A new stem Orthoptera (Archaeorthoptera: Oedischioidea) from the Early Permian of the Saar-Nahe basin, southwest Germany

André Nel, Markus Poschmann

► To cite this version:

André Nel, Markus Poschmann. A new stem Orthoptera (Archaeorthoptera: Oedischioidea) from the Early Permian of the Saar-Nahe basin, southwest Germany. *Geobios*, 2020, 63, pp.47-52. 10.1016/j.geobios.2020.10.001 . hal-03146600

HAL Id: hal-03146600

<https://hal.sorbonne-universite.fr/hal-03146600>

Submitted on 19 Feb 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

A new stem Orthoptera (Archaeorthoptera: Oedischiioidea) from the Early Permian of the Saar-Nahe basin, southwest Germany

André Nel^a, Markus J. Poschmann^b

^a*Institut de Systématique, Evolution, Biodiversité (ISYEB), Muséum national d'Histoire naturelle, CNRS, Sorbonne Université, EPHE, Université des Antilles, CP 50, 57 rue Cuvier, 75005 Paris, France. E-mail: anel@mnhn.fr*

^b*Generaldirektion Kulturelles Erbe RLP, Direktion Landesarchäologie/Erdgeschichte, Niederberger Höhe 1, D-56077 Koblenz, Germany; E-mail: markus.poschmann@gdke.rlp.de*

ABSTRACT

The new oedischiine *Palatinoedischia elongata* nov. gen., nov. sp. is described from the Early Permian of Germany. It is characterized by a very particular broad area between R+M+CuA and CuP of the tegmen. The possible closest relative is the genus *Plesioidischia*, also from the Early Permian of Germany. They possibly constitute their own clade, but a phylogenetic analysis is needed to clarify the whole superfamily Oedischiioidea.

Keywords: Insecta; Oedischiidae; *Palatinoedischia elongata* gen. et sp. nov.; Lower Rotliegend; Saar-Nahe basin.

1. Introduction

The Oedischiioidea Handlirsch 1906 is a rather diverse group of Orthoptera, currently known from the Late Carboniferous to the Early Jurassic. Its monophyly and limits, and the

composition of the different included families are questionable (Béthoux and Nel, 2002b: 224). A new phylogenetic analysis is needed to solve these important questions, crucial to clarify the phylogeny of the Orthoptera, because, depending on the authors, this superfamily is considered as belonging to the stem group of the Orthoptera or of the Ensifera. Also, depending on the authors (see fossilworks database), the Oedischiodea would comprise the Oedischiinae Handlirsch, 1906, Elcanoedischiinae Gorochov, 1987a, Mezenoedischiinae Gorochov, 1987a, Mesoedischiidae Gorochov, 1987b, Bintoniellidae Handlirsch, 1939, Proparagryllacrididae Riek, 1956, Pruvostitidae Zalesky, 1928 (= Pruvostitinae Zalesky, 1928, Sylvoedischiinae Gorochov, 1987a, Kamiinae Sharov, 1968, Kargalariinae Gorochov, 1995, Maculoedischiinae Gorochov, 1987a, Tettavinae Sharov, 1968), and the Tcholmanvissiidae Zalesky, 1934 (= Tcholmanvissiinae Zalesky, 1934, Tettoedischiinae Gorochov 1987a).

The Late Carboniferous oldest fossil Orthoptera are attributed to this superfamily. It greatly diversified during the Permian. Depending of the confirmation of its monophyly, this superfamily survived the Permian-Triassic mass extinction.

It is also important to better define the limits and Permian diversity of this group through a phylogenetic analysis, in order to estimate the evolutionary changes that could have occurred during the Carboniferous, Permian, and Triassic.

Here we describe a new Early Permian fossil from the Saar-Nahe basin in southwest Germany that belongs to this group but shows some very particular forewing venational structures.

2. Material and methods

The specimen has been found by one of us (MJP) at a locality situated between the villages of Sitters and Schiersfeld in the Moschelbach valley/Rhineland-Palatinate (Fig. 1). Poschmann and Schindler (2004) described a nearby situated locality “Sitters”, which is slightly

51 older than the one that yielded the present specimen. The fossil described here originates from
52 the younger “Niedermoschel black shale” sensu Schindler (1997), stratigraphically belonging
53 to the informal unit M5 of the Jeckenbach Subformation, Meisenheim Formation, Glan
54 Subgroup of the Lower Rotliegend (Boy et al., 2012, Fig. 1).

55 The Niedermoschel black shale is known since the early 20th century (Reis, 1913). Schindler
56 (1997) characterized it in a stratigraphical context and Poschmann and Schindler (1997)
57 described this unit in terms of lithology and palaeoecology. The type locality yielded plant
58 remains (Uhl, 2008), a variety of vertebrates (e.g., Hampe, 1996, Poschmann and Schindler,
59 1997) such as fishes and rare branchiosaurs. It is extraordinary for the rich occurrence of
60 arthropods such as ostracods, spinicaudatans, syncarid crustaceans (Uhl, 1999), xiphosurids
61 (Malz and Poschmann, 1993), and insects (Hörschemeyer, 1999). The terrestrial insect
62 remains were introduced into a lacustrine environment influenced by deltaic input and comprise
63 a large number of lemmatophorids, Blattinopsidae (Hörschemeyer and Stapf, 2001), and
64 Miomoptera (Hörschemeyer, 1999; Brauckmann, 2007). Most of the insect fossils are wings
65 less than two centimeters long. An exceptionally preserved stem orthopteran, *Nosipteron*
66 *niedermoschelensis* Béthoux and Poschmann, 2009, has also been described from there. The
67 new locality near Sitters, which yielded the stem orthopteran described herein, shows
68 essentially the same suite of fossils encompassing plant remains, fishes, conchostracans,
69 xiphosurids, and insects. No detailed scientific exploration is available as yet. The sediments at
70 both localities show contact-metamorphism, which greatly enhanced the recognizability of the
71 insect remains as they appear as shiny, silvery fossils on the dark, gray-bluish matrix
72 (Montenary and Uhl, 2005 concerning preservation).

73 In fact, the Early Permian insects from “Odernheim town site” described by Prokop et
74 al. (2012) originate from various localities in the Rotliegend of the Saar-Nahe basin (K.-D.
75 Weiß, pers. comm.). Some of these may originate from the Niedermoschel black shale as well.

The specimen was prepared using pneumatic chisels and studied under a Leica MZ 7.5 binocular microscope. It was coated with MgO, photographed using a Canon 600D digital camera equipped with a canon EFS 60mm macro lens and drawn using a Leica drawing tube attached to the microscope. Photographs with differing planes of focus were stacked into a composite with enhanced depth of field using the free software CombineZP by Alan Hadley. We follow the classification and wing venation terminology of Béthoux and Nel (2002a) and Schubnel et al. (2020) for the Archaeorthoptera. Abbreviations: C costa; ScA subcosta anterior; ScP subcosta posterior; RA radius anterior; RP radius posterior; MA median anterior; MP median posterior; CuA cubitus anterior; CuP cubitus posterior; PCu postcubital vein; AA anal veins.

urn:lsid:zoobank.org:pub:F2195993-BA7A-4BC3-8342-EF6E6AEEB13E

3. Systematic palaeontology

Clade Archaeorthoptera Béthoux and Nel, 2002

Order Orthoptera Olivier, 1789

Superfamily Oedischiioidea Handlirsch, 1906

Family Oedischiidae Handlirsch, 1906

Subfamily Oedischiinae Handlirsch, 1906

Genus *Palatinoedischia* nov.

urn:lsid:zoobank.org:act:066637A2-A1FE-43E0-9D3B-6E969F85CE7C

Derivation of the name: Named after the Palatinate, the region where the type locality is, and *Oedischia*. Gender feminine.

Type species: *Palatinoedischia elongata* nov. gen., nov. sp.

Diagnosis: Tegmen characters only. Tegmen narrow elongate; a well-defined vein ScA; veins in area between ScA and ScP all simple and straight; ScP with short branches; distal anterior

branches of RA short; two to four rows of irregular cells in very broad area between R+M+CuA and CuP, much broader than that between M and CuA+CuPa α ; anterior branch MA1 of MA shortly connected to RP; two branches of MA basal of MA1; basal part of CuA elongate; CuPa β ‘rudimentary’ near its base, partly ‘lost’ in a net of irregular cells; no supplementary independent branch basal to fusion of CuPa α with CuA.

Palatinoedischia elongata nov. gen., nov. sp.

Figs 2, 3

urn:lsid:zoobank.org:act:A73201ED-ADFC-418D-A64E-DE1ACD0E2C7F

Derivation of the name: Named ‘*elongata*’ after the narrow elongate tegmen.

Holotype: PE 2018/5000-LS, State Collection of Natural History of Rhineland-Palatinate, Mainz (original collector’s number 751-P; see Brauckmann, 2007). Part and counterpart of a nearly complete forewing, very well-preserved with only extreme base and parts of costal and posterior margins missing.

Type horizon and locality: Early Permian, Lower Rotliegend, Meisenheim Formation, Jeckenbach Subformation, Niedermoschel black shale (sensu Schindler, 1997), probably Asselian–?Sakmarian (Schneider and Werneburg, 2012, Schneider et al., 2020); Saar-Nahe Basin south of Sitters, Germany.

Diagnosis: As for the genus by monotypy.

Description: Tegmen 62.3 mm long, 10.7 mm wide, rather narrow elongate and slightly falcate; a well-defined ScA, 10.6 mm long; area between C and ScA poorly preserved, ca. 1.4 mm wide; crossveins between ScA and ScP simple, straight and short, perpendicular to ScP and ScA, those between ScP and C poorly preserved, but apparently also short; area between costal margin and ScP ca. 1.7 mm wide; base of RP 27.0 mm distal of wing base; ScP and R+(M+CuA) well separated, 1.2 mm apart with numerous straight crossveins in between; ScP

probably ending in C; presence of a basal common stem R+M+CuA but R and M+CuA separating close to wing base, with a 0.7 mm wide area in-between at level of separation of M with CuA; RA convex, simple, with a narrow distal area with short veinlets between it and C; broad area between RA and RP with strongly curved crossveins, 2.6 mm wide; RP rather concave; distance between its base and point of fusion with MA1 7.3 mm; RP+MA1 0.8 mm long; MA1 long and straight, with an apical fork; RP with five branches; CuA separated from M in basal third of wing, at 13.8 mm from wing base; basal stem of M very short, 0.6 mm long; neutral MA with three distal branches, most basal one simple, second forked; and third (MA1 ending into RP and separating again distally; concave MP simple; CuA fused with CuP α 2.5 mm of its base; CuA+CuP α posteriorly pectinate, with three visible branches; CuPa long basal of its fusion with CuA, 4.7 mm long; CuPa β simple, well discernible as a vein distinctly wider than crossveins at its base, but poorly defined distally and partly lost in an irregular net of cells in a broad area between CuA+CuP α and CuPb; division of CuP into CuPa and CuPb 10.6 mm from wing base; CuPb simple; PCu and two anal veins, all simple; area between R+M+CuA and CuP very broad, 2.9 mm wide, with a net of 3-4 rows of irregular cells in-between.

4. Discussion

This forewing corresponds to that of a clade Panorthoptera Crampton, 1928 sensu Béthoux and Nel (2002a: 27) because of the following synapomorphies: CuPa differentiated into two branches (CuP α and CuP β) just basal of the fusion of the anterior one (CuP α) with CuA (synapomorphy of Panorthoptera); ScP probably reaching anterior wing margin and not RA; MA1 and MA2 can be differentiated; CuA+CuP α with at least two posterior branches; CuPb simple. *Palatinoedischia* nov. gen. shares with the Orthoptera (sensu Béthoux and Nel, 2002a: 38-39) the MA forked; MP, CuP β , CuPb, and PCu simple.

Nevertheless, the vein CuPa β is ‘rudimentary’ near its base, partly ‘lost’ in a net of irregular cells. Similar ‘aberrant’ situations can occur for some other Permian Orthoptera, e.g., ‘*Tettoedischia minuta* Sharov, 1968, undoubtedly closely related to *Macroedischia* within Tettoedischiinae, has a free and simple CuPa α , without any clear anterior branch reaching CuA’; Béthoux and Nel, 2002b: 224). A similar situation occurs in the panorthopteran family Geraridae Scudder, 1885 (Béthoux and Nel, 2003). The pattern of venation fits quite well with those of the Oedischiinae, in the presence of a well-defined vein ScA, a series of regular crossveins in subcostal area and area between ScP and R/RA, ScP and RA well separated, broad areas between RA and RP and between R/RP and MA, and basal fork of M very close to point of separation between M and CuA. We consider that the venation of *Palatinoedischia* nov. gen. is compatible with an attribution to the Orthoptera.

Palatinoedischia nov. gen. has two to four rows of irregular cells in the area between R+M+CuA and CuP, while nearly all the described Oedischioidea have a distinctly narrower area with one row of cells. A similar situation occurs in *Gerarus* Scudder, 1885. *Palatinoedischia* nov. gen. strongly differs from the Geraridae in the simple MP and CuPb, narrow elongate tegmen, and very short stem of M (Béthoux and Nel, 2003).

Also, affinities with the Tcholanvissiidae sensu Béthoux and Nel (2002b) are excluded because *Palatinoedischia* nov. gen. has an anterior branch of MA ending into RP, and no supplementary independent branch basal to fusion of CuPa α with CuA. The Bintoniellidae and the Proparagryllacrididae also have no anterior branch of MA ending into RP (Riek, 1955, 1956, 1976; Sharov, 1968; Gorochoy, 1987b, 1989, 2013; Béthoux and Beckemeyer, 2007).

The Mezenoedischiinae have a narrow area between MP and the anterior stem of CuA + CuPa α , and the presence of only one branch of MA posterior to base of MA1, unlike two in *Palatinoedischia* nov. gen. (Carpenter, 1966; Sharov, 1968; Gorochoy, 1987a; Béthoux et al., 2002; Béthoux and Beckemeyer, 2007). The Elcanoedischiinae (*Kansaoedischia* Gorochoy

175 1987a, *Elcanoedischia* Gorochov 1987a, *Metoedischia* Martynov 1928); and the
176 Sylvoedischiinae (*Stenoedischia* Gorochov 1987a, *Sylvoedischia* Sharov 1968) differ from
177 *Palatinoedischia* nov. gen. in the presence of only one branch of MA posterior to base of MA1
178 (Martynov, 1928; Sharov, 1968; Gorochov, 1987a). The Sylvoedischiinae also have broader
179 tegmina compared to their length. The Pruvostitidae have ScP with longer branches than in
180 *Palatinoedischia* nov. gen., and either only one branch of MA posterior to base of MA1 and/or
181 a long basal stem of M before its separation into MA and MP, and/or no fusion between anterior
182 branch of MA and RP, unlike *Palatinoedischia* nov. gen. (Zalessky, 1929; Gorochov, 1987a,c,
183 2013). The Mesoedischiidae also have a long stem of M (Sharov, 1968; Gorochov, 2005).

184 The Oedischiinae Handlirsch, 1906 have a short stem of M as in *Palatinoedischia* nov.
185 gen. *Oedischia* Handlirsch, 1906 has only one branch of MA posterior to base of MA1 (Sharov,
186 1968). *Sinoedischia* Hong, 1985 has such two branches, but the basal half of the tegmen is not
187 preserved, so that the length of basal part of M and the pattern of the cubital veins are unknown,
188 rendering the position of this taxon uncertain (Hong, 1985: figs 29-30). *Anhomalophlebia*
189 Handlirsch, 1919 has a basal stem of M longer than in *Palatinoedischia* nov. gen. and no fusion
190 of a branch of MA with RP (see figure in the internet site
191 <http://mediaphoto.mnhn.fr/media/14986360852690vFhvxWDuH8srHmM>).

192 *Afroedischia* Geertsema and van Dijk, 1999 has a very long stem of M, and no fusion of a
193 branch of MA with RP (Geertsema and van Dijk, 1999: figs 1-2). *Anelcana* Carpenter, 1986
194 (replacement name for *Parelcana* Carpenter, 1966) differs from *Palatinoedischia* nov. gen. in
195 the area between ScA and ScP quite narrow, a very short basal part of CuA and a short CuPaß
196 (Carpenter, 1966: fig. 19). *Kamaites* Zalessky, 1929 is based on a very incomplete wing not
197 showing the essential structures to be compared to the other Orthoptera (Zalessky, 1929: fig. 9).
198 *Nobloedischia* Beckemeyer, 2011a differs from *Palatinoedischia* nov. gen. in the presence of
199 only one branch of MA posterior of MA1, presence of long anterior branches of RA, narrower

areas between R+M+CuA and CuP and between CuPa and CuPb (Beckemeyer, 2011a: figs 1-3). *Scalaeoptera* Bolton, 1922 is based on a very fragmentary tegmen, impossible to compare to the other Paleozoic Orthoptera (Bolton, 1922: fig. 27). *Xeroptera* Bolton, 1922 is also based on an incomplete tegmen; it possibly does not belong to the Archaeorthoptera but to a very different group, the Paoliida (sensu Prokop et al., 2014), because it has a series of anterior branches of CuA, a rather broad area between CuA and CuP, and apparently no branches of CuP ending into CuA (Bolton, 1922: fig. 26). This taxon needs to be revised. *Loxoedischia* Beckemeyer, 2011b shares many characters with *Palatinoedischia* nov. gen. in the pattern of the veins Cu and M, ScP and ScA. Nevertheless, it has anterior branches of RP, no branch of MA ending into RP (Beckemeyer, 2011b: fig. 1).

The tegmen of *Plesioidischia baentschi* Schlechtendal, 1906 (in Handlirsch, 1906) from the upper Meisenheim or Disibodenberg Formation of Nonnweiler near Birkenfeld/Nahe, revised by Guthörl (1934: fig. 58), greatly resembles that of *Palatinoedischia* nov. gen., with only the following differences: the area between R+M+CuA and CuP is only slightly wider than that between M and CuA+CuPa α , the veins in area between ScA and ScP are clearly irregular while they are all simple and straight in *Palatinoedischia* nov. gen. Bolton (1922: 92-93, text-fig. 29, pl. 6, fig. 3) described and figured a *Plesioidischia* sp. from the ‘Middle Coal Measures (binds between ‘Brooch’ and ‘Thick’ coals); Tipton, Staffs’ in UK. This fossil is the basal third of a tegmen, but it does not show the broadened area between R+M+CuA and CuP of *Plesioidischia baentschi*. It probably corresponds to a different genus; we consider it as an *Oedischioidea incertae sedis*.

5. Conclusion

Palatinoedischia nov. gen. does not fit with any of the described *Oedischioidea*. It seems to be close to *Plesioidischia baentschi* because of the great similarities in the wing venations.

Plesioidischia is also known from the early Permian of Germany, but the new fossil clearly corresponds to a different genus and species. Both could belong to the same clade, characterized by the broadened area between R+M+CuA and CuP. We provisionally attribute it to the Oedischiinae, but a phylogenetic analysis of the whole Oedischioidea is necessary to clarify the relationships and definitions of its different components. The monophyly of the whole group and its components are questionable. Thus the comparison of any new taxon to the different families and genera can only be based on similarities and not on well-defined synapomorphies.

Acknowledgements

We sincerely thank two anonymous referees for the useful comments on the first version of the paper. MJP thanks Dr. Thomas Schindler (Spabrücken) for joint fieldwork, Sabine Treptow (Waldesch) for help with graphics, and Klaus-Dieter Weiß (Fischbach) for useful hints.

References

- Beckemeyer, R.J., 2011a. *Nobloedischia rasnitsyni*, a new genus and species of Oedischiidae (Orthoptera) from the Lower Permian Wellington Formation of Oklahoma, USA. In: Shcherbakov, D.E., Engel, M.S., Sharkey, M.J. (eds). Advances in the systematics of fossil and modern insects: Honouring Alexandr Rasnitsyn. ZooKeys 130, 103–110.
- Beckemeyer, R.J., 2011b. A new genus and species of Orthoptera from the Lower Permian Wellington Formation of Noble County, Oklahoma, USA. Transactions of the Kansas Academy of Science 114, 88–94.
- Béthoux, O., Beckemeyer, R.J., 2007. New and rare insect species from the Wellington Formation (Orthoptera, Grylloblattodea; Lower Permian, USA). Alavesia 1, 49–61.
- Béthoux, O., Nel, A., 2002a. Venation pattern and revision of Orthoptera sensu nov. and sister groups. Phylogeny of Palaeozoic and Mesozoic Orthoptera sensu nov. Zootaxa 96, 1–88.

250 Béthoux, O., Nel, A., 2002b. New data on Tcholmanvissiidae (Orthoptera; Permian). Journal
 251 of Orthoptera Research 11, 223–235.

252 Béthoux, O., Nel, A., 2003. Wing venation morphology and variability of *Gerarus fischeri*
 253 (Brongniart, 1885) sensu Burnham (Panorthoptera; Upper Carboniferous, Commeny, France),
 254 with inferences on flight performance. Organisms Diversity and Evolution 3, 173–183.

255 Béthoux, O., Nel, A., Gand, G., Lapeyrie, J., Galtier, J., 2002. Discovery of the genus *Iasvia*
 256 Zalesky, 1934 in the Upper Permian of France (Lodève basin) (Orthoptera: Ensifera:
 257 Oedischiidae). Geobios 35, 293–302.

258 Béthoux, O., Poschmann, M., 2009. A new lobeatid insect from the Permo-Carboniferous of
 259 Niedermoschel, southwestern Germany (Archaeorthoptera). Journal of Orthoptera Research 18,
 260 139–143.

261 Bolton, H., 1922. A monograph of the fossil insects of the British coal measures.
 262 Palaeontographical Society Monograph, London 74, 81–156.

263 Boy, J.A., Haneke, J., Kowalczyk, G., Lorenz, V., Schindler, T., Stollhofen, H., Thum, H.,
 264 2012. Rotliegend im Saar-Nahe-Becken, am Taunus-Südrand und im nördlichen
 265 Oberrheingraben. In: Deutsche Stratigraphische Kommission (eds.) Stratigraphie von
 266 Deutschland X. Rotliegend. Teil I: Innervariiscische Becken. Schriftenreihe der Deutschen
 267 Gesellschaft für Geowissenschaften 61, 254–377.

268 Brauckmann, C., 2007. Die Insekten im Permokarbon des Saar-Nahe-Beckens. In: Schindler,
 269 T., Heidtke, U.H.J. (eds.) Kohlesümpfe, Seen und Halbwüsten. Dokumente einer rund 300
 270 Millionen Jahre alten Lebewelt zwischen Saarbrücken und Mainz. POLLICHIA
 271 Sonderveröffentlichung 10, 170–196.

272 Carpenter, F.M., 1966. The Lower Permian insects of Kansas. Part 11. The orders
 273 Protorthoptera and Orthoptera. Psyche 73, 46–88.

274 Carpenter, F.M., 1986. Substitute names for the extinct genera *Cycloptera* Martynova
275 (Mecoptera) and *Parelcana* Carpenter (Orthoptera). *Psyche* 93, 375–376.

276 Crampton, G.C., 1928. The grouping of the insect orders and their lines of descent. *The*
277 *Entomologist* 61, 82–85.

278 Geertsema, H., Van Dijk, D.E., 1999. The earliest known Palaeozoic ensiferan insect from
279 Africa, *Afroedischia oosthuizeni* gen. et sp. n. (Orthoptera: Oedischiidae). *South African*
280 *Journal of Science* 95, 229–230.

281 Gorochov, A.V., 1987a. Permian Orthoptera of the infraorder Oedischiidea (Ensifera).
282 *Paleontological Journal* 21, 65–75.

283 Gorochov, A.V., 1987b. New fossil orthopterans of the families Bintoniellidae, Mesodischiidae
284 fam. n. and Pseudoelcanidae fam. n. (Orthoptera, Ensifera) from Perm and Triassic deposits of
285 the USSR. *Vestnik Zoologii* 25, 18–23. [in Russian, with English summary.]

286 Gorochov, A.V., 1987c. New fossil orthopterans of the families Adumbratomorphidae fam. n.,
287 Pruvostitidae and Proparagryllacrididae (Orthoptera, Ensifera). *Vestnik Zoologii* 25, 20–28. [in
288 Russian, with English summary.]

289 Gorochov, A.V., 1989. New taxa of the orthopteran families Bintoniellidae, Xenopteridae,
290 Permelcanidae, Elcanidae and Vitimiidae (Orthoptera, Ensifera). *Vestnik Zoologii* 27, 20–27.
291 [in Russian.]

292 Gorochov, A.V., 1995. Sistema i evolyutsiya pryamokrylykh podotryada Ensifera (Orthoptera)
293 [System and Evolution of the suborder Ensifera (Orthoptera).] Parts 1 and 2. *Trudy*
294 *Zoologicheskogo Instituta* [Russian Academy of Sciences, Proceedings of the Zoological
295 Institute] 260, 3–224 + 261: 3–212. [in Russian]

296 Gorochov, A.V., 2005. Review of Triassic Orthoptera with descriptions of new and little known
297 taxa: part 1. *Paleontological Journal* 39, 178–186.

298 Gorochov, A.V., 2013. New taxa of the superorder Orthopteroidea from the latter half of the
 299 Permian of European Russia. *Paleontological Journal* 47, 782–793.

300 Guthörl, P., 1934. Die Arthropoden aus dem Karbon und Perm der Saar-Nahe-Pfalz-Gebietes.
 301 *Abhandlungen des Koenigliche Preussichen Geologische Landesanstalt (N.F.)* 164, 48–178.

302 Hampe, O., 1996. Dermal Skelettelemente von *Lissodus* (Chondrichthyes: Hybodontoida)
 303 aus dem Unterperm des Saar-Nahe-Beckens. *Paläontologische Zeitschrift* 70, 225–243.

304 Handlirsch, A., 1906-1908. Die fossilen Insekten und die Phylogenie der rezenten Formen. Ein
 305 Handbuch für Paläontologen und Zoologen, 1430 pp.

306 Handlirsch, A., 1919. Revision der paläozoischen Insekten. *Denkschriften der Kaiserlichen*
 307 *Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse* 96, 511–592.

308 Handlirsch, A., 1939. Neue Untersuchungen über die fossilen Insekten mit Ergänzungen und
 309 Nachträgen sowie Ausblicken auf phylogenetische, paläogeographische und allgemeine
 310 biologische Probleme. Teil 2. *Annalen des Naturhistorischen Museums in Wien* 49, 1–240.

311 Hörnschemeyer, T., 1999. Fossil insects from the Lower Permian of Niedermoschel
 312 (Germany). AMBA projects AM/PFICM98/1.99. *Proceedings of the First International*
 313 *Palaeontomological Conference, Moscow 1998*, 57–59.

314 Hörnschemeyer, T., Stapf, H., 2001. Review of Blattinopsidae (Protorthoptera) with description
 315 of new species from the Lower Permian of Niedermoschel (Germany). *Neues Jahrbuch für*
 316 *Geologie und Paläontologie Abhandlungen* 221, 81–109.

317 Hong, Y.-c., 1985. [Insecta] pp. 489–510. In: [Palaeontological atlas of North China. 1.
 318 Paleozoic volume.] (ed. Tianjing Institute of Geology and Mineral Resources). Geological
 319 Publishing House, Beijing. [in Chinese.]

320 Malz, H., Poschmann, M., 1993. Erste Süßwasser-Limuliden (Arthropoda, Chelicerata) aus
 321 dem Rotliegenden der Saar-Nahe-Senke. *Osnabrücker naturwissenschaftliche Mitteilungen* 19,
 322 21–34.

323 Martynov, A.V., 1928. Permian fossil insects of North-East Europe. Trudy Geologicheskogo
324 Muzeya Akademii nauk SSSR [Travaux du Musée Géologique près l'Académie des Sciences
325 de l'URSS] 4, 1–118.

326 Montenari, M., Uhl, D., 2005. Mikroanalytische und rasterelektronenmikroskopische
327 Untersuchungen zur Taphonomie von Arthropoden in „kontaktmetamorphen“ Sedimenten –
328 Erste Ergebnisse. Mitteilungen der Pollichia 91, 13–20.

329 Olivier, G.A., 1789. Encyclopédie Méthodique. Histoire naturelle, Tome Quatrième, Insectes,
330 1–331.

331 Poschmann, M., Schindler, T., 1997. Ein Neufund von *Fayolia* sp. (Chondrichthyes: Hai-
332 Eikapsel) mit paläoökologischen Anmerkungen zum Fundhorizont (Niedermoschel-Bank,
333 Unteres Rotliegend; Saar-Nahe-Becken). Mainzer geowissenschaftliche Mitteilungen 26, 25–
334 36.

335 Poschmann, M., Schindler, T., 2004. Sitters and Grügelborn, two important Fossil-
336 Lagerstaetten in the Rotliegend (?Late Carboniferous – Early Permian) of the Saar-Nahe Basin
337 (SW-Germany), with the description of a new palaeoniscoid (Osteichthyes, Actinopterygii).
338 Neues Jahrbuch für Geologie und Paläontologie Abhandlungen 232, 283–314.

339 Prokop, J., Krzeminski, W., Krzeminska, E., Hörnschemeyer, T., Ilger, J.-M., Brauckmann, C.,
340 Grandcolas, P., Nel, A., 2014. Late Palaeozoic Paoliida is the sister group of Dictyoptera
341 (Insecta: Neoptera). Journal of Systematic Palaeontology 12, 601–622.

342 Prokop, J., Weiß, K.-D., Dechambre, R.-P., Nel, A., 2012. Early Permian insects from Saar-
343 Nahe Basin of Odernheim town site, Rheinland-Pfalz in Germany (Insecta, Grylloblattida,
344 Blattinopseida). Geodiversitas 34, 271–281.

345 Reis, O.M., 1913. Über einige im Unter- und Oberrotliegenden des östlichen Pfälzer Sattels
346 gefundene Tierreste. Geognostische Jahreshefte 25, 237–254.

347 Riek, E.F., 1956. A re-examination of the mecopteroid and orthopteroid fossils (Insecta) from
 348 the Triassic beds at Denmark Hill, Queensland, with descriptions of further specimens.
 349 Australian Journal of Zoology 4, 98–110.

350 Sanchez, S., Steyer, J.S., Schoch, R.R., De Ricqlès, A., 2010. Palaeoecological and
 351 palaeoenvironmental influences revealed by long-bone palaeohistology: the example of the
 352 Permian branchiosaurid *Apateon*. Geological Society, London, Special Publications 339, 139–
 353 149.

354 Schindler, T., 1997. Neue lithostratigraphische Leithorizonte im unteren Rotliegend des Saar-
 355 Nahe-Beckens (U. Perm, SW-Deutschland). 1. Leithorizonte der lithostratigraphischen Einheit
 356 Lauterecken- bis Odernheim-Schichten L-O 5 (Boy and Fichter). Mainzer geowissenschaftliche
 357 Mitteilungen 26, 37–44.

358 Schneider, J.W., Werneburg, R., 2012. Biostratigraphie des Rotliegend mit Insekten und
 359 Amphibien. In: Deutsche Stratigraphische Kommission (eds.) Stratigraphie von Deutschland
 360 X. Rotliegend. Teil I: Innervariscische Becken. Schriftenreihe der Deutschen Gesellschaft für
 361 Geowissenschaften 61, 110–142.

362 Schneider, J.W., Lucas, S.G., Scholze, F., Voigt, S., Marchetti, L., Klein, H., Opluštil, S.,
 363 Werneburg, R., Golubev, V.K., Barrick, J.E., Nemyrovska, T., Ronchi, A., Day, M.O.,
 364 Silantiev, V.V., Rößler, R., Saber, H., Linnemann, U., Zharinova, V., Shen, S.-Z., 2020. Late
 365 Paleozoic–early Mesozoic continental biostratigraphy – links to the Standard Global
 366 Chronostratigraphic Scale. Palaeoworld 29, 186–238.

367 Schubnel, T., Desutter-Grandcolas, L., Legendre, F., Prokop, J., Mazurier, A., Garrouste, R.,
 368 Grandcolas, P., Nel, A. 2019 (2020). To be or not to be: postcubital vein in insects revealed by
 369 microtomography. Systematic Entomology 45, 327–336.

370 Scudder, S.H., 1885. Palaeodictyoptera: on the affinities and classification of Paleozoic
 371 Hexapoda. Memoirs of the Boston Society of Natural History 3, 319–351.

Sharov, A.G., 1968. Filogeniya ortopteroidnykh nasekomykh. Trudy Paleontologicheskogo Instituta, Akademiya Nauk S.S.S.R. 118, 1–216, Moskva. [in Russian, Translated in English in 1971: Phylogeny of the Orthopteroidea. Israel program for scientific translations, Keter Press, Jerusalem, 1–251.]

Uhl, D., 1999. Syncarids (Crustacea, Malacostraca) from the Stephanian D (Upper Carboniferous) of the Saar-Nahe-Basin (SW-Germany). Neues Jahrbuch für Geologie und Paläontologie Monatshefte 1999, 679–697.

Uhl, D., 2008. Die Paläoflora aus dem Rotliegend (Oberkarbon – Unterperm; Meisenheim Formation; M5) von Niedermoschel (Saar-Nahe-Becken, SW-Deutschland). Mainzer geowissenschaftliche Mitteilungen 36, 7–36.

Zalessky, M.D., 1928. Sur un nouvel insecte nevropteroïde du Permien du bassin de Kama. Bulletin de la Société Géologique de France (4) 28, 387–390.

Zalessky, M.D., 1929. On the new insects from the Permian basins of Kama, Viatka and Belaia rivers. Trudy Obshchestva Estestvoispytatelej pri Kazansskom y Universitet Kazan 52, 48–75. [in Russian.]

Zalessky, G.M., 1934. Sur deux représentants permien nouveaux de l'ordre des Protorthoptères. Annales de la Société Entomologique de France 103, 149–158.

Figure captions:

Fig. 1. Simplified geographical position and geology (with approximate ages, mya) of the Saar-Nahe Basin, with both the ‘Niedermoschel black pelite’ and the Sitters locality indicated by black asterisks (modified after Sanchez et al., 2010).

Fig. 2. *Palatinoedischia elongata* nov. gen., nov. sp., holotype PE 2018/5000-LS. Photographs of forewing, whitened with MgO. **A.** Part PE 2018/5000-LSa. **B.** Counterpart PE 2018/5000-LSb. **C.** Basal portion of part. **D.** Middle portion. **E.** Apical portion, rotated 90° counter-clockwise. Scale bars: 10 mm.

Fig. 3. *Palatinoedischia elongata* nov. gen., nov. sp., holotype PE 2018/5000-LS. Drawings. **A.** Part PE 2018/5000-LSa. **B.** Counterpart PE 2018/5000-LSb. **C.** Interpretative drawing of wing venation combined from part and counterpart. Scale bar: 10 mm.

- Rotliegend:
Lauterecken to Meisenheim Formations
- Rotliegend:
Remigiusberg to Quirnbach Formations
- Carboniferous: Steinkohle Group

A

B

C