Permian fossil insects of North-East Europe: new and little-known Ideliidae (Insecta, Plecopteroidea, Grylloblattida)

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New Permian taxa of the family Ideliidae from North-East Europe are described and the genus Permoteirmopsis Martynov is revised. New taxa: Stenaropodites sojanesis sp. n., S. mistshenkoi sp. n., S. magna sp. n.; Idelinella macroptera gen. et sp. n.; Idelina kamensis gen. et sp. n.; Khosaridelia martynovi gen. et sp. n.; Sojanidelia gen. n.; S. maculosa sp. n.; S. fasciata sp. n.; S. multimediana sp. n.; S. vorkuten sis sp. n.; S. longula sp. n.; S. parvula sp. n.; S. nana sp. n.; S. makarkini sp. n.; S. fluctuosa sp. n.; S. lineata sp. n. and S. striata sp. n. A key to 12 species of Sojanidelia is given, and one species, S. kostinae (Sharov, 1961) comb. n., is transferred from Metidelia Martynov to Sojanidelia gen. n.

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1. Introduction


The family Atactophlebiidae was recently transferred from the order Grylloblattida to the order Gerarida (Storozhenko 1990).

The terminology of the wing-venation is adopted from Sharov (1962), Kukalova (1964) and Hennig (1981). Since only MP and CuP are concave (or groove-shaped) in the fore wing of the family Ideliidae, the symbols for convex (+) and concave (−) wing veins are omitted from the figures.

The present study is based on material deposited in the Paleontological Institute, Academy of Sciences of USSR, Moscow. This material was collected by the expeditions of the Laboratory of Paleontomology of the Paleontological Institute. All materials are from the following well-known Permian localities: the Sojana River in the Arkhangelsk region, the Kitjak River in the Kirov region, Tichije Gory on the Kama River and Vorkuta in the Komi ASSR.
2. Description of new taxa

Order Grylloblattida Walker, 1914

Family Ideliidae M. Zalessky, 1929

Type genus: Idelia M. Zalessky, 1929 = Stenaropodites Martynov, 1928.

Diagnosis: Fore wing with Sc terminating on C, costal area broad with numerous veinlets, M not united with R in proximal third of wing, MA branched in distal part of wing, CuA with numerous pectinate branches, CuA₂ not distinct, archediclyton or irregular cross-veins present in all areas. The family Ideliidae is closely related to the families Archiprobionidae, Megakhosariae, Blatagryllidae, Mesorthopteridae and Lio­mopteridae (Rasnitsyn 1980). The Archiprobionidae differs from Ideliidae by the very broad areas between R, RS, MA, MP and CuA with parallel simple cross-veins (Sharov 1962). The Megakhosariae and Blatagryllidae are distinguished from Ideliidae by the simple S-shaped cross-veins in the CuA–CuP area (Sharov 1961, Rasnitsyn 1976, Storozhenko 1988). The Mes­orthopteridae differs from Ideliidae in having M close to or united with R in the proximal third of the fore wing (Rasnitsyn 1980). The Lio­mopteridae is distinguished from Ideliidae by the distinct, usually simple CuA₂ (Sharov 1962, Kukalova 1964).


Stenaropodites Martynov, 1928

Type species: Stenaropodites reticulata Martynov, 1928, Upper Permian of Kama River (Tikhije Gory); by original designation.

Species included: S. reticulata Martynov, 1928 and S. permiakovae (M. Zalessky, 1929) are known from the Upper Permian of Tikhije Gory. Three new species are described below.

Stenaropodites sojanensis Storozhenko, sp. n.

Figs. 1, 2.

Holotype: Fore wing, imprint and counter-imprint, specimen No 3353/146; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth, Iva­Gora; Upper Permian, Kazanian Stage; in collection of Paleontological Institute, Moscow.


Locality and occurrence: USSR: Sojana River (Iva­Gora, Sheimo-Gora and Letopala); Upper Permian: Kazanian Stage.

Description: Fore wing about 3 times longer than broad, with rounded apex. Costal area with 17–18 simple or branched veinlets; ratio of its width to maximum width of radial area 1.8–2.0. Sc terminating at or before three-quarters of wing length; subcostal area narrow, RS originating before first third of wing, with 4–5 branches, M dividing before origin of RS; MA with 4–5 branches; MP simple. CuA with 9–12 branches; proximal 4–5 branches terminating on CuP or disappearing in CuA–CuP area; distal 4 branches curving upwards. CuP straight. A₁ simple, S-shaped. A₂ with 4–5 curved or S-shaped branches. Archediclyton present in all areas. Fore wing light, with dark brown longitudinal stripes between veins; costal area dark brown with light veinlets and archediclyton. Hind wing with rounded apex. Costal, subcostal and radial areas very narrow. RS with 9–10 branches. M fused shortly with CuA near base. CuA with 3–4 branches; CuP simple. Anal lobe enlarged. A₁ weakly developed. A₂
The fore wing of *Stenaropodites sojanensis* differs from that of *S. reticulata* Martynov, 1928 and *S. permiakovae* (M. Zalesky, 1929) by 4 long distal upwards curving branches of *CuA* while only 2 such branches are known in the related species.

with numerous branches. Hind wing light; costal area brown. Length of fore wing 50–57 mm, width of fore wing 18.8–19.5 mm. Length of hind wing 43–47 mm. Maximum width of costal area of fore wing 3.5–4.5 mm, of hind wing 1.5–1.7 mm.

Fig. 1. *Stenaropodites sojanensis* sp. n., fore wing. — A: holotype, spec. No 3353/146; B: paratype, spec. No 3353/240; C: paratype, spec. No 3353/160; D: paratype, spec. No 3353/311. — Scale bars 5 mm.
Stenaropodites sojanensis sp. n.

Fig. 2. Stenaropodites sojanensis sp. n., hind wing, paratypes. — A: spec. No 3353/174; B: spec. No 3353/343. — Scale bars 5 mm.

Stenaropodites mistshenkoi Storozhenko, sp. n.

Fig. 3.

Holotype: Fore wing, imprint and counter-imprint, specimen No 801/117 & 804/117; USSR: Arkhangelsk region, right bank of Sojana River, about 57 km from its mouth, Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype and 5 paratypes (all from Sojana River: Iva-Gora and Letopala): fore wing, specimens No 3353/323, 793/117 and 353/117 & 836/117; hind wing, specimens No 3353/219 and 803/117.

Locality and occurrence: USSR: Sojana River (Iva-Gora and Letopala); Upper Permian: Kazanian Stage.

Description: Fore wing about 3 times longer than broad, with rounded apex. Costal area with a series of 11–17 simple or branched veinlets; ratio of its width to maximum width of radial area 1.4–1.6. Subcostal area narrow. RS with 7–8 branches. MA with 3–5 branches, MP with 2 branches. Distal branch of MA sometimes shortly fused with RS. Archediction present in all areas. Fore wing light, with brown longitudinal
Fig. 3. *Stenaropodites mistshenkoi* sp. n. — A: fore wing, holotype, spec. No 804/117 & 801/117; B: fore wing, paratype, spec. No 3353/323; C: hind wing, paratype, spec. No 3353/219. — Scale bars 5 mm.
stripes between veins; costal area brown. Hind wing with very narrow costal area. RS with 9 branches. M with 2 branches, fused shortly with CuA near base. CuA with 6 branches. Anal lobe strongly enlarged. A1 simple; A2 with numerous branches. Hind wing light, costal area dark. Length of fore wing 41–53 mm, of hind wing 40.5 mm. Maximum width of costal area of fore wing 2.8–3.1 mm, of hind wing 1.0–1.1 mm.

S. mistshenkoi is closely related to S. sojanensis, but differs by the more branched RS of the fore wing and by the more narrow costal area of the fore and hind wings.

Named in honour of Dr. L. L. Mistshenko, the well-known Russian orthopterologist.

**Stenaropodites magna** Storozhenko, sp. n.

*Fig. 4A*

Holotype: Anterior half of fore wing, imprint and counter imprint, specimen No 1366/239; USSR: Kirov region, left bank of Kitjak River near village of Boshhoj Kitjak (= Big Kitjak); Upper Permian: Tatarian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype only.

Locality and occurrence: USSR: Kitjak River; Upper Permian: Tatarian Stage.

Description: Fore wing long, probably with rounded apex. Costal area with a series of 18 simple or branched veinlets; ratio of its width to maximum width of radial area 1.9. Sc terminating at about 2/3 of wing length. RS originating at about first third of wing, with 4 branches. M dividing before origin of RS. CuA with 6 branches, 3 directed posteriorly and 3 anteriorly. CuP and A1 probably simple; A2 probably branched. Cross-veins numerous, irregular. Wing light, with dark costal area. Length of fore wing about 65–67 mm; width of costal area 6.2 mm.

*S. magna* differs from all known species of the genus *Stenaropodites* by the large size and by the 3 distal anteriorly directed branches of CuA.

**Idelinella macroptera** Storozhenko, sp. n.

*Fig. 4B*

Holotype: Basal half of fore wing, imprint and counter imprint, specimen No 94/129 & 94/130; USSR: Arkhangelsk region, right bank of Sojana River about 56 km from its mouth, Sheimo-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype only.

Locality and occurrence: USSR: Sojana River (Sheimo-Gora); Upper Permian: Kazanian Stage.

Description: Costal area of fore wing probably with a series of 25–30 simple veinlets. Subcostal area narrow, its width 3.5 times less than width of costal area. RS, MA and MP broken. Wing light, without spots or stripes, veins light. Length of fore wing 60–65 mm, width 19.7 mm.

**Idelina** Storozhenko, gen. n.

Type species: *Idelina kamensis* sp. n.; Upper Permian of Kama River, USSR.

Description: Fore wing membranous, without hairs. Sc terminating on C near apical quarter of wing; costal area relatively narrow, only 1.05 times broader than maximum width of radial area; costal area with about 20 simple veinlets. R simple, RS with 4 branches, dichotomous. M forked proximally to origin of RS; MP branched. CuA with 7 branches. CuA–CuP area with irregular, partly S-shaped veinlets. CuP simple, slightly curved. A1 with 5 branches. Cross-veins mostly irregular, forming rows of two or three cells; cross-veins in radial area slanted in the opposite direction than in other areas; in RS–MA area and anal area cross-veins almost straight. Anal area short.
Idelina is related to Paridelia and to Khosaridelia, but easily distinguished by a shorter anal area with 5-branched A₁ and by dense and more irregular cross-veins, slanted in the opposite direction than in the radial area.

Species included: Type species only.

Idelina kamensis Storozhenko, sp. n.
Fig. 5A

Holotype: Imprint of fore wing, specimen No 1259/1; USSR: Kama River, Tikhije Gory; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype only.
Locality and occurrence: USSR: Kama River (Tikhije Gory); Upper Permian: Kazanian Stage.

Description: Fore wing about 3.2 times longer than broad. Subcostal area broad, its width 1.2 times less than width of costal area. RS originating at about first quarter of the wing, dichotomous. MA with 2 branches, MP pectinated, with 3 branches; A₁ with 5 branches, A₂ with 4 branches. Wing light, without spots or stripes; veins dark. Length of fore wing 48 mm, width 15 mm.
**Khosaridelia Storozhenko, gen. n.**

Type species: *Khosaridelia martynovi* sp. n.; Lower Permian of Vorkuta, USSR.

Description: Fore wing membranous, without hairs. *Sc* terminating on *C* near apex of wing; costal area relatively narrow, only 1.35 times broader than maximum width of radial area; costal area with more than 30 simple or branched veinlets. *R* simple; *RS* with 6 branches, pectinate. *M* forked proximally to the origin of *RS*; *MP* branched. *CuA* with 13 branches; 8 proximal branches straight or slightly S-shaped, disappearing in *CuA–CuP* area. *CuP* simple, straight. *A* simple. Cross-veins mostly regular, straight, forming rows of two irregular cells in the *R–RS*, *RS–MA*, *MA–MP* and *MP–CuA* areas. Anal area long.

*Khosaridelia* is related to *Paridelia*, but differs by 6 branches of *RS* and by distinct branches of *CuA* in *CuA–CuP* area. In partly S-shaped branches of *CuA* in *CuA–CuP* area and mostly straight cross-veins the new genus is similar to representatives of the family Megakhosaridae, but is easily distinguished from these by the broader costal area with simple cross-veins and sometimes branched veinlets. Undoubtedly the Megakhosaridae originated from the Ideliidae by forms closely related to *Khosaridelia*.

Species included: Type species only.

**Khosaridelia martynovi Storozhenko, sp. n.**

Fig. 5B

Holotype: Imprint of fore wing, specimen No 1631/363; USSR: Komi ASSR, Vorkuta; Lower Permian; in collection of Paleontological Institute, Moscow.

Material: Holotype only.

Locality and occurrence: USSR: Vorkuta; Lower Permian.

Description: Fore wing about 3.4 times longer than broad. Subcostal area broad, its width 1.5 times less than width of costal area. *RS* originating at about the first third of wing, pectinate. *MA* with 2 branches, *MP* dichotomous, with 4
branches. $A_1$ simple, straight. $A_2$ with 5 branches. Length of fore wing 34.3 mm, width 10.0 mm.

Named in honour of Prof. A. V. Martynov, the founder of modern paleoentomology.

**Sojanidelia Storožhenko, gen. n.**

Type species: *Sojanidelia maculosa* sp. n.; Upper Permian of Sojana River, USSR.

Description: Fore wing membranous, without hairs. $Sc$ terminating on $C$ near apical third or quarter of wing; costal area relatively narrow or broad, with 11–23 simple or branched veinlets. $R$ simple, $RS$ simple or with 2–5 branches, curved upwards. First fork of $M$ proximal to origin of $RS$; $MA$ with 2–5 branches, $MP$ simple or bifurcated. $CuA$ with 6–12 branches; 1–5 proximal straight or slightly curved branches disappearing in $CuA$-$CuP$ area; distal 3–5 branches of $CuA$ upwards curving. $CuP$ simple, straight. $A_1$ simple, straight or S-shaped; $A_2$ with 2–4 branches. Archedictyon present. Anal area short.

*Sojanidelia* is closely related to *Paridelia* Sharov, 1961, *Metidelia* Martynov, 1937 and *Rachimentomon* G. Zalesky, 1939. From *Paridelia* and *Metidelia* it differs by the upwards curved distal branches of $CuA$ and by the very numerous and irregular cross-veins. *Rachimentomon* is easily distinguished from *Sojanidelia* by the S-shaped pectinated $RS$ curving downwards.

Species included: There are 12 species from Lower Permian and Upper Permian, 11 of them described below. Sharov (1961) described *Metidelia kostinae*, but on the basis of the wing-venation this species must be transferred to *Sojanidelia*.

As all the species are included in the key below, no specific diagnoses are given.

**Key to the species of *Sojanidelia***

1. Length of fore wing 22–29.5 mm; maximum width of costal area 1.0–1.9 mm .............................................. 2
   - Length of fore wing 32–39 mm; maximum width of costal area 2.0–2.8 mm .................................................. 9
2. $RS$ with 3–4 branches .............................................. 3
   - $RS$ simple or only with 2 branches .......................... 8
3. $M$ with 7 branches .................................................. 4
   - $M$ with 5 branches ............................................. 9
4. Length of fore wing 25–29.5 mm. Maximum width of costal area 1.4–1.9 mm .................................................. 5
   - Length of fore wing 22–24 mm. Maximum width of costal area 1.0–1.3 mm .................................................. 7
5. Fore wing without spots. $M$ with 4 branches .............. .......................... 9
   - Fore wing with dark spots. $M$ with 5 branches .......... 6
6. Fore wing with large spots. Length of wing 24–26 mm. Maximum width of costal area 1.5–1.8 mm ......... .......................... 9
   - Fore wing with small spots. Length of wing 29.5 mm. Maximum width of costal area 1.4 mm .......... 7
7. $RS$ with 4 branches; $MA$ with 2. Costal area broader than radial area. Lower Permian of Kuznetsk basin, USSR .................................................. 9
   - $RS$ with 3 branches; $MA$ with 3. Radial area broader than costal area .................................................. 9
8. Fore wing without spots. $RS$ with 2 branches. Distal branch of $CuA$ simple ............................................. 9
   - Fore wing with large dark spots. $RS$ simple. Distal branch of $CuA$ bifurcate ............................................. 9
9. Fore wing without spots or stripes. Maximum width of costal area 2.5–2.8 mm .................................................. 10
   - Fore wing with longitudinal dark stripes across veins and costal area. Maximum width of costal area 2.0–2.3 mm .................................................. 11
10. Distal branch of $CuA$ with 3 branches. $RS$ not anastomosed with $MA$. Length of fore wing 32–34 mm .................................................. 9
    - Distal branch of $CuA$ simple. $RS$ anastomosed with $MA$. Length of fore wing 39 mm ............................................. 9
11. $RS$ not united with $MA$, anastomosis between them absent. Distal branch of $CuA$ mostly simple $S$. *lineata*
    - $RS$ united with $MA$ or distinct anastomosis between them present. Distal branch of $CuA$ always bifurcate . .......................... 9

**Sojanidelia maculosa Storožhenko, sp. n.**

Fig. 6A, B

Holotype: Imprint of fore wing, specimen No 3353/136; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth, Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.


Locality and occurrence: USSR: Sojana River (Iva-Gora); Upper Permian: Kazanian Stage.

Description: Fore wing 2.85–3.0 times longer than broad, with broadly rounded apex. Costal area with a series of 17–18 simple or branched veinlets; costal area 5.1–5.6 times narrower than maximum width of wing. $RS$ originating at about
first third of wing, with 3–4 branches. Maximum width of radial area 1.1–1.4 times less than width of costal area. 

Sojanidelia fasciata Storozhenko, sp. n.

Fig. 6C, D

Holotype: Fore wing, imprint and counter-imprint, specimen No 3353/281; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth; Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: In addition to holotype one paratype from Sojana River (Iva-Gora): fore wing, specimen No 3353/235.

Locality and occurrence: USSR: Sojana River (Iva-Gora); Upper Permian: Kazanian Stage.

Description: Fore wing 3.1–3.2 times longer than broad, with broadly rounded apex. Costal area with 21–23 simple veinlets; ratio of its width to maximum width of wing 5.75–5.8. 

Sojanidelia multimediana Storozhenko, sp. n.

Fig. 7A

Holotype: Fore wing without basal and apical parts, imprint and counter-imprint, specimen No 1631/368; USSR: Vorkuta; Lower Permian; in collection of Paleontological Institute, Moscow.

Material: Holotype only.

Locality and occurrence: USSR: Vorkuta; Lower Permian.

Description: Fore wing probably about 3 times longer than broad. Costal area broken. 

Sojanidelia vorkutensis Storozhenko, sp. n.

Fig. 7B

Holotype: Imprint of fore wing, specimen No 1631/225; USSR: Komi ASSR, Vorkuta; Lower Permian; in collection of Paleontological Institute, Moscow.

Material: Holotype only.

Locality and occurrence: USSR: Vorkuta; Lower Permian.

Description: Fore wing 3.2 times longer than broad, with acutely rounded apex. Costal area with a series of 14–15 simple or bifurcate veinlets; ratio of its width to maximum width of wing 4.65. 

Sojanidelia longula Storozhenko, sp. n.

Fig. 7C

Holotype: Fore wing without anal area, imprint and counter-imprint, specimen No 814/117 & 869/117; USSR: Arkhangelsk region, right bank of Sojana River about 56–60 km from its mouth; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.
Fig. 6. Fore wings of Sojanidella. — A, B: S. maculosa sp. n.; A: holotype, spec. No 3353/136; B: paratype, spec. No 3353/278. — C, D: S. fasciata sp. n.; C: holotype, spec. No 3353/281; D: paratype, spec. No 3353/235. — Scale bars 5 mm.
Fig. 7. Fore wings of Sojanidela. — A: S. multimediana sp. n., holotype, spec. No 1631/368. — B: S. vorkutensis sp. n., holotype, spec. No 1631/225. — C: S. longula sp. n., holotype, spec. No 814/117 & 869/117. — Scale bars 5 mm.

Material: Holotype only.
Locality and occurrence: USSR: Sojana River; Upper Permian: Kazanian Stage.

Description: Fore wing 3.35 times longer than broad, with broadly rounded apex. Costal area with a series of 19 branched veinlets; narrow: ratio of its maximum width to width of wing 6.3. RS terminating at about first third of wing, with 4 branches. Maximum width of radial area 1.05 times width of costal area. M with 5 branches: MA with 4, MP simple. CuA with 7 branches; two proximal ones disappear in CuA–CuP area; distal branch of CuA simple. Dense archedictyon present in all areas. Fore wing light, with little oval dark spots. Length of fore wing 29.5 mm, width 8.8 mm. Maximum width of costal area 1.4 mm.
**Sojanidelia parvula** Storozhenko, sp. n.

Fig. 8A, B

_Holotype: Fore wing, imprint and counter-imprint, specimen No 3353/274; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth; Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow._

_Material: Holotype and 2 paratypes (all from Sojana River: Iva-Gora): fore wing, specimens No 3353/159 and 2642/117._

_Locality and occurrence: USSR: Sojana River (Iva-Gora); Upper Permian: Kazanian Stage._

_Description: Fore wing 2.8–2.95 times longer than broad, with broadly rounded apex. Costal area with a series of 11–12 mostly simple veinlets; ratio of its width to maximum width of wing 5.0–5.1. **RS** originating clearly beyond first third of wing, with 2 branches. Maximum width of radial area and costal ones equal. **M** with 5 branches; **MA** with 3, **MP** with 2 branches. **CuA**
with 6–7 branches; one proximal branch disappears in CuA–CuP area; distal branch of CuA simple. \( A_1 \) simple, S-shaped. \( A_2 \) with 3 branches. Archedictyon present only in the costal area; cross-veins forming rows of two cells in most areas and three cells in radial area. Fore wing light, without spots or stripes. Length of fore wing 22.5–25.5 mm, width 7.5–9.0 mm. Maximum width of costal area 1.4–1.7 mm.

**Sojanidelia nana** Storozhenko, sp. n.  
Fig. 8C, D

Holotype: Apical half of fore wing, imprint and counter-imprint, specimen No 94/1122 & 94/1128; USSR: Arkhangelsk region, right bank of Sojana River about 56–60 km from its mouth; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype and 3 paratypes (from Sojana River: about 56–60 km from its mouth and Iva-Gora): fore wing, specimens No 3353/188, 2334/287 and 94/1133.

Locality and occurrence: USSR: Sojana River (Iva-Gora); Upper Permian: Kazanian Stage.

Description: Fore wing 2.85–3.0 times longer than broad, with broadly rounded apex. Costal area with a series of 13–15 mostly simple veinlets; ratio of its width to width of wing 4.9–5.6. RS originating slightly beyond first third of wing, simple. Maximum width of radial area and costal areas is equal. \( M \) with 5 branches: \( MA \) with 4 ones, \( MP \) simple. \( CuA \) with 7–9 branches; one proximal branch disappears in \( CuA–CuP \) area; distal branch of \( CuA \) divided. \( A_1 \) simple, S-shaped. \( A_2 \) with 4–5 branches. Archedictyon present in all areas. Fore wing light, with large dark spots. Length of fore wing 22–24 mm, width 7.5–8.4 mm. Maximum width of costal area 1.5–1.7 mm.

**Sojanidelia makarkini** Storozhenko, sp. n.  
Fig. 9A

Holotype: Fore wing, imprint and counter-imprint, specimen No 3353/167; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth, Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: In addition to holotype 4 paratypes (all from Sojana River: Iva-Gora): fore wing, specimens No 94/370, 94/371, 368/117 and 1133/117.

Locality and occurrence: USSR: Sojana River (Iva-Gora); Upper Permian: Kazanian Stage.

Description: Fore wing 3.0–3.2 times longer than broad, with broadly rounded apex. Costal area with a series of 20–21 mostly simple veinlets; ratio of its width to maximum width of wing 4.8–5.2. RS originating at about the first third of wing, with 3–4 branches. Maximum width of radial area 1.01–1.1 times less than width of costal area. \( M \) with 4 branches: \( MA \) with 3 branches, \( MP \) simple. \( CuA \) with 10–11 branches; 4 proximal ones disappear in \( CuA–CuP \) area; distal branch of \( CuA \) simple. \( A_1 \) simple, S-shaped. \( A_2 \) with 3 branches. Dense archedictyon present in all areas. Fore wing light, without any spots or stripes. Length of fore wing 25.2–28.5 mm, width 8.4–8.7 mm. Maximum width of costal area 1.7–1.9 mm.

Named in honour of the famous neuropterologist Dr. V. N. Makarkin (Vladivostok).

**Sojanidelia fluctuosa** Storozhenko, sp. n.  
Fig. 9B–D

Holotype: Fore wing, imprint and counter-imprint, specimen No 3353/148; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth, Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype and 4 paratypes (from Sojana River: about 56–60 km from its mouth and Iva-Gora): fore wing, specimens No 3353/288, 3353/294, 874/117 and 94/675 & 94/934.

Locality and occurrence: USSR: Sojana River (Iva-Gora); Upper Permian: Kazanian Stage.

Description: Fore wing 2.9–3.0 times longer than broad, with broadly rounded apex. Costal area with a series of 14–15 simple veinlets; ratio of its width to width of wing 4.2–4.4. RS originating clearly beyond first third of wing, with 4 branches, dichotomous. Maximum width of radial area 1.6–1.7 times less than width of costal area. \( M \) with 5 branches: \( MA \) with 3, \( MP \) with 2 branches. \( CuA \) with 9–11 branches; one proximal branch disappears in \( CuA–CuP \) area; distal branch of \( CuA \) divided into 3 branches, pectinate. \( A_1 \) simple, S-shaped. \( A_2 \) with 3 branches. Dense archedictyon present in all areas. Fore wing light, without spots or stripes. Length of fore wing 32–35 mm, width 11.0–11.3 mm. Maximum width of costal area 2.5–2.8 mm.
Fig. 9. Fore wings of Sojanidelia. — A: *S. makarkini* sp. n., holotype, spec. No 3353/167. — B–D: *S. fluctuosa* sp. n.; B: holotype, spec. No 3353/148; C: paratype, spec. No 3353/288; D: paratype, spec. No 3353/294. — Scale bars 5 mm.
Sojanidelia lineata Storozhenko, sp. n.

Fig. 10A, B

Holotype: Fore wing without apex, imprint and counter-imprint, specimen No 3353/184; USSR: Arkhangelsk region, right bank of Sojana River about 57 km from its mouth, Iva-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.


Locality and occurrence: USSR: Sojana River (Iva-Gora and Letopala); Upper Permian: Kazanian Stage.

Description: Fore wing 3.2–3.3 times longer than broad, with broadly rounded apex. Costal area with a series of 15–17 branched or simple veinlets, ratio of its width to width of wing 5.2–5.5. RS originating at about first third of wing, with 4–5 branches; RS not united with MA, anastomosis between them absent. Maximum width of radial area 1.1–1.3 times less than width of costal area. M with 3–4 branches; MA with 2–3, MP simple. CuA with 8–9 branches; 3 proximal branches disappear in CuA–CuP area; distal branch of CuA mostly simple, but in one case (specimen No 3353/130) bifurcate. A1 simple, straight. A2 with 4 branches. Archedictyon present in all areas. Fore wing light with longitudinal dark stripes across veins and costal area. Length of fore wing 37–39 mm, width 11–12 mm. Maximum width of costal area 2.0–2.3 mm.

Sojanidelia striata Storozhenko, sp. n.

Fig. 10C, D

Holotype: Fore wing, imprint and counter-imprint, specimen No 845/117 & 856/117; USSR: Arkhangelsk region, right bank of Sojana River about 60 km from its mouth, Letopala; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Holotype and 3 paratypes (all from Sojana River: Iva-Gora and Letopala): fore wing, specimens No 94/559 & 94/814, 94/780 & 94/1132 and 796/117 & 800/117.

Locality and occurrence: USSR: Sojana River (Iva-Gora and Letopala); Upper Permian: Kazanian Stage.

Description: Fore wing 3.2–3.3 times longer than broad, with broadly rounded apex. Costal area with a series of 15–17 branched or simple veinlets; ratio of its width to width of wing 5.2–5.5. RS originating at about first third of wing, with 4–5 branches; RS united with MA or with distinct anastomosis between them. Maximum width of radial area 1.1–1.3 times less than width of costal area. M with 4–5 branches; MA with 3–4, MP simple. CuA with 10–13 branches; 4–5 proximal ones disappear in CuA–CuP area; distal branch of CuA with fork. A1 simple, S-shaped. A2 with 3 branches. Archedictyon present in all areas. Fore wing light, with longitudinal dark stripes across veins and costal area. Length of fore wing 37–39 mm, width 11–12 mm. Maximum width of costal area 2.0–2.3 mm.

3. Revision of the genus Permotermopsis

Permotermopsis Martynov, 1937

Permotermopsis Martynov, 1937:84

Type-species: Permotermopsis roseni Martynov, 1937, Upper Permian of Arkhangelsk region; by original designation.

Description: Fore wing membranous, without hairs. Sc terminating on C near apical quarter of wing; costal area broad or narrow, 1.05–1.7 times broader than maximum width of radial area; with about 18–24 simple veinlets. R simple; RS with 6–7 branches, dichotomous or pectinate. M forks proximally to origin of RS; MP branched. CuA with about 7–9 branches terminating at posterior margin and a series of short straight branches terminating on CuP; with regular simple cross-veins between them. CuP simple, slightly curved. Cross-veins straight near base, forming rows of two cells in most areas and three cells in radial area. Anal area short and narrow.

Permotermopsis was described by Martynov (1937) from two incomplete imprints of fore wings, both without basal parts and posterior margins, from the Upper Permian of the Sojana River (Sheimo-Gora) and placed in a new family Permotermopsidae. Sharov (1962) transferred the genus to the family Ideliidae, but he did not formally mention Permotermopsidae as a synonym of the former. The full imprints of both species described by Martynov can be found in the collection of the Paleontological Institute, so
Fig. 10. Fore wings of Sojanidelia. — A, B: S. lineata sp. n.; A: holotype, spec. No 3353/184; B: paratype, spec. No 3353/130. — C, D: S. striata sp. n.; C: holotype, spec. No 845/177 & 856/117; D: paratype, spec. No 94/780 & 94/1132. — Scale bars 5 mm.
that the descriptions of the genus and species can be completed. The wing-venation shows that *Permotermopsis* is a member of the family Idelidae; therefore Permotermopsidae is a younger synonym of the former.

*Permotermopsis* is closely related to *Idelina* gen. n., from which it is easily distinguished by the more branched RS and by the presence of thick branches of CuA in the CuA–CuP area.

Species included: Two species from the Upper Permian of the Sojana River.

**Permotermopsis roseni** Martynov, 1937

Fig. 11A, B

*Permotermopsis roseni* Martynov, 1937:85, fig. 1.

*Permotermopsis roseni* Sharov, 1962:121, fig. 291.

Holotype: Imprint of fore wing, specimen No 2334/335; USSR: Arkhangel'sk region, right bank of Sojana River, Sheimo-Gora; Upper Permian: Kazanian Stage; in collection of Paleontological Institute, Moscow.

Material: Apart from holotype in collection of Paleontological Institute there are 4 additional fore wings from Sojana River (Iva-Gora and Letopala): specimens No 265/117 & 266/117, 3353/172, 3353/285 and 3353/329.

Locality and occurrence: USSR: Sojana River (Iva-Gora, Sheimo-Gora and Letopala); Upper Permian: Kazanian Stage.

Description: Fore wing about 3 times longer than broad, with acutely rounded apex. Costal area with a series of 20–24 simple veinlets; ratio of its width to each area only 1.05–1.1. Sc terminating at about 3/4 of the wing length; subcostal area narrow. RS with 6–7 branches, pectinate. M dividing well before origin of RS; MA with 2 branches; MP with 3, first fork of MP near origin of RS. A1 with 3–4, A2 with 5–6 branches. Length of fore wing 52–61 mm.

*P. pectinata* differs from *P. roseni* by the more proximal first fork of MP, the narrow costal area and the pectinate RS.

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**References**


Fig. 11. Fore wings of Permotermopsis. — A, B: P. roseni Martynov; A: spec. No 3353/286; B: spec. No 3353/172. — C: P. pectinata Martynov, spec. No 3353/375. — Scale bars 5 mm.


