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REVISION OF THE FAMILY NECROPHASMATIDAE (INSECTA: CNEMIDOLESTIDA)

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Summary. The type genus of the family Necrophasmatidae, *Necrophasma* Martynov, 1925 from Karatau (Upper Jurassic of Kazakhstan), is re-described. The monotypic family Juraperlidae from Daohugou (Middle Jurassic of China) is synonymized under Necrophasmatidae (Cnemidolestida). The genus *Ferganomadygenia* Storozhenko et Vršanský, 1995 from Madygen (Middle Triassic of Kyrgyzstan) is included in this family, which also contains the type genus and *Juraperla* Huang et Nel, 2007. The family Necrophasmatidae is placed in the suborder Parmapterina of the order Cnemidolestida.

Key words: Insecta, Cnemidolestida, Parmapterina, taxonomy, Triassic, Jurassic.

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Резюме. Переописан типовой род семейства Necrophasmatidae – *Necrophasma* Martynov, 1925 из Каратау (верхняя юра Казахстана). Монотипичное семейство Juraperlidae из Даохугоу (средняя юра Китая) сведено в синонимы к Necrophasmatidae (Cnemidolestida). В семейство, кроме типового рода и *Juraperla* Huang et Nel, 2007, включен род *Ferganomadygenia* Storozhenko et Vršanský, 1995 из Мадыгена (средний триас Кыргызстана). Necrophasmatidae отнесено к подотряду Parmapterina отряда Cnemidolestida.

INTRODUCTION

The family Necrophasmidae was placed by different authors in different suborders and superfamilies of phasmids, namely order Phasmatodea: suborder Necrophasmatodea (Martynov, 1925; 1938); suborder Chresmododea (Martynova, 1962); superfamily Xiphopteroidea (Sharov, 1968); superfamily Aeroplanoidea (Vishnyakova, 1980). Some authors voiced their doubts about the placement of Necrophasmidae in the phasmid order, but nevertheless discussed them within Phasmatida (Sharov, 1968; Nel *et al.*, 2004) or did not discuss them at all (Gorokhov, 1993).

The genus *Necrophasma* is distinguished from phasmids in the absence of alignment of veins subparallel to the wing margins, and in the division of M rather proximally, in the basal

quarter of the wing. In my opinion, this genus has no substantial differences from representtatives of Juraperlidae (Huang & Nel, 2007; Cui *et al.*, 2010; Aristov, 2016), and the family Juraperlidae is therefore synonymized here under Necrophasmidae. In the original description the family Juraperlidae was placed in the order Grylloblattida (Huang & Nel, 2007). The genus *Ferganomadygenia*, originally described in the family Tunguskapteridae of the order Grylloblattida (Storozhenko & Vršanský, 1995), was mentioned but not placed in Juraperlidae in the original description of that family (Huang & Nel, 2007). It was placed in Juraperlidae later, and the family itself was placed in the order Cnemidolestida (suborder Parmaterina: Aristov, 2016). In my opinion, the family Necrophasmidae also belongs to this order.

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TAXONOMY

CLASS INSECTA LINNÉ, 1758

Infraclass Gryllones Laicharting, 1781

Superorder Perlidea Latreille, 1802

Order Cnemidolestida Handlirsch, 1937

Cnemidolestodea Handlirsch, 1937: 63.
Cnemidolestida: Aristov, 2014: 5; Aristov, 2016: 14.

Suborder Parmapterina Aristov, 2016

Parmapterina: Aristov, 2016: 14.

Family Necrophasmidae Martynov, 1925

Necrophasmidae Martynov, 1925: 584; Martynov,1938: 127; Martynova, 1962: 160; Sharov, 1968: 111; Vishnyakova, 1980: 173; Gorokhov, 1993: 112; Nel *et al.*, 2004: 34.
Juraperlidae Huang & Nel, 2007: 837; Cui *et al*., 2010: 710; Aristov, 2016: 19; **syn. n.**

Type genus: *Necrophasma* Martynov, 1925.

DESCRIPTION. Anterior margin of forewing changing from concave to convex (in *Juraperla grandis* convex from base to apex). Costal area in basal half of wing wider than subcostal area. False costa ("C") ending proximal of wing middle joining C or bifurcating and joining both C and SC. SC ending distal of wing middle joining C or bifurcating and joining both C and R. RS beginning around wing middle, simple. M_5 and first bifurcation of M close to each other; MA and MP simple. CuA dividing into CuA_1, with CuA_1 dividing distal of its middle, and CuA_2, with CuA_2 simple or with short fork. CuP simple (in *Ferganomadygenia* with very short fork). Veins in distal half of wing with sharp curves at junctures with crossveins (except in *Juraperla grandis*). Crossveins simple or, in fewer cases, Y-shaped or forming double row of cells.

DIAGNOSIS. The family is distinguished from all families of the suborder Parmapterina by the presence of the false costa ("C"). This character is absent in any other family of the suborder (Aristov, 2016).

COMPOSITION. Three genera: monotypic *Necrophasma* Martynov, 1925 from Karatau locality (Kazakhstan, South Kazakhstan Region; Middle-Upper Jurassic, Karabastau Formation), monotypic *Ferganomadygenia* Storozhenko et Vršanský, 1995 from Madygen locality

(Kyrgyzstan, Osh Region; Middle Triassic, Ladinian Stage, Madygen Formation) and *Juraperla* Huang et Nel, 2007 with two species from Daohugou locality (China, Inner Mongolia; Middle Jurassic, Jiulongshan Formation).

Key to genera of the family Necrophasmidae

1(2) "C" ending in basal quarter of wing; CuA_2 with bifurcation …….. ……... *Ferganomadygenia* Storozhenko et Vršanský, 1995
2(1) "C" ending distal of basal one-third of wing; CuA_2 simple.
3(4) Forewing 4.9 times as long as wide; M_5 joining CuA proximal of its division into CuA_1 and CuA_2 …… *Necrophasma* Martynov, 1925
4(3) Forewing 3–3.6 times as long as wide; M_5 joining CuA around its division into CuA_1 and CuA_2 ……..…….... *Juraperla* Huang et Nel, 2007

Genus *Necrophasma* Martynov, 1925

Necrophasma Martynov, 1925: 584; Martynov, 1938: 127; Martynova, 1962: 160; Sharov, 1968: 112; Nel *et al*., 2004: 34.

Type species: *Necrophasma shabarovi* Martynov, 1925.

DESCRIPTION. Forewing 4.9 times as long as wide. Wing apex pointed. "C" joining C near distal boundary of basal one-third of wing. SC joining C immediately distal of wing middle. Base of M_5 and first bifurcation of M not close to each other. M_5 joining CuA proximal of its division into CuA_1 and CuA_2. CuA_1 and A_1 dividing; CuA_2 and A_2 simple.

SPECIES INCLUDED. Type species only.

***Necrophasma shabarovi* Martynov, 1925**
Figs 1, 2

Necrophasma shabarovi Martynov, 1925: 584, fig. 8; Martynov, 1938: 127, fig. 65; Martynova, 1962: 160, fig. 423; Sharov, 1968: 112, fig. 42zh; Nel *et al*., 2004: 34.

MATERIAL. Holotype PIN, No 1787/90, positive imprint of forewing; Kazakhstan: South Kazakhstan Region, Baidibekskii District, Mikhailovka Village; Middle-Upper Jurassic, Karabastau Formation; in PIN.

DESCRIPTION. Slender longitudinal vein running between "C" and SC. CuA_1 and A_1 with three branches each. Crossveins simple, equal in width to longitudinal veins, and simple and Y-shaped in medial area. Coloration near wing base and as longitudinal vein along anterior margin in central part of wing; veins colored; wing membrane covered with small hairs.

MEASUREMENTS. Forewing length 25 mm.

Genus *Ferganomadygenia* Storozhenko et Vršanský, 1995

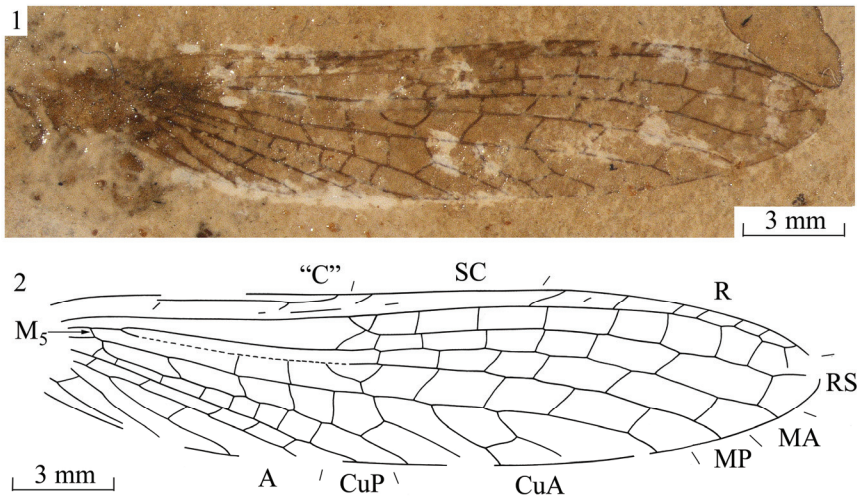
Ferganomadygenia Storozhenko & Vršanský, 1995: 1; Storozhenko, 1998: 125; Aristov, 2016: 19.

Type species: *Ferganomadygenia plicata* Storozhenko et Vršanský, 1995.

DESCRIPTION. Forewing 3.1 times as long as wide. Wing apex rounded. "C" joining C near in basal quarter of wing. SC ending in bifurcation joining C and R in distal quarter of

wing. Base of M_5 and first bifurcation of M close to each other. M_5 joining CuA near its division into CuA_1 and CuA_2. CuA_2 with short fork.

SPECIES INCLUDED. Type species only.



Figs 1, 2. *Necrophasma shabarovi* Martynov, 1925 (Cnemidolestida: Necrophasmatidae), holotype PIN, No 1787/90, forewing; Karatau locality, Kazakhstan; Upper Jurassic.

Genus *Juraperla* Huang et Nel, 2007

Juraperla Huang & Nel, 2007: 837; Cui *et al*., 2010: 710; Aristov, 2016: 19.

Type species: *Juraperla daohugouensis* Huang et Nel, 2007.

DESCRIPTION. Forewing 3–3.6 times as long as wide. Wing apex pointed. "C" ending in bifurcation joining C and SC distal of basal quarter of wing. SC ending in bifurcation joining C and R near proximal boundary of distal one-third of wing. Base of M_5 and first bifurcation of M close to each other. M_5 joining CuA near its division into CuA_1 and CuA_2. CuA_2 simple.

SPECIES INCLUDED. Type species and *J. grandis* Cui, Béthoux, Shih et Ren, 2010.

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