SPIXIANA	32	2	187–192	München, November 2009	ISSN 0341–8391

Prosphyracephala kerneggeri spec. nov. – a new stalk-eyed fly from Baltic amber

(Diptera, Diopsidae)

Marion Kotrba

Kotrba, M. (2009): *Prosphyracephala kerneggeri* spec. nov. (Diptera, Diopsidae) – a new stalk-eyed fly from Baltic amber. – Spixiana **32/2**: 187-192

Among close to 30 specimens of fossil stalk-eyed flies from Baltic amber known today, mostly from private collections, there is one with particularly long and slender eye stalks. Morphometric comparison with 28 specimens of *Prosphyracephala succini* (Loew) confirms that this long-eyed specimen belongs to a different species. The species is described as *P. kerneggeri* spec. nov. The description of *P. succini* is augmented with additional information.

Marion Kotrba, Zoologische Staatssammlung München, Münchhausenstr. 21, 81247 Munich, Germany; e-mail: marion.kotrba@zsm.mwn.de

Introduction

Papp et al. (1997) described the first extant European species of stalk eyed flies, *Sphyracephala europaea* Papp et Földvári 1997 from Hungary. Until then Diopsidae had been represented in western Europe only by a few fossil specimens of *Prosphyracephala succini* (Loew 1873) from Baltic amber, originally described in *Sphyracephala* Say 1828. *S. breviata* (Meunier 1903), likewise described from Baltic amber, was considered as likely synonymous with *S. succini* by Hennig (1965), who erected the genus *Prosphyracephala* Hennig 1965 for this fossil species. The ultimate confirmation of the synonymy would depend on the examination of the type of *S. succini*, which is probably lost. Four subsequent finds from Bitterfeld were classified as *P. succini* as well by Schumann (1994). He provided revised descriptions for the genus and the species. An unnamed fossil specimen likely to belong to the same species was described from oil-shale sediments from Ceresté, France by Lutz (1985). A similar shale deposit specimen from the Ruby River Basin, Montana, was published as separate species *P. rubiensis* Lewis (1971) based on the geographic separation.

After Schumann's (1994) publication several additional amber specimens surfaced, mostly in private collections (Kotrba 2004), including one with particularly long eye stalks (specimen #01, Figs 2, 3). This specimen was identified as new species by previous investigators (D. Burkhardt, I. de la Motte & H. Feijen; H. Feijen pers. comm., 1999) but not formally described. This hesitation was possibly due to the lack of distinctive diagnostic characters. Many of the taxonomically relevant structures, such as wing venation and terminalia, are lost or cannot be discerned in the specimen. The discernable characters generally fit the description of *P. succini*. The only distinctive character, i. e. the longer and more slender eye stalks, is difficult to interpret for following reasons: The species to which the new specimen belongs is possibly sexually dimorphic, as is *P. succini* (Kotrba 2004). The specimen is possibly a male, which means that females of this species might have much shorter eye stalks. The descriptions of *P. succini* by Loew (1873), Meunier (1903), Hennig (1965) and Schumann (1994) are possibly based exclusively on female specimens. Therefore it cannot be ruled out a priori, that the new specimen constitutes a male of *P. succini*.

The present study establishes the intraspecific variation for a number of measurements such as eye span, body length, thorax width and eye stalk diameter for males and females of *P. succini* based on measurements taken from 28 fossil specimens. Comparison of the respective values in the new specimen with the ranges established for *P. succini* shows that it belongs to neither sex of that species but indeed represents a different and therefore new species which is formally described here.

Material and methods

The specimens studied and their respective depositories are listed in Table 1. In addition to the new specimen (#01), 27 specimens of *P. succini* from Baltic amber (including Bitterfeld amber) were investigated, including the holotype of *P. breviata* (#21). The type material of *P. succini* was not available for this study. It is probably lost. Measurements of the oil-shale specimen described by Lutz (1985) were taken from the published photograph (#19).

The following morphometric parameters were measured: eye span E (distance between the lateral eye margins), eye stalk diameter D (at the narrowest point), body length L (distance between face and posterior end of the abdomen or tips of folded wings, whichever could be determined), and thorax width T. Additionally the gender of the specimens was recorded. Regression lines and 95 % confidence intervals in Fig. 1 were computed with Student Minitab 14. A morphometric analysis of the measurements of *P. succini* was published by Kotrba (2004).

The specimens were studied using a Leica MZ12 stereoscope equipped with drawing tube and Zeiss AxioCam

Table 1. Depositories and measurements (in mm) of the investigated specimens. E: eye span; L: body length; T: thorax width; D: diameter of eye stalk; IMGPG: Institut und Museum für Geologie und Paläontologie Göttingen; MNHUB: Museum für Naturkunde der Humboldt-Universität zu Berlin; ZSM: Zoologische Staatssammlung München.

Nr.	depository	sex	E	L	T	D	remarks
1	ZSM	?	4.78	5.3	1.25	0.25	holotype *P. kerneggeri*
2	Coll. Ernst, P. & K. Nordmann, Skagen	♂	2.52	4.08	1.32	0.30	
3	Coll. Gröhn, C., Glinde	?	2.94	?	?	0.44	
4	Coll. Gröhn, C., Glinde	♀	?	4.30	?	?	
5	Coll. Herrling, A., Bramsche	?	3.03	4.44	1.34	0.32	
6	Coll. Herrling, A., Bramsche	♀	1.45	3.30	?	0.25	
7	Coll. Herrling, A., Bramsche	♀	1.75	3.71	0.93	0.33	
8	Coll. Herrling, A., Bramsche	♂	2.21	3.98	1.09	0.31	
9	Coll. Hoffeins, C. & H. W., Hamburg	♀	2.00	4.05	1.10	0.35	
10	Coll. Hoffeins, C. & H. W., Hamburg	♀	2.11	3.68	?	?	strongly distended
11	Coll. Krümmer, H. J., Greifswald	♂	2.50	4.40	?	0.24	
12	Coll. Krylov, A. D., Kaliningrad	♀	2.20	4.60	1.15	0.35	
13	Coll. Krylov, A. D., Kaliningrad	♂	1.95	3.60	1.00	0.30	
14	Coll. Kutscher, M., Sassnitz	♀	1.94	4.25	0.97	0.30	
15	Coll. Kutscher, M., Sassnitz	♀	2.63	5.11	1.43	0.39	
16	Coll. Kutscher, M., Sassnitz	♀	2.25	5.00	1.19	0.37	
17	Coll. Ludwig, W., Berlin	♀	2.05	4.45	?	0.39	
18	Coll. Ludwig, W., Berlin	♀	2.16	4.72	1.22	0.39	
19	Lutz (1985)	?	2.65	5.1	1.4	0.35	oil-shale specimen
20	IMGPG	♀	2.00	4.14	?	0.36	
21	IMGPG	♀	2.60	5.20	1.42	0.47	holotype *S. breviata*
22	MNHUB	?	2.56	?	?	0.28	
23	MNHUB	♀	1.50	3.75	0.95	0.26	
24	MNHUB	♂	2.58	4.70	1.24	0.24	
25	Natural History Museum Krakow	♂	2.80	4.35	1.25	0.27	
26	Coll. Teuber, D., Gütersloh	♂	1.75	3.31	1.00	0.25	
27	Coll. Velten, J., Idstein	?	1.89	?	?	?	
28	Coll. Velten, J., Idstein	♂	3.25	4.30	1.25	0.25	
29	Coll. Wenzel, H., Bielefeld	♂	2.70	4.40	?	0.35	

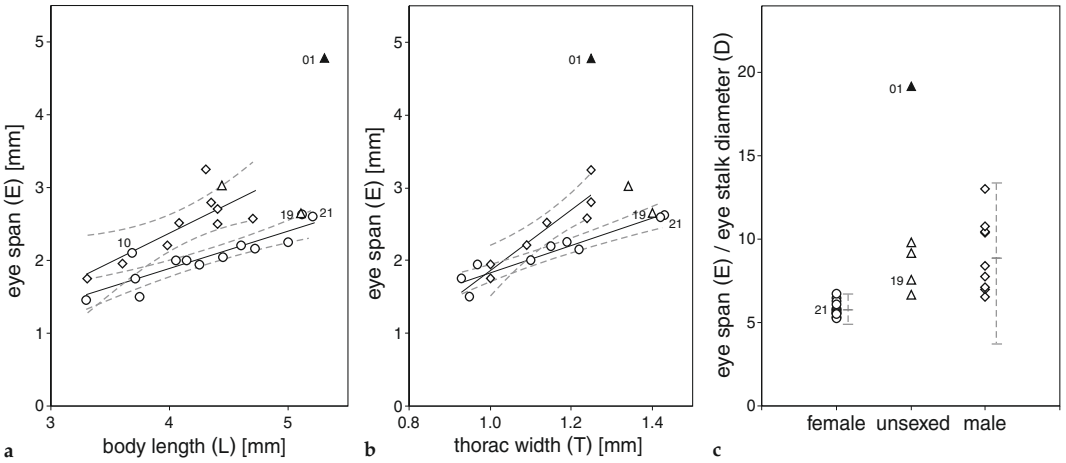


Fig. 1. Morphometric analysis of *P. succini* and *P. kerneggeri* spec. nov. **a,** eye span (E) as a function of body length (L); **b**, eye span (E) as a function of thorax width (T); **c,** ratio of eye span (E) and eye stalk diameter (D). ◇: males; ○: females; △: unsexed specimens; ▲: *P. kerneggeri* spec. nov. Regression lines and 95 % confidence interval (hatched) added for males and females. Numbers refer to Table 1.

digital camera. Some of the amber pieces were temporarily submerged in water to reduce distortion effects without altering the specimen. Each amber specimen differs in which characters are revealed or hidden due to its particular position in the stone and to inclusions of air, particles, swirls etc. in the stone. Therefore it was impossible to take all measurements in all specimens. A few of the data are approximations rather than exact measurements (see Kotrba 2004). In some specimens the terminalia were not clearly visible but the gender could be determined from the shape of the abdominal tip. Where the tip of the abdomen was entirely lost the gender could not be inferred.

For a detailed general description of diopsid morphology see Feijen (1989).

Results

The individual measurements are listed in Table 1. Figure 1 illustrates the ratios of eye span to body length (Fig. 1a), eye span to thorax width (Fig. 1b) and eye span to eye stalk diameter (Fig. 1c) for the male, female and unsexed specimens separately. The new specimen (#01) is clearly separated from the rest of the sample. Its eye span is distinctly larger not only with respect to the estimated body length but also with respect to the thorax width. The ratio of eye span to eye stalk diameter, which constitutes a character independent of overall body size, is also much larger. The new specimen is therefore described as new species.

Prosphyracephala succini (Loew)

Sphyracephala succini Loew 1873: 102. Holotype, sex unknown, Baltic amber, type probably lost.
Sphyracephala breviata Meunier 1903: 404. Holotype, female, Baltic amber (examined).
Prosphyracephala succini Hennig 1965: 63. New combination.

The diagnostic characters provided by Loew (1873), Meunier (1902), Hennig (1965) and Schumann (1994) are summarized below.

Description. Eye stalks present, inner and outer vertical bristles present, arista three-segmented, thorax with only two pairs of bristles, i. e. the intraalar bristles and the apical bristles on top of the scutellar spines; posterior notopleural bristles lacking; scutellum comparatively short and wide; scutellar spines about as long as scutellum, spaced far apart; apical bristles as long as scutellar spines; pointed pleurotergal spines present; basal section of R_{4+5} about 3 times as long as anterior crossvein r-m; CuA_1 not reaching wing margin, axillar lobe narrow; anal cell short, not narrowed; apical portion of anal vein in slightly angled continuation of posterior border of anal cell, not reaching wing margin; femur of foreleg incrassate, ventrally adorned with double rows of 3-6 bristles each and twice as many spines.

The present study of 28 fossil specimens of *P. succini* allows to add or redefine the following characters: crossvein bm-cu absent; alula reduced (in contrast to Hennig's (1965) description, but in

ageement with Schumann's (1994) illustration); anal cell short, almost as narrow as in *Sphyracephala* (see Kotrba 2004); wing entirely covered with microtrichia; precoxal bridge not closed. Size ranges (mm): body length: 3.31-4.70 (males), 3.30-5.20 (females); eye span: 1.75-3.25 (males), 1.45-2.63 (females); eye stalk diameter: 0.24-0.44 (males), 0.25-0.47 (females); wing length: 2.38-3.20 (males), 2.45-3.60 (females); thorax width: 1.00-1.25 (males), 0.93-1.43 (females).

Remarks. The amber specimens show some variation not only in the measurements of the eye stalks but also in some morphological characters such as the visibility of the anal vein or the presence of a wing pattern. It could not be decided, whether the observed differences result from different states of preservation in the amber or from the presence of additional cryptic species within the sample.

Prosphyracephala kerneggeri spec. nov.
(Figs 2-7)

Type. Holotype, sex indeterminable, Baltic amber, Germany, Neuland, Hamburg-Harburg, leg. F. Kernegger (ZSM). Condition of type: The specimen is well preserved, but partially concealed by air bubbles and other enclosures as well as by a flow line of the amber. Large parts of the specimen, especially on the head and thorax, are covered by a thin reflecting gas layer. The distal portion of the wings and the posterior part of the abdomen with the genitalia are missing. The amber fragment was cut and embedded in polyester during earlier investigations. For the present study it was cut again by a specialist and later embedded again by the collector.

Diagnosis. The species is distinguished from *P. succini* by a generally more slender appearance and in particular by the larger eye span in relation to body length, thorax width and eye stalk diameter.

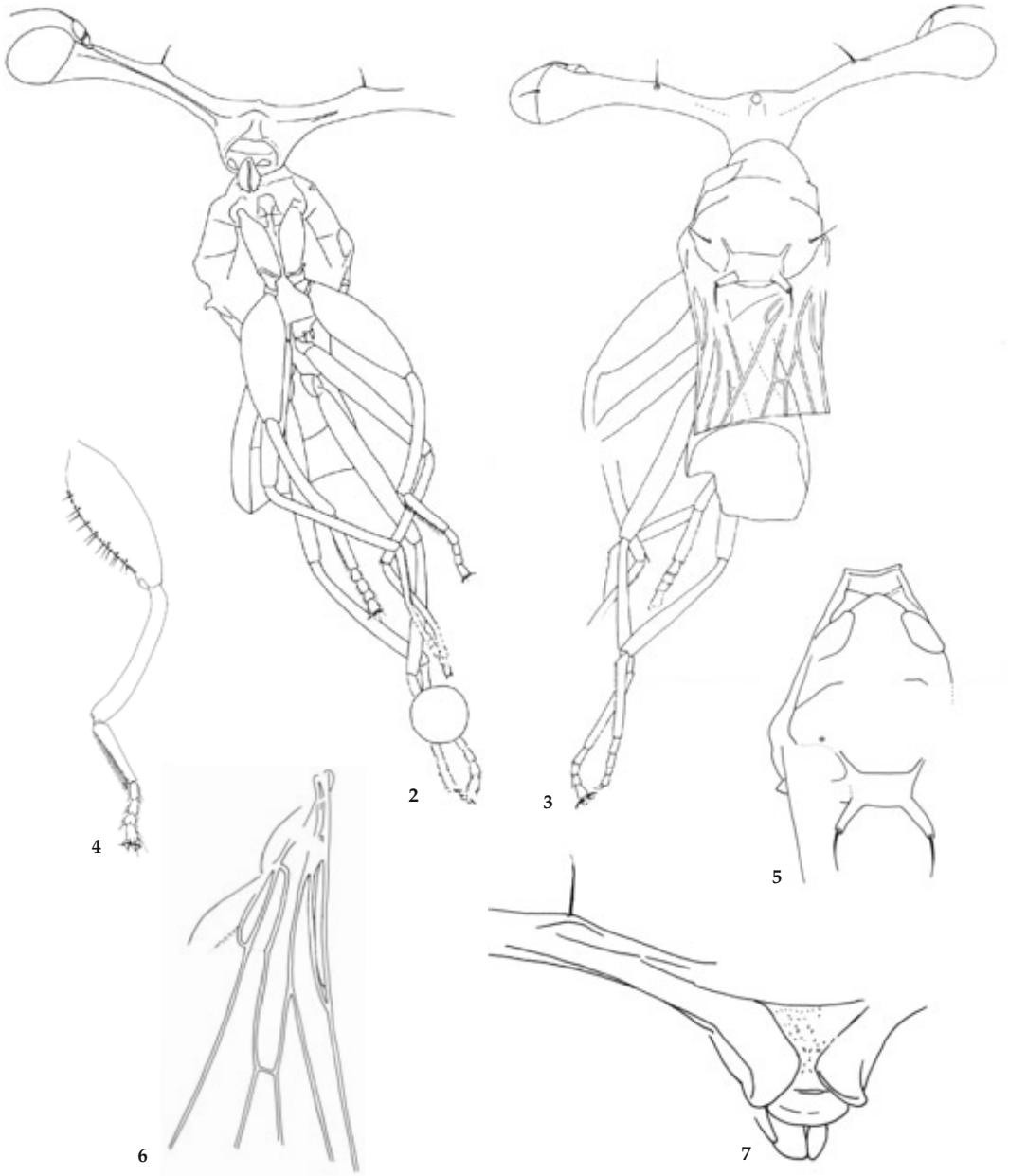
Description

Measurements (in mm): Estimated body length (measured from frons to estimated end of abdomen): 5.30; eye span: 4.78; eye stalk diameter: 0.25; thorax width: 1.25; thorax length: 1.88; length of front leg: 4.56; front femur length: 1.40; front femur width: 0.45; length of scutellar spines, apical bristles, intra-alar bristles and inner vertical bristles: about 0.3.

Head. The most prominent feature of the head are the long eye stalks distally bearing the relatively large teardrop-shaped compound eyes (Figs 2, 3). Their span almost equals the estimated body length. The middle portion of the head gradually tapers towards the eye stalk without abrupt kink. Dorsally the median part of the vertex is separated from each eye stalk by a shallow longitudinal groove. Other than that no sculpturing is discernible on the vertex. The antennae are positioned anteriorly near the end of the eye stalks, i. e. close to the eyes. The first flagellomere is rounded. The pedicel apically bears a sparse row of short bristles. The glabrous arista is tripartite. The inner vertical bristles are positioned dorsally on a slight elevation in the middle of the eye stalk. The slightly shorter outer vertical bristles are positioned posterodorsally next to the eye. Aside from these bristles the head is entirely bare. The ptilinal suture extends anteriorly along the entire length of the eye stalks. Near the base of the eye stalks its ventral margin curves ventrally and converges with its counterpart from the other side in an hour-glass shape above the clypeus (Fig. 7). Between the dorsal and the ventral margins of the ptilinal suture a roughly triangular plate is thus enclosed, which bears a shallow protrusion medially. The face is trapezoidal in anterior view. Its ventrolateral corners are rounded. The clypeus is relatively large in comparison with other Diopsidae.

Thorax. The thorax appears more slender than in *P. succini* with well developed pronotum and pronounced humeral calli (Figs 3, 5). It bears only two pairs of bristles, i. e. the intraalar bristles and the apical bristles on top of the scutellar spines. The notopleural bristles are here interpreted as lacking, although a very tiny bristle is visible under high magnification on the specimen's left side in the position of the posterior notopleural bristle. The scutellum is apically wider than long. The straight scutellar spines are slightly longer than the scutellum and spaced far apart. Each bears an apical bristle which is about as long as the spine itself. A pair of short pleurotergal spines adorns the thorax laterally in front of the halteres (Fig. 2). Previous investigators observed the presence of a precoxal bridge when they studied the specimen with the help of a particularly powerful microscope before it was embedded in resin (Feijen pers. comm., 1999). This could not be detected in the present investigation but the structure might have been concealed by a thin layer of gas covering this region of the thorax.

Wings. Only the basal part of the wings is left (Figs 3, 6). What is discernible of the wing venation agrees with the venation of *P. succini* (see Kotrba 2004). The subcosta is not clearly separated from R_1. The basal section of R_{4+5} is about 3 times as long as the anterior crossvein r-m. Crossvein bm-cu is absent. The anal cell is short and narrow. Only at certain angles of illumination a streak can be discerned posterodistally of the anal cell, which could be interpreted as a trace of the anal vein. It runs at a very slight angle from the posterior margin of the anal cell as in *P. succini* (Kotrba 2004). The anal lobe is narrow, the alula reduced. No wing pattern can be discerned.



Figs 2-7. *P. kerneggeri* spec. nov. **2,** anteroventral view; **3,** posterodorsal view; **4,** left front leg; **5,** dorsal view of thorax; **6,** wing venation reconstructed from both wings; **7,** head in anterodorsal view.

Legs. Front femur moderately incrassate, on its ventral side bearing two longitudinal rows of prominent spinous bristles (7 in the anterior and 6 in the posterior row) and between these two additional rows of much shorter tubercles (ca. 2 × 24) almost along its entire length (Fig. 4). The mid tibiae bear 2 very small ventral preapical bristles. The front and hind metatarsi are ventrally covered with brush-like pubescence. Apart from this the long and slender legs are bare.

Abdomen. The clavate abdomen is rather slender. Feijen and colleagues perceived a distinct

suture to be present between terga 1 and 2 (Feijen pers. comm., 1999) which could not be detected in the present investigation. The posterior half of the abdomen is missing.

Etymology. The new species is described under the name already proposed by previous investigators (Feijen pers. comm., 1999), i. e. *P. kerneggeri* spec. nov. in honor of Friedrich Kernegger, the collector of this rare find.

Discussion and conclusions

Previous investigators considered the erection of a new genus for this species based on their observations (Feijen pers. comm., 1999). The present study, however, did not reveal distinctive characters justifying this action and the new species is therefore placed in *Prosphyracephala*. The issue might be addressed again, especially if additional specimens are found. Future investigators are encouraged to review this issue as well as the question of the presence of cryptic species in *P. succini* as it is presently conceived, especially if more sophisticated techniques should become available for their study.

Acknowledgements

This study is largely based on material from private collectors (Tab. 1). It exemplifies how the collaboration of amateurs significantly adds to scientific progress. Thank you all for your cooperation. I am specifically indebted to F. Kernegger, the collector of the holotype of *P. kerneggeri* spec. nov., who confidently and patiently surrendered the precious piece to me for several years. E. Stenzel (MNHUB) competently cut and polished the amber piece to reveal different aspects and more detail.

Regarding scientific support my thanks go, above all, to H. R. Feijen. He kindly communicated the results of his investigation of F. Kernegger's specimen in 1992 together with D. Burkhardt and I. de la Motte (Feijen pers. comm., 1999). His observations were very important for my own interpretation of the piece. Moreover he very constructively commented on the various versions of this manuscript. Michael Hiermeier helped with the statistics. Other colleagues and friends who contributed to the progress of the manuscript are D. Burckhardt, D. Grimaldi, S. Hilger, and R. Meier. My sincere thanks to them all.

References

Feijen, H. R. 1989. Diopsidae. In Griffiths, G. C. D. (ed.): Flies of the Nearctic Region, Vol. 9, 12. Schweizerbart, Stuttgart, 122 pp.

Hennig, W. 1965. Die Acalyptratae des Baltischen Bernsteins und ihre Bedeutung für die Erforschung der phylogenetischen Entwicklung dieser Dipteren-Gruppe. Stuttgarter Beiträge zur Naturkunde 145: 1-215.

Kotrba, M. 2004. Baltic amber fossils reveal early evolution of sexual dimorphism in stalk-eyed flies (Diptera, Diopsidae). Organisms, Diversity and Evolution 4: 265-275.

Loew, H. 1873. Ueber die Arten der Gattung *Sphyracephala* Say. Zeitschrift für die gesamten Naturwissenschaften 42: 101-105.

Lutz, H. 1985. Eine fossile Stielaugenfliege aus dem Unter-Oligozän von Ceresté, Frankreich (Diptera: Diopsidae). Paläontologische Zeitschrift 59: 75-78.

Meunier, F. 1903. Etudes de quelques Diptères de l'ambre. Annales des Sciences Naturelles, Paris (8) XVI (1902): 395-406, Taf. 2.

Papp, L., Földváry, M. & Paulovics, P. 1997. *Sphyracephala europaea* sp. n. (Diptera: Diopsidae) from Hungary represents a family new to Europe. Folia entomologicae hungaricae 58: 137-146.

Schumann, H. 1994. Diopsiden-Funde im Sächsischen Bernstein. Deutsche Entomologische Zeitschrift, N.F. 41: 141-145.