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The first Permian representative of the family Xenopteridae (Orthoptera: Ensifera)

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ABSTRACT

A new genus and a new species, *Permoxenopterum laticostum* gen. et sp. n., are described from the Lopingian deposits of the Tarkastad Subgroup of the Beaufort Group in KwaZulu-Natal, South Africa. This genus is the most ancient representative of the Xenopteridae, which has been previously known from the Middle and Upper Triassic of Asia, Australia and South Africa. The systematic position of this genus within the family is briefly discussed.

KEY WORDS: Orthoptera, Xenopteridae, South Africa, Gondwana, Permian, Lopingian, new genus, new species.

INTRODUCTION

The family Xenopteridae was described by Riek (1955) for a tegmen from the Upper Triassic of Australia. This taxon was included by him in the order Orthoptera. In a book about phylogeny of orthopteroid insects (Sharov 1968), this family was synonymized with the Triassomantidae (Triassomanteidae *sensu* Sharov) described by Tillyard (1922) for another wing from Upper Triassic of Australia. In this book, Sharov included this family in the superfamily Oedischioidea Handlirsch, 1906 (Oedischiidea *sensu* Sharov) of the order Orthoptera. He described also three additional genera from the Middle–Upper Triassic of Central Asia. It is useful to mention that Tillyard originally included Triassomantidae in the former order Orthoptera *sensu lato* as he considered this family related to mantises (now the suborder Mantina in the order Dictyoptera), but Riek (1956) transferred the family to the order Orthoptera *sensu stricto* (in a recent volume), and Sharov (1962) first put this taxon in the order Protoblattodea (= Eoblattida; Rasnitsyn 2002).

Later Riek (1970) transferred Triassomantidae (but not Xenopteridae) to the order Paraplecoptera (= Grylloblattida; Storozhenko 2002), and Kevan (1977) agreed with the latter opinion by Riek and created a separate superfamily (Xenopteroidea) only for this family. This point of view was partly used by Gorochov (1989, 1995) who put Xenopteroidea (including Xenopteridae and Adumbratomorphidae Gorochov, 1987) in the infraorder Oedischiidea. He also described several additional genera from the Middle–Upper Triassic of Central Asia and divided Xenopteridae into three subfamilies (Xenopterinae, Ferganopterinae Gorochov, 1989 and Axenopterinae Gorochov, 2005) (Gorochov 1989, 2005). Wappler (2001) described the genus *Lutheria* from the Upper Triassic of South Africa, included it in the Xenopteridae and, in this way, first recorded this family (and the superfamily Xenopteroidea) for Africa.

The new find of the Xenopteridae in the Lopingian deposits shows that this group is distinctly more ancient, than was previously thought. The similarity of the new genus with the Triassic Xenopteridae is an additional support for the hypothesis about the Late Permian beginning of the Mesozoic stage in the evolution of Orthoptera, which

was made on the base of some previous finds of Triassic groups of Polyneoptera below the P/T boundary (Gorochov 2007).

The holotype was collected in a quarry in the town of Bulwer in KwaZulu-Natal and is deposited in the KwaZulu-Natal Museum, Pietermaritzburg, South Africa (NMSA). This locality has been very productive and has yielded numerous fossil insect taxa (van Dijk & Geertsema 2004; Sukatsheva *et al.* 2007; Rasnitsyn & Dijk 2011; and papers cited therein). The deposits are identified as the uppermost in the South African Permian (van Dijk 1997; Gastaldo *et al*. 2005). The stratigraphy and palaeoenvironment of this locality are discussed by Gastaldo *et al*. (2005).

TAXONOMY

Infraorder Oedischiidea Handlirsch, 1906
Superfamily Xenopteroidea Riek, 1955
Family Xenopteridae Riek, 1955
Subfamily Ferganopterinae Gorochov, 1989

Genus **Permoxenopterum** gen. n.

Etymology: From the Permian system and the genus *Xenopterum*. Neuter gender.

Type species: *Permoxenopterum laticostum* sp. n.

Diagnosis: Tegmen (fore wing) similar to that of *Ferganopterus* Sharov, 1968, *Pteroferganella* Gorochov, 1989 and *Pterofergánodes* Gorochov, 1989, in the presence of a widened central area completely limited in its distal half by parts of the following longitudinal veins: middle part of R before its bifurcation; short proximal parts of RS and $1MA_1$ before their fusion; short proximal part of MA_1 before bifurcation; middle part of MA before its division into MA_1 and MA_2. In other genera of Ferganopterinae, this area appears not to be completely limited to the distal half, as a short proximal part of $1MA_1$ before fusion with RS is indistinguishable from cross-veins (see illustrations in Sharov (1968) and Gorochov (1989)). However, in the new genus, the tegmen is distinguished from all three first-listed genera by the noticeably shorter both central area and proximal part of RS before fusion with $1MA_1$. This genus differs from members of the Xenopterinae and Axenopterinae in having the central area of the tegmen distinctly widened and $2MA_1$ not completely fused with RS.

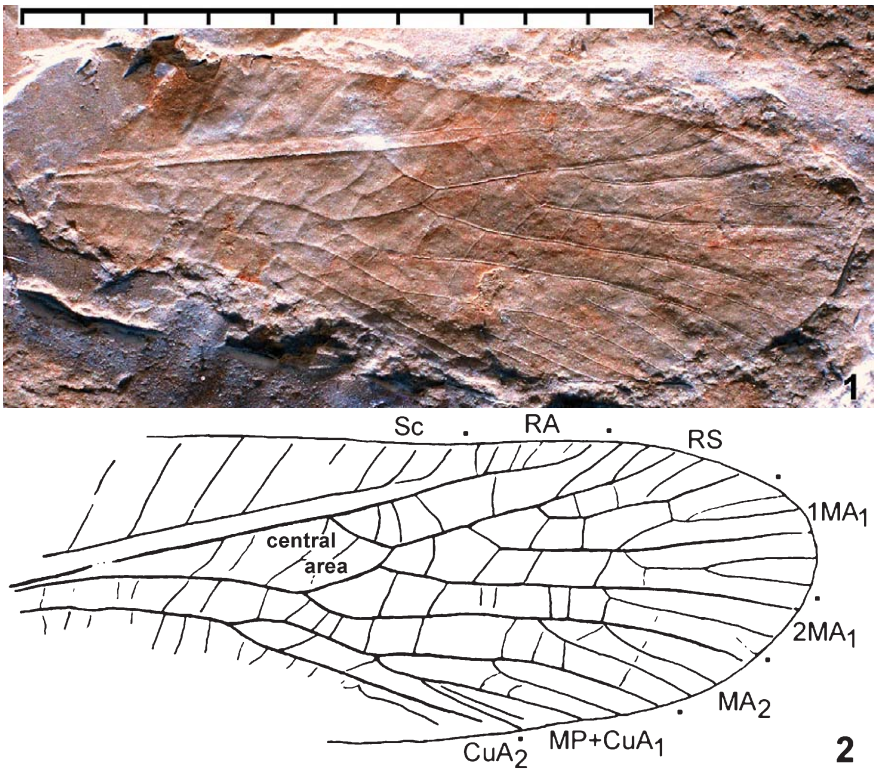
Permoxenopterum laticostum sp. n.

Figs 1, 2

Etymology: From Latin *latus* (wide) and *costa* (one of the insect wing veins).

Description:

Length of imprint 13 mm; presumed length of wing 14 mm. Costal area very wide, wider than central area; RA has six branches; RS has six branches (one with its base near middle of RS is part of $1MA_1$ perhaps having a few additional branches, and five other branches with bases in distal half of RS, which are possibly its true branches); short proximal part of $1MA_1$ not fused with RS; $2MA_1$ free and possibly with one additional branch; MA_2 with two such branches; $MP+CuA_1$ has four or five almost parallel branches ending well before apical part of wing; base of CuA_2 situated before bases of RS and MA_2; cross-veins in central area rather sparse (Figs 1, 2).



Figs 1, 2. Fore wing of *Permoxenopterum laticostum* gen. et sp. n., general appearance (1) and details of the wing venation (2). Scale in millimetres.

Holotype: NMSA 2732, positive imprint of isolated tegmen (fore wing) without basal part, colouration is not preserved. SOUTH AFRICA: *KwaZulu-Natal*: Bulwer Quarry (29.79953°S:29.78657°E); Lopingian, Lower Beaufort Group, Normandien Formation (Balfour Formation equivalent).

DISCUSSION

The new genus is related to the Triassic representatives of Xenopteridae as their tegmina have the following synapomorphies: tegmen is rather small (9–24 mm long); Sc ends well before the apical part of the tegmen; branches of RA are comb-like; proximal (free) part of MP is strongly reduced, indistinguishable from a cross-vein; branches of MP+CuA_1 are not numerous and occupy a rather narrow area; base of CuA2 is situated in the middle part of the tegmen, not very far from the RS base. These characters allow us to include *Permoxenopterum* in the family Xenopteridae.

Tegmen of this genus has the moderately short central area, which is more or less intermediate among those in three known subfamilies of Xenopteridae. If such a rather short area is presented in a general ancestor of all the known representatives of Triassic Xenopteridae, further evolution of this area might go by two different routes. It might be changed into a longer area characteristic of the Triassic Ferganopterinae or strongly reduced as a result of the shortening of RS proximal part and of its transformation into a vein almost indistinguishable from cross-veins (the latter process might have taken place twice, in the Xenopterinae and in Axenopterinae; Gorochov 2005).

Thus, this genus does not clearly belong to one of these subfamilies. However, it is reasonable at present to include it in the Ferganopterinae because of the absence of both the narrowing of the central area and the fusion of subproximal parts of $2MA_1$ and RS with each other in the tegmen. In this case, this subfamily may be considered a plesiomorphic group, ancestral for the Xenopterinae and Axenopterinae that have such a narrowing and fusion.

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