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AN UNUSUAL MAYFLY (INSECTA: EPHEMEROPTERA) FROM THE TRIASSIC OF SOUTH AFRICA

by

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ABSTRACT

An unusual mayfly from the Upper Triassic near Dordrecht in the Cape Province of South Africa is described as *Xenophlebia optata* gen. et sp. nov., and is ascribed to a new family, the Xenophlebiidae, as its sole representative.

INTRODUCTION

The classification of Recent Ephemeroptera is based, to a considerable extent, on structures other than the wings of the adults. However, the major groups (subfamilies and higher categories) of Recent Ephemeroptera can be defined on differences in venation, with the possible exception of a few Baetoidea (Ametropodidae and Metretopodidae) in which it is also necessary to know the structure of the adult tarsi, or the structure of the head of the nymph, to distinguish them from Heptageniidae.

The major trend in the wings of Ephemeroptera has been reduction in the size of the hind wing. The known Permian species and some early Mesozoic ones had a hind wing that was as long as and slightly broader than the fore wing. Reduction has culminated in the complete loss of the hind wing in the more specialised Recent species of a number of phyletic lines. In the initial stages of reduction of the hind wing, a complementary tornus, or obtuse angle, formed on the hind margin of the fore wing at a point about level with the apex of the hind wing. The tornus is situated between the two branches of the cubitus, except in the Baetiscidae. Even though the hind wing is relatively large in the Baetiscidae, which retain a very primitive wing venation, the tornus is in the anal field. The Baetiscidae is the only family in which CuA and CuP are subparallel and connected by simple cross veins for all or most of their length. In all other mayflies, the tornus, when present, is between the branches of Cu. As the hind wing is reduced, there is a greater complementary reduction in the length of CuP as compared with CuA so that the length of the wing margin occupied by the cubital field increases up to a point, and then remains relatively constant.

When the hind wing is very reduced or absent, the tornus is lost, and the hind margin of the fore wing is rounded, and slightly to markedly widened in the cubito-anal field. The base of the wing is markedly widened in Caenidae, Baetidae and Tricorythidae but it is not widened in Leptophlebiidae. The hind wings are not markedly reduced (or absent) in other Ephemeroptera. At no stage in the sequence of reduction do the two main branches of the cubitus become re-oriented and subparallel to one another as they are

in the Permian Misthodotidae and Recent Baetiscidae.

However, the fossil species under review from the Upper Triassic of southern Africa has a very reduced cubito-anal area, and the two branches of Cu are close and subparallel (and connected by a simple cross vein or veins). The tornus is lost but the wing is not widened at base. The cubito-anal field is markedly reduced and occupies only a minute area at the base of the wing.

Reduction in venation resulting in a long relatively narrow wing with a minute cubito-anal field (and a large MP field) had been unknown in any phyletic line, either fossil or Recent.

This very unusual mayfly, of which only the wing, almost certainly a fore wing, is known, is referred to a new superfamily without recognisable close phyletic relationship to any known Ephemeroptera.

SYSTEMATICS

SUPERFAMILY XENOPHLEBIOIDEA superfam. nov.

Diagnosis

Wing. Stem of Cu distinct to wing base, as in Permian Ephemeroptera, branching into CuA and CuP more basally than the thickened stem of the anal field. Basal thickened stem of anal field curved upwards, mainly at the cross connection between 1A and CuP; stem more similar to that in Recent than in Permian species. Rs appearing to arise as a forward branch of MA, and MP arising very close to the wing base, before the separation of Rs + MA from the stem of R, as in Recent Ephemeroptera. Bullae present, on Sc and the upper branch of Rs. Posterior branch of MP arising close to base, not deflected towards CuA close to its origin from the stem of MP, but more or less straight throughout its length.

Notes. The basal origins of the main veins are partly as in Recent Ephemeroptera and partly as in the Permian Proterisimatidae and Misthodotidae. The more or less straight posterior branch of MP is similar to that in Baetoidea, Heptagenioidea and Leptophlebioidea, as distinct from Ephemeroidea, but the triad is developed very close to the wing base, as in Ephemeroidea. The absence of cubital intercalary veins may be due entirely to the very marked reduction in the cubito-anal field of

the wing, and may not relate the group to the Baetiscidae in which this area of the wing is fully developed.

The absence of a tornus indicates that the hind wing was absent or minute, at least in the one known species. However, development of the hind wing is variable in Recent Ephemeroptera.

The superfamily represents a line of development distinct from any that lead to the Recent Ephemeroptera, in which such a marked reduction in the cubito-anal field is unknown.

One included family, from the Upper Triassic of southern Africa.

FAMILY XENOPHLEBIIDAE fam. nov.

Diagnosis

Wing. MP forming a simple triad, or at most with a tendency towards attached marginal intercalary veins. Without intercalary veins between MP and CuA. Without cubital intercalary veins (CuA and CuP connected by a simple cross vein or veins). CuP straight. Rs arising from close to wing base. Cross venation well developed. Wing without short marginal intercalaries.

One included genus.

Genus *Xenophlebia* gen. nov.

Etymology

Xenos = stranger, and phleps = vein, from the very unusual venation.

Type species

Xenophlebia optata sp. nov.

Diagnosis

Wing. Almost certainly fore wing: hind wing almost certainly absent. Tornus absent. Cubito-anal area minute. Triad on MA arising about middle of vein. Rs forking moderately close to origin, but about level with triad on MA. CuA and CuP very short, connected by only a basad cross vein. Three distinct anal veins, all minute, simple. MP with convex middle branch forking close to wing margin (possibly a variable character). Cross veins complete over whole wing, simple, except in part, close to margin. Cross veins simple in pterostigmatic area. Bulla on upper branch of Rs very close to origin of branch.

Xenophlebia optata sp. nov.

(Figures 1-3)

Type

C-Dt II 752 a, b and paratypes 754 a, b and 755 a, b, in Bernard Price Institute.

Type locality

Bird's River, Dordrecht, Eastern Cape Province. Molteno Formation. Upper Triassic.

Description

In Recent Ephemeroptera specific characters are recognised mainly in the terminalia which are unknown for the species.

Holotype

Fore wing, complete. Length *c.* 21 mm. Cross veins not appreciably closer in the pterostigmatic area than more basally and, thus, pterostigma not defined. Triad on MP arising from basal fork in vein. Bulla on upper branch of Rs at the level of the first cross vein to the basad triad. Short cross connection from CuA near its base to the stem of M before separation of MP. 1A very widely separated from CuP, with a strong cross connection appearing as an upward continuation of the stem of A. Only three anal veins, simple, the third very short.

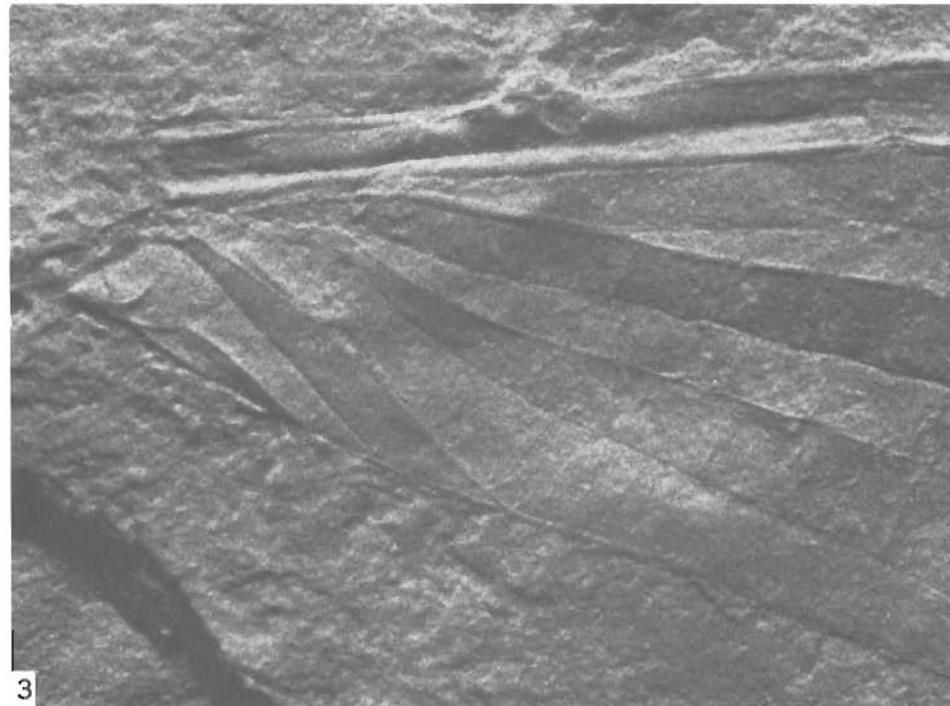
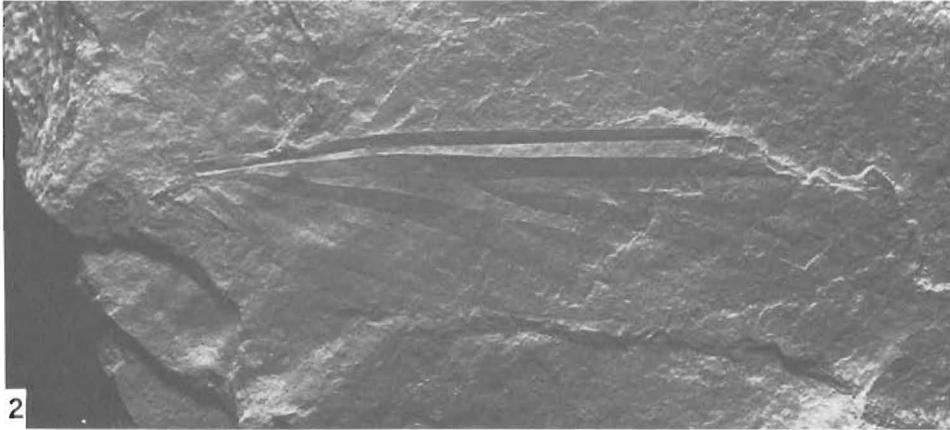
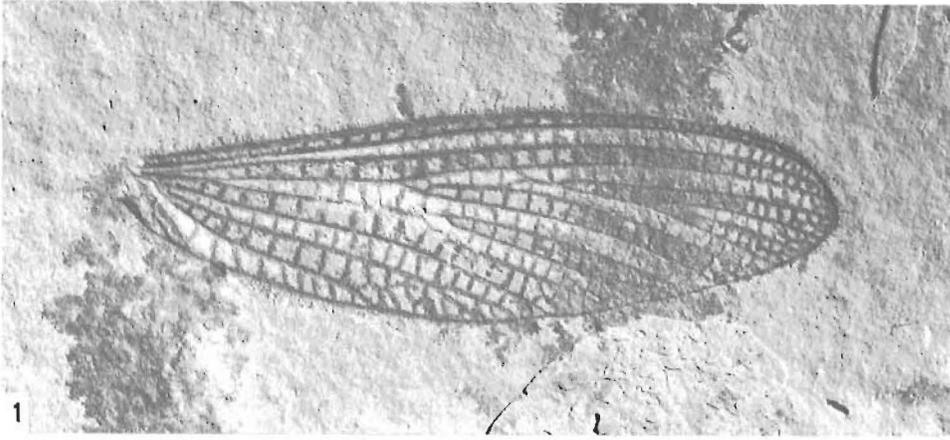
C-Dt II 754 a, b is a complete wing, slightly weathered and therefore the impression is pale but venation distinct, including basal swellings of the veins. Costal margin thickened at base. Humeral vein simple, humeral space not widened but rather long.

C-Dt II 755 a, b is the distal half of a wing from the bullae to apex. This wing is very slightly larger than the other two wings.

Note. The venation of the almost perfectly preserved holotype wing is accentuated by mineral staining.

ACKNOWLEDGEMENTS

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Figures 1-3. *Xenophlebia optata* gen. et sp. nov. 1. C-Dt II 752 a, reversed. 2. C-Dt II 754 b. 3. C-Dt II 754b. Base of wing enlarged.
(For size of specimens, see text.)