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# New Tertiary Neuroptera (Insecta) from the Russian Far East

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**Abstract:.:** *Prosuhpalacsa biamoensis* gen. et sp. nov. (Ascalaphidae), *Oligogetes relictum* gen. et sp. nov. (Solenoptilidae) and an indeterminate member of the Nothochrysinae (Chrysopidae) are described from the Sikhote-Alin Mountains (Russian Far East). *Oligogetes relictum* is the first Tertiary representative of an extinct family of Neuroptera.

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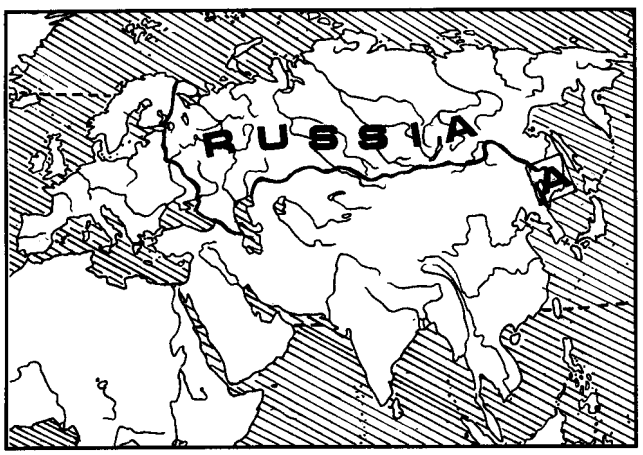
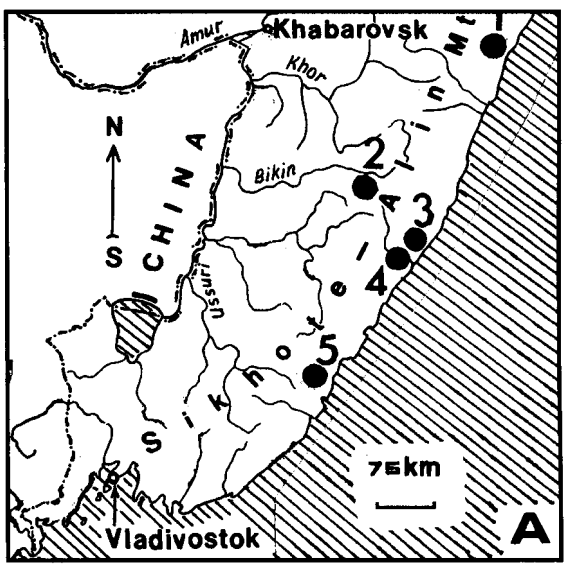
## INTRODUCTION

Tertiary Neuroptera have been studied for a long time. Since the pioneering work of Pictet-Baraban & Hagen (1856) approximately 70 species have been described, almost all belonging to Recent families. Fossil records are only lacking for the now relict families Dilaridae, Rapismatidae and Ithonidae. The richest deposits for Neuroptera are the Early Eocene Mo-Clay, Denmark (Henriksen, 1922; Larsson, 1975; Schlüter,1982; Willmann, 1993), Eocene Baltic amber (Hagen, 1856; Krüger, 1923; MacLeod, 1970), the Late Eocene of the Isle of Wight, England (Cockerell,1921; Jarzembowski, 1980), the Early Oligocene of Florissant, Colorado (Scudder, 1890; Cockerell, 1907; 1908a-c; 1909; 1914; Carpenter, 1935; 1943; 1960; Adams, 1967) and the Middle Miocene of Stavropol, Russia (Makarkin, 1991).

Tertiary insects occur frequently in the south of the Russian Far East in the Sikhote-Alin Mountains (see Text-fig. 1). However at all localities Neuroptera are rare. Up to now, only three species have been described; *Miopsychopsis relictum* Makarkin, 1991 and *M. sikhotensis* Makarkin, 1991 (Psychopsidae) and *Drepanepteryx oedobia* Makarkin, 1991 (Hemerobiidae).

In the present paper, I describe three new species belonging to three different families; Chrysopidae, Ascalaphidae and Solenoptilidae. The first of these is from the locality of Botchi, northern Sikhote-Alin (Text-fig 1: locality 1). Akhmet'ev (1973) dated the Botchi deposits as Late Miocene based on the flora. At this locality the rare insects occur in association with fishes and crustaceans. The latter have evidently not been described. The flora is abundant with *Alnus pseudohirsuta* Endo and *Carpinus subcordata* Nathorst dominating (Akhmet'ev, 1973). The locality of Bolshaya Svetlovodnaya (central Sikhote-Alin) (Text-fig. 1: locality 2), from where originated the remaining species, differs from Botchi in having an abundant insect fauna. The age of this deposit is Late Oligocene-Early Miocene (Zherikhin, 1989). The insects occur in association with spiders and a fish. According to Zherikhin (1989) the plants are dominated by *Metasequoia occidentalis* (Newberry) Chaney, *Zelkova ungeri* Kovats and *Trochodendrodes* sp. The insect fauna has been summarized by Zherikhin (1989); it includes representatives of 15 orders and has been partly described by McCafferty & Sinitschenkova, 1983; Zherikhin, 1989; Sukacheva, 1989; Nikolaev, 1990 and Nemkov, 1990.




**Text-fig. 1** Maps of Russia showing general location of Sikhote-Alin Mounains( A) and position of all known localities yielding Neuroptera within this area.

1: Botchi; Upper Miocene (treated herein).
2: Bolshaya Svetlovodnaya; Late Oligocene - Early Miocene (treated herein).
3: Armu; Late Oligocene - Early Miocene (see Makarkin, 1991).
4: Velikaya Kema; Late Oligocene - Early Miocene (see Makarkin, 1991).
5: Zerkalnaya; Palaeocene (Makarkin & Zherikhin, in prep.).

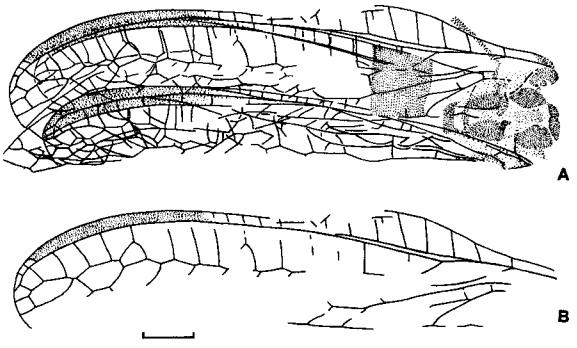
## SYSTEMATIC PALAEONTOLOGY

### Family CHRYSOPIDAE Schneider

### Subfamily NOTHOCHRYSINAE Navás

### Gen. et sp. indet.

Plate 1A; Text-fig 2A, B




**Text-fig. 2.** Nothochrysinae gen. et sp. indet. PIN 2054/8. Scale bar = 1mm. A: General view; B: Forewing.

**Material**: Specimen PIN 2054/8 in the Palaeontological Institute, Russian Academy of Sciences, Moscow; an incomplete, crumpled insect.

**Locality**: Three to four kilometres from the coalescence of the Botchi and Mulpa Rivers, northern Sikhote-Alin Mountains, 25km from Grossevichi, Sovetskaya Gavan' District, Khabarovskiy Kray, Russian Far East (48° N, 139° E).

**Horizon:** Botchi Formation, Upper Miocene.

**Description:** Forewing. Length 10.4mm. Costal area moderately broad, 0.6mm wide. Branches of Sc widely spaced. Rs arising close to the wing base. 15 crossveins between R and Rs.

**Discussion:** Judging from the basal origin of Rs the species belongs definitely to the subfamily Nothochrysinae. Other subfamilies of Chrysopidae (Limaiinae and Apochrysinae) possess very different venation, and both extant and extinct Chrysopinae have origin of Rs in a more distal position.

The specimen is incomplete and crumpled so that it is impossible to assign it to a genus. However, it resembles the Oligocene North American *Palaeochrysa* Scudder, 1890, *Tribochrysa* Scudder, 1885 and *Dyspetochrysa* Adams, 1967 in having similar venation.

The Nothochrysinae are a small relict subfamily compising some 20 extant species distributed in Europe, southern Africa, western North America, South America, and Australia (Adams & Penny, 1992). Ten fossil genera referable to this subfamily are known from the Tertiary of Europe and North America (Adams, 1967; Schlüter, 1982; Nel & Séméria, 1986; Willmann, 1993; Willmann & Brooks, 1991; Peñalver et al., 1995). Another taxon described from the Lower Cretaceous of China is believed to belong to this subfamily (Yang & Hong, 1990). The subfamily is reported here for the first time from the Asian Tertiary.

### Family ASCALAPHIDAE Lefebvre

### Genus *Prosuhpalacsa* gen. nov.

**Etymology:** Derived from the generic name Suhpalacsa. Gender feminine.

**Type species**: *Prosuhpalacsa biamoensis* gen. et sp. nov.

**Diagnosis**: Thorax with relatively sparse long hairs. Femur with sparse short setae, tibia with dense strong setae. Hindwing with Rs arising very near to the wing base; the most proximal branch of Rs is dichotomously branched. CuP long, with its branches also long. Abdomen covered with comparatively sparse minute setae.

**Discussion:** In the Recent fauna there are about 70 genera and 350 species belonging to two major subfamilies, Ascalaphinae and Haplogleniinae; a third subfamily, Albardiinae, contains only one species (Oswald & Penny, 1991). Although the Ascalaphidae have never been revised on a worldwide basis, relatively recent taxonomic treatments of the family are available for some regions (Tjeder, 1980; Penny, 1981a, b; New, 1984). Two fossil species certainly belonging to Ascalaphidae have been described from the Oligocene of Europe: *Borgia proavus* (Hagen, 1858) and *Ascaloptynx oligocenicus* Nel, 1991. All other fossils referred to Ascalaphidae belong to different families (Zherikhin, 1978; Ren et al., 1995) or even orders (Oustalet, 1870). The systematic position of *Cratopteryx robertosantosi* Martins-Neto & Vulcano, 1989 from the Lower Cretaceous of the Santana Formation, Brazil is still unclear.

Judging from its venation the genus *Prosuhpalacsa* nov. belongs apparently to the subfamily Ascalaphinae. The main distinguishing features are the eyes: the Haplogleniinae are characterized by entire compound eyes, whilst in the Ascalaphinae the eyes are divided by a median sulcus into two parts. Unfortunately in *Prosuhpalacsa* gen. nov. the head is unknown but the closest genera are Recent *Suhpalacsa* Lefebvre, 1842, *Pilacmonotus* New, 1989 and *Megacmonotus* New, 1989, from which *Prosuhpalacsa* differs in Rs arising very near to the base of the wing and in having dense setae on the tibia. I am not aware of any other ascalaphids with such dense tibial setae.

### *Prosuhpalacsa biamoensis* sp. nov.

Plates 1B, C; 2A; Text-fig. 3A-G

**Etymology:** The species is named after the River Biamo.

**Holotype:** Specimen PIN 3429/304 collected by V. V.Zherikhin in 1976; a very incomplete, crumpled insect. Housed in the Palaeontological Institute, Russian Academy of Sciences, Moscow.

**Locality:** Upper reaches of the Barachek Stream, right tributary of the River Bolshaya Svetlovodnaya [formerly the River Biamo], basin of the River Bikin, central Sikhote-Alin Mountains, Primorskiy Kray, Russian Far East (46° N, 138° E).

**Age**: Late Oligocene-Early Miocene.

**Description:** Thorax: uncertain fragment, resembling a

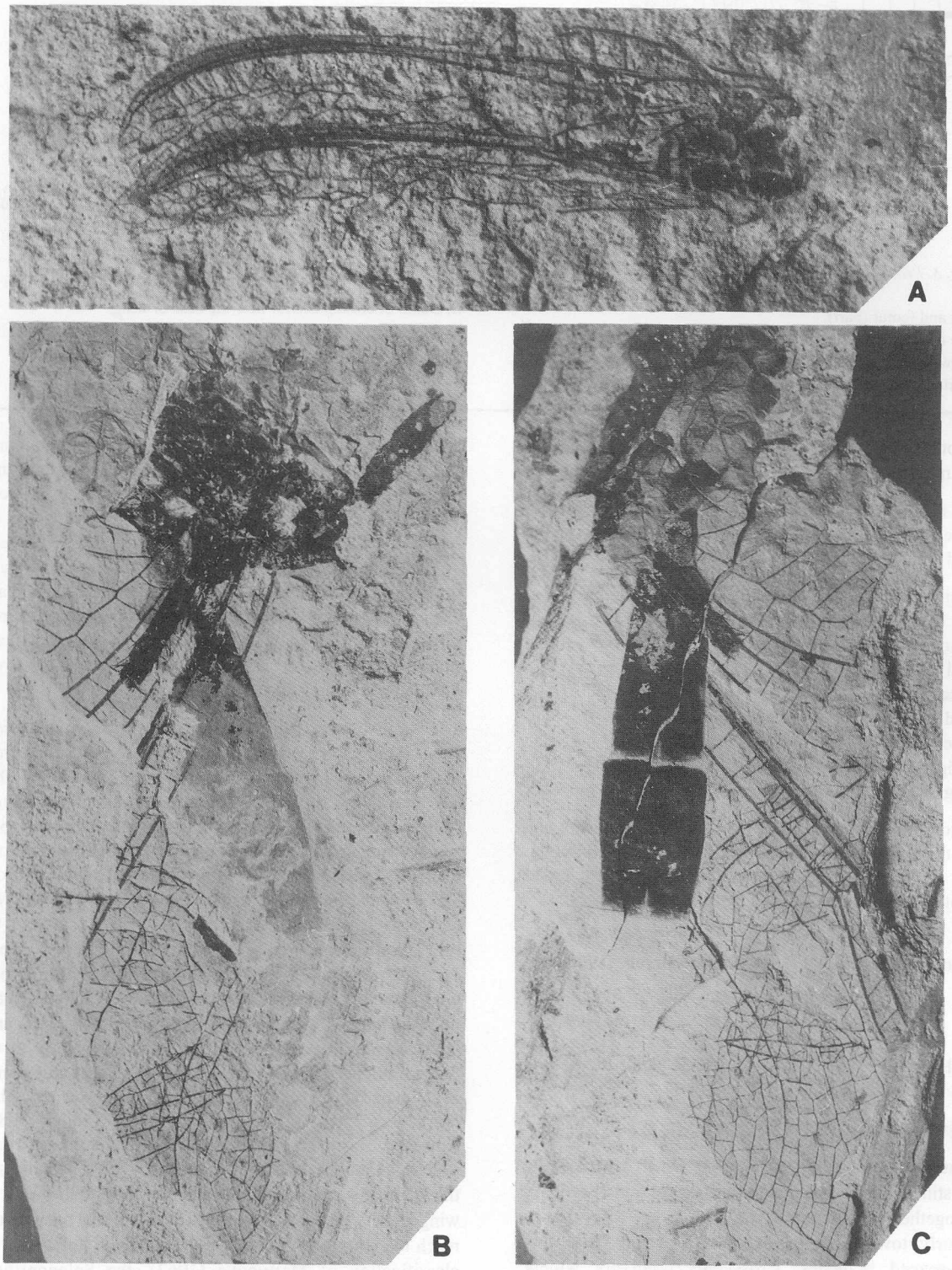
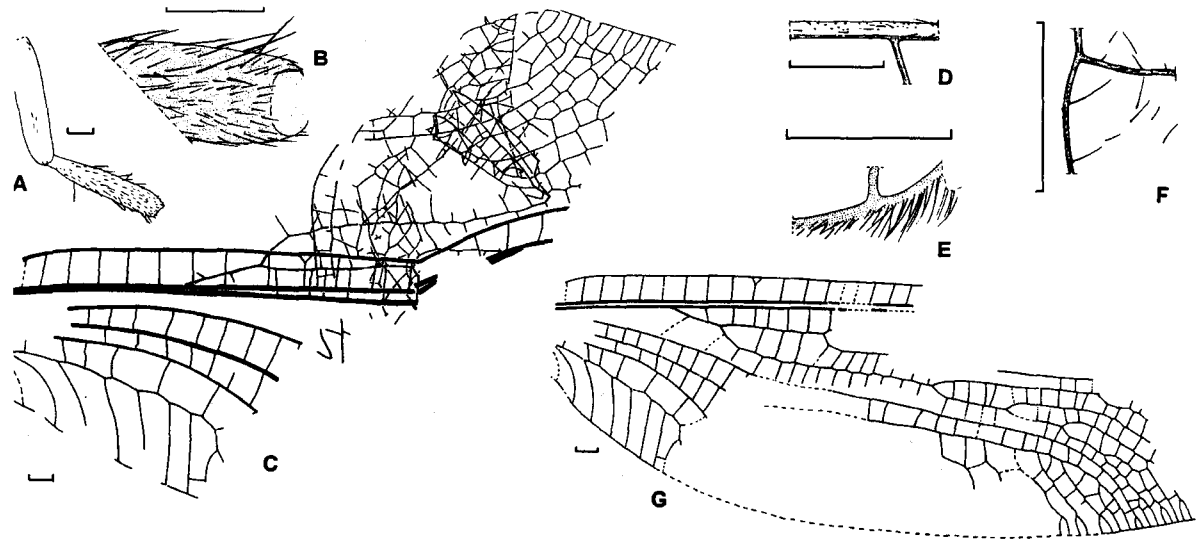



**Plate 1.**

**A**: Nothochrysinae gen. et sp. indet. PIN 2054/8. 25km from Grossevichi, Khabarovskiy Kray, Russian Far East. x10.0.

**B-C**: *Prosuhpalacsa biamoensis* gen. et sp. nov. Holotype, PIN 3429/304 (part and counterpart). Basin of the Bikin River, cental Sikhote-Alin Mountains, Primorskiy Kray, Russian Far East. x3.4.




**Text-fig. 3.** *Prosuhpalacsa biamoensis* gen. et sp. nov. Holotype, PIN 3429/304. All scale bars = 1mm.

**A**: Tibia and femur (part).
**B:** Tibia in detail (counterpart).
**C**: Hindwing.
**D**: Detail of costa anterior near the base of wing.
**E**: Detail of costa posterior near the base of wing.
**F**: Part of Rs in detail.
**G**: Reconstruction of venation.

mesonotum but too small (width 3.0mm) to be the mesonotum or metanotum (see Plate 2A).

Legs: a right femur and tibia and a left femur are preserved. Femur covered with sparse short setae (Text-fig. 3A). Tibia covered completely with dense long setae (Text-fig. 3A, B).

Hindwing: very crumpled (Text-fig. 3C).The preserved portion of membrane is hyaline. Veins dark brown, except for branches of Rs which are somewhat darker. Costa covered anteriorly with rather dense short setae (Text-fig. 3D) except posteriorly at the base of wing where it is covered with rather long dense setae (Text-fig. 3E). Branches of Rs and M covered with very sparse long setae (Text-fig. 3F). A reconstruction of the venation is shown in Text-fig. 3G.

Abdomen: represented by four (?) very dark segments, the former two narrow and short, the latter two broad and long. Minute setae are present directed towards the two broad segments.

### Family SOLENOPTILIDAE Handlirsch, [1906]

#### Genus *Oligogetes* gen. nov.

**Etymology**: Derived from Oligocene and the genus *Archigetes*. Gender neuter.

**Type species**: *Oligogetes relictum* gen. et sp. nov.

**Diagnosis:** Forewing (?): Trichosors absent. Pterostigma very distinct. Costal space very narrow, Sc and R running close together but not fused apically. Sc is hardly curved posteriorly towards the apex. Rs apparently with few widely-spaced branches. Crossveins relatively widely spaced, arranged in irregular gradate series.

**Discussion**: *Oligogetes* gen. nov. certainly belongs to an extinct family; it is tentatively assigned to the family Solenoptilidae (see below) but is most closely related to some of the Mesozoic species formerly placed in the family Prohemerobiidae. Until comparatively recently the range of Prohemerobiidae was poorly defined. However, following Whalley's (1988) designation of *Prohemerobius dilaroides* Handlirsch, 1908 as the type species of *Prohemerobius* Handlirsch, it became possible to restrict the range of the family to species more or less allied to the genotype and exclude other species tentatively as 'Neuroptera incertae sedis'. In contrast to the Solenoptilidae, in the Prohemerobiidae (as recognized herein) the costal space is relatively broad and crossveins are not regularly arranged.

The family Solenoptilidae was erected for *Solenoptilon kochi* Handlirsch based on an apical portion of a wing from the Lower Jurassic of Germany (Handlirsch, 1906-1908). Martynova (1949) included another species, *S. martynovi* Martynova, based also on an incomplete and poorly preserved wing from the Late Jurassic of Kazakhstan. However, this species is apparently not a solenoptilid. Bode (1953) added *Tetanoptilon brunsvicense* and *Solenoptilon* (?) *grasselense* from the Upper Lias of Germany; the former species apparently belongs to the family Nymphidae, whereas the latter is a very fragmentary portion of a wing which is consequently indeterminate. Subsequently, no other species were referred to this family. In fact, until now *Solenoptilon kochi* alone could be assigned to the Solenoptilidae. Martynova (1949, 1962) placed this family in the superfamily Myrmeleontoidea. This systematic placing was accepted by Schlüter (1986) and Whalley (1988). However, this placement is not justified because in the Myrmeleontoidea Sc and R are always fused apically and then curved posteriorly to reach the margin beyond the wing apex, whereas in *Solenoptilon kochi* they are free and reach the margin well before the wing apex. Following the classification of Martynova (1962), the Solenoptilidae should be placed in the superfamily Hemerobioidea.

Other families with a free Sc and R have a markedly different venation.

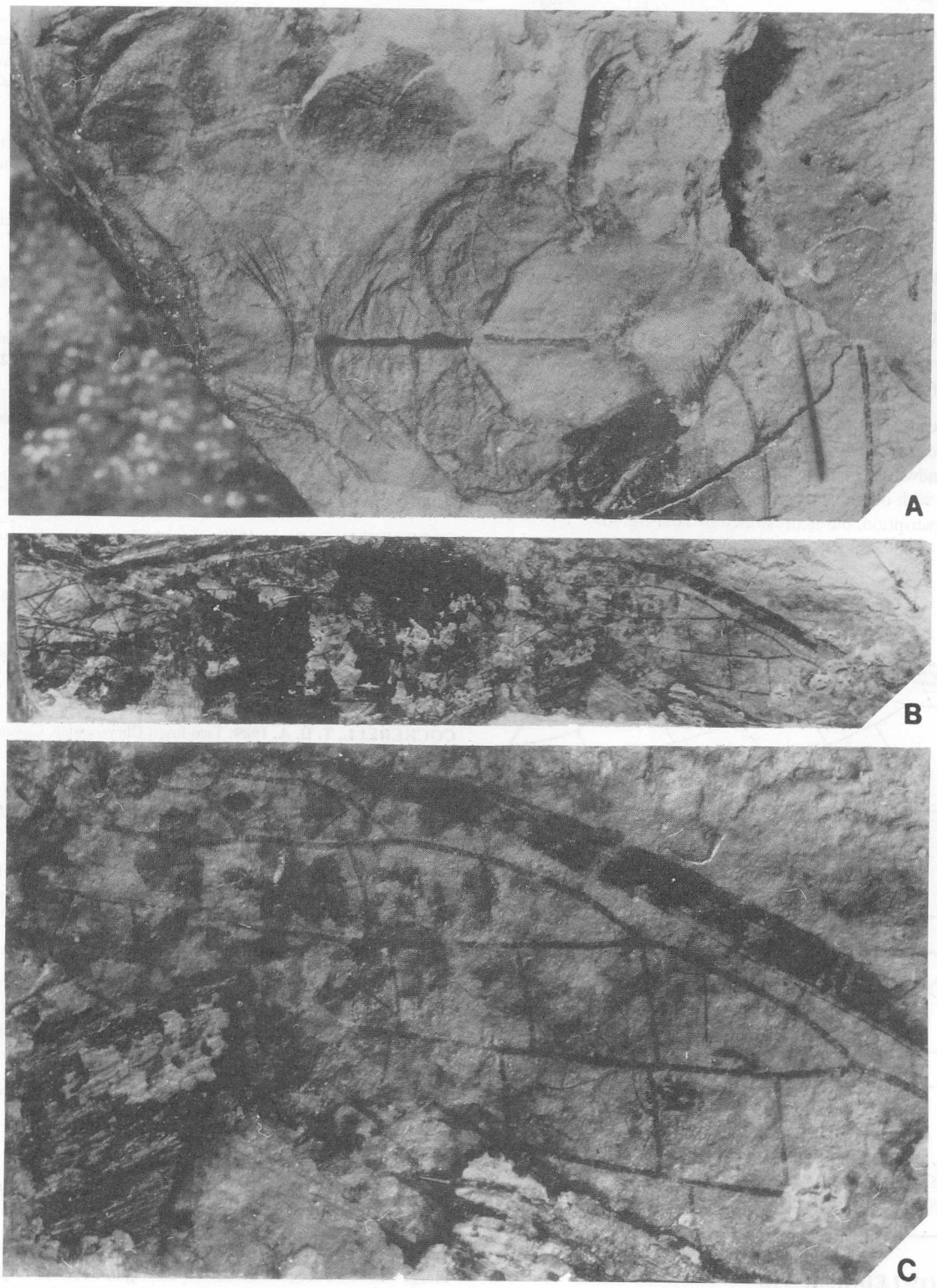



**Plate 2**

**A**: *Prosuhpalacsa biamoensis* gen. et sp. nov. Holotype, PIN 3429/304; Details of the thorax (?). x13.7.
**B-C:** *Oligogetes relictum gen.* et sp. nov. Holotype, PIN 3429/305. Basin of the Bikin River, Primorskiy Kray, Russian Far East. B: Whole specimen, x3.3; C: Forewing (?), x13.2.

***Oligogetes relictum* sp. nov.**

(Plate 2B, C; Text-fig. 4A, B)

**Etymology**: *relictum*, Latin for remainder.

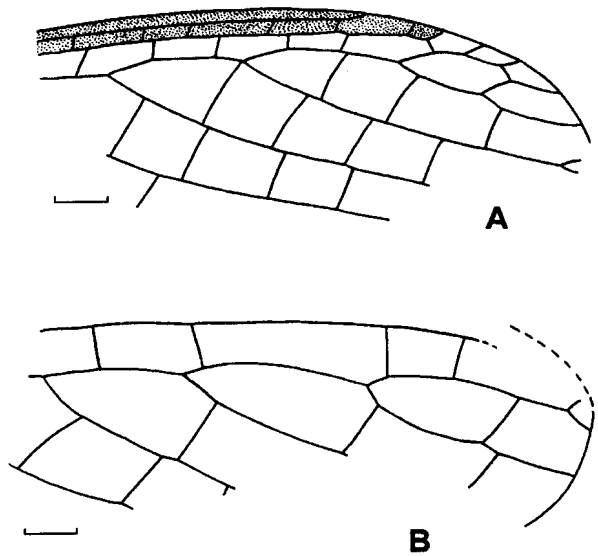
**Holotype**: Specimen PIN 3429/305 collected by V. V. Zherikhin in 1976, deposited in the Palaeontological Institute, Russian Academy of Sciences, Moscow; apical fragments of a fore and hindwing (?).

**Locality**: Upper reaches of the Barachek Stream, right tributary of the River Bolshaya Svetlovodnaya [formerly River Biamo], basin of the Bikin River, cental Sikhote-Alin Montains, Primorskiy Kray, Russian Far East (46° N, 138° E).

**Age**: Late Oligocene-Early Miocene.

**Description:** Forewing (?). Branches of Rs covered very densely with small 'pits' which are in a single row (about 40 'pits' per mm). Setae or hairs are absent. Maculation absent (except for pterostigma).

**Remarks**: One wing, probably a forewing, is separated from two overlapping wings, one of which is considered to be a hindwing. The latter is very poorly preserved and covered with debris and hence the hindwing (?) is not used in the description, but is illustrated in Text-fig. 4B.




**Text-fig. 4.** *Oligogetes relictum* gen. et sp. nov. Holotype, PIN 3429/305. Scale bars = 1mm.
A: Forewing (?); B: Hindwing (?).

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