

***Grauvogelia arzvilleriana* sp. n. – the oldest *Diptera* species (Lower/Middle Triassic of France)**

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Abstract. The description of the oldest *Diptera* species, *Grauvogelia arzvilleriana* is given. The *Diptera* come from the Grés à Voltzia Formation (Late Upper Buntsandstein) of Arzviller (Moselle, France), which is of early Middle Triassic (Lower Anisian) age. Wing venation of a new species shows a peculiar mosaic of characters observed in different dipteran groups, with one special character, loop-like vein A2. New species is separated into a new family, *Grauvogeliidae*, and new infraorder, *Grauvogeliomorpha* (suborder: *Diarchineura*).

Key words: Middle Triassic, *Diptera*, *Diarchineura*, *Grauvogelia*, fossil, France.

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INTRODUCTION

The discoveries of the *Diptera* from the Permian were several times recorded (TILLYARD 1929, 1937; RIEK 1977; WILLMANN 1989).

However, all these fossils appeared eventually to belong in *Mecoptera* or *Paratrachoptera*. The *Diptera* described by ROHDENDORF (1962, 1964) from Issyk Kul as the Triassic ones, are now dated at the Lower Jurassic.

At present, the oldest known *Diptera* remain those described from the Upper Triassic of Australia (KOVALEV 1983) and North America (OLSEN et al. 1978; KRZEMIŃSKI 1992). Further records of the Middle Triassic *Diptera* were mentioned by KOVALEV (1983) from the Ferganskaya Valley (Asia), but their bad state of preservation did not allow any more detailed classification.

In the Triassic sediments of eastern France (Grés à Voltzia Formation; Late Upper Buntsandstein) an enormous collection of plant and animal fossils was collected by Louis

GRAUVOGEL in a time span of ca. 60 years, continued with J.-C. GALL since 1961. Among other insects, also the true *Diptera* were found which are at present the oldest representatives of this order, being dated at the beginning of the Middle Triassic – Upper Buntsandstein (GALL 1971; GRAUVOGEL-STAMM 1978). Here we present the species most abundantly represented and in the best condition.

SYSTEMATICS

Order: *Diptera*

Suborder: *Diarchineura*

Infraorder: *Grauvogeliomorpha* n. infr.

Family: *Grauvogeliidae* n. fam.

Genus: *Grauvogelia* n. gen.

Diagnosis of the new infraorder, new family and new genus is covered by that of the new species.

Grauvogelia arzvilleriana n. sp.

D i a g n o s i s . Small flies of 4-4.5 mm wing length. Venation: cross-vein *sc-r* in fork of *Rb*, just behind the sharp bending of this vein; five radial veins present, with *R2* short and terminating close to *R1* tip; four medial veins present; *d* cell small; *M1*+2 prolongating beyond *d* cell (i. e., *m1* cell with petiole); only one long anal vein present; *A2* loop-shaped.

T y p e g e n u s : *Grauvogelia*, monotypic, with *G. arzvilleriana* n. sp. from Lower/Middle Triassic (Upper Buntsandstein), Arzviller, France.

Origin of name: the new genus name is dedicated to Louis GRAUVOGEL in recognition of his merits in collecting and organizing this magnificent fossil material.

A new species name is derived from its locality, Arzviller.

D e s c r i p t i o n . Wing 4.6-4.8 mm long, rather broad (2.5 times as long as wide); *h* thick, conspicuous; *Sc* ending opposite cross-vein *r-m*, just beyond 1/2 of winglength; *sc-r* in *Rb* fork; five radial veins terminate in wing margin; *R2* very short, terminating close to *R1* tip; *R2*+3 long, ca. 3 times as long as *R2* and almost equal *Rs*; *R4*+5 equals

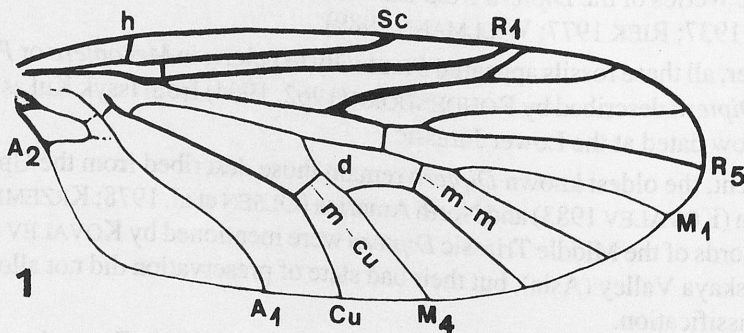


Fig. 1. Wing venation of *Grauvogelia arzvilleriana* sp. n. from the Lower/Middle Triassic of France.

1/3 of *Rs* length; *r-m* connecting midth of *R4+5* and 2/3 of *d* cell; four medial veins present, terminating in wing margin; *d* cell rather small (ca. 1/6 of winglength) and under the *Mb* level (i. e., first section of *M1+2* lies in the straight, direct prolongation of *Mb*); *M1+2* prolongating beyond *d* cell (= petiole of *m1* cell present); cross-vein *m-cu* in midth of *d* cell basal section; *A1* long, *A2* short, forming a loop at the wingbase.

Material examined. Holotype No. 5514 (+,-), (only wing preserved), beginning of Lower/Middle Triassic (Upper Buntsandstein); locality: Arzwiller. Coll. L. GRAUVOGEL & J.-C. GALL. Paratypes: No. 5490, 5491 (+,-); 5209, 5210 (+,-); 5910, 5911 (+,-). Housed in the Institut de Géologie de l'Université Louis Pasteur, 1 rue Blessig, 67984 Strasbourg, France.

Other material. Nos.: 4277 (+,-); 5296, 5297 (+,-); 5359; 5365; 5368; 5479, 5480 (+,-); 5481, 5482 (+,-); 5483, 5484 (+,-); 5485; 5487; 5492, 5493 (+,-); 5496; 5500; 5521; 5522; 5523, 5524 (+,-); 5525, 5526 (+,-); 5527, 5528 (+,-); 5920; 5921; 5929, 5930 (+,-); 5978, 5979 (+,-); 6166; 6265; 6366; 6399, 6400 (+,-); 6403; 6404; 6442, 6443 (+,-); 6459; 6460; 6524; 9064; 9065 (+,-); 9066, all housed in the same Institute.

Remarks. Five radial veins terminating in the Costa allow to place the new family in the suborder *Diarchineura*; however, the position of *sc-r*, petiolate *m1* cell, and above all, the unusual loop-shaped of second anal vein convinced us to separate the new family into a new infraorder, *Grauvogeliomorpha*.

DISCUSSION

Grauvogelia arzwilleriana sp. n. takes a very special position among all flies, fossil and Recent, known to date, being the oldest fly known and staying in close proximity to the beginning of the *Diptera* evolution. Numerous wings imprintings in very good condition allowed reconstruction of delicate cross-veins and venation of basal and anal field, the part most susceptible to damage in fossil state. The venation shows a surprising mosaic of features observed in different Recent groups of *Diptera*, some regarded primitive (as *Tanyderidae*) and other advanced (higher *Brachycera*):

1. Cross-vein *sc-r* is positioned just behind *h* vein (basal position), as for instance in some *Simuliidae*, *Mycetophilidae*, *Anisopodidae* or *Asilomorpha*, and not at the end of *Sc* (terminal position) as in the *Tanyderidae*, *Psychodidae* and some *Tipulomorpha*, nor in midth of *Sc*, as, for instance, in the *Trichoceridae*.

2. Five long radial veins terminate in wing margin; a character observed till now exclusively in the *Tanyderidae* and *Psychodidae* (suborder *Diarchineura* sensu KRZEMIŃSKI 1992). However, *Rs* leaves *Rb* shortly behind the sharp bending of this vein in the most basal part of wing. This is a feature present in the majority of so called higher *Brachycera*, while in the *Nematocera* and lower *Brachycera* *Rs* begins far beyond the bending of *Rb* (with exception for some *Eoptychopteridae*, *Dolichopodidae* and part of *Empididae*).

3. Venation of the medial field with the petiole of *m1* cell is typical of the entire *Polyneura* (*Trichoceridae*, *Limoniidae*, *Tipulidae* and *Cylindrotomidae*) and only exceptionally observed in several species of other dipteran groups, fossil (as: genus *Protychop-*

terina KALUGINA in *Eoptychopteridae*) and Recent (for instance, *Haruka* OKADA and *Pergatospes* KRIVOSHEINA & MAMAEV in *Cramptonomyiidae*).

4. Quite a new feature, never met till now in fossil or Recent *Diptera*, is a loop in anal field formed either by A2 vein, or resulting from the connection of two anal veins homologous to A2 and A3 of the *Mecoptera*. The importance of this vein to the discussion on the evolution of anal field in the *Diptera* needs further investigations of the remaining, separated by us *Diptera* from the GRAUVOGEL & GALL collection. However, the anal field of these fossils is not so clearly visible.

Being the oldest fly, *Grauvogelia arzvilleriana* sp. n. may represent a wing venation pattern most close to the earliest one in the *Diptera*. It differs from the hypothetical ground-plans proposed by HENNIG (1973), MCALPINE (1981) and WOOTTON & ENNOS (1989) in having the *sc-r* in basal part of wing and not at the tip of *Sc*.

In the radial field only five long radial veins are present, without the additional cross-vein *r-r* as in WOOTTON & ENNOS, op. cit.; this supports the known conception of *r-r* being derived from *R2*, which in the course of evolution took an upright position between *R1* and *R3*.

Considering A2, whatever explanations of its shape could be proposed, it seems at present that the second anal vein was originally a short one (plesiomorphic character, according to KRZEMIŃSKI 1992), and not a long one that became reduced in the course of evolution, as was proposed by all authors cited.

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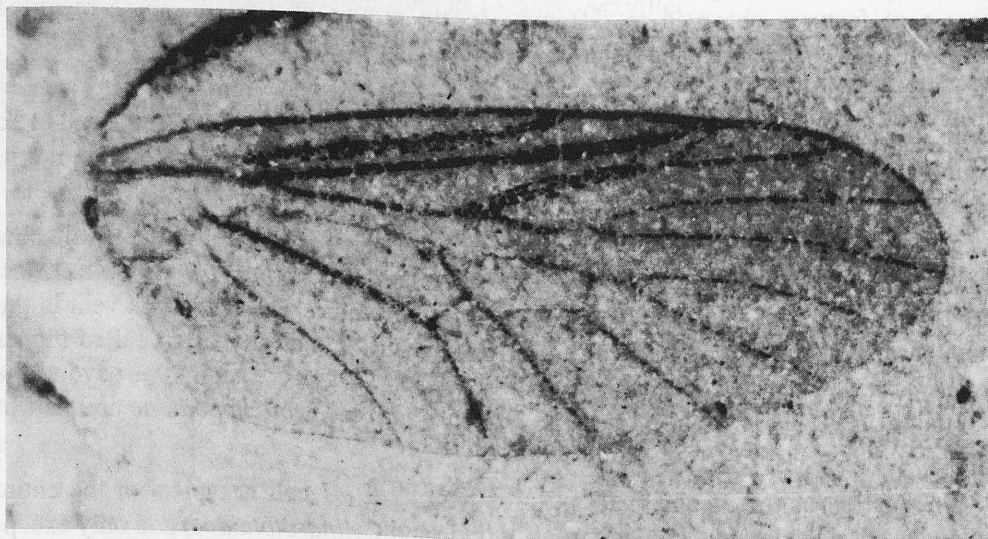


Fig. 2. *Grauvogelia arzvilleriana* sp. n. – wing.

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