comparatively wide, deeply concave basally and without longitudinal rib or strengthened lateral sides, well conforms to the basal part of juxta in the *Agriopis*. The similarity in the structure of juxta allows to admit the similarity in the position of the flexor of valva that is attached to the base of juxta in the *Agriopis* (Razowski & Wojtusiak, 1981). If it is right, *Semidesertobia* can not be closed with the robust-bodied Bistonini, having intrasaccular flexor of valva. Secondly, the cornutus in aedeagus of *Semidesertobia* slightly curved laterally, being similar to the curved or spiral cornutus in the *Agriopis*, *Phigaliohybernia*, *Pachyerannis*, *Protalcis*, *Larerannis*, *Pterotocera* and *Phigalia*. Possibly,

the last character can be considered as synapomorphy of the all slender bodied Bistonini. However, the both characters need to be studied more carefully.

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