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On the identity of *Aleochara* (*Coprochara*) *pauxilla* (MULSANT & REY, 1874)

(Coleoptera: Staphylinidae)[1]

With 1 figure

CHRISTIAN MAUS

Summary

The identity and taxonomic status of *Aleochara pauxilla* (MULSANT & REY, 1874) are investigated based on morphological characteristics and DNA sequence data (COI/II and 18S rRNA genes). *A. pauxilla* (MULSANT & REY, 1874) is finally recognised as a junior synonym of *A. verna*, *A. pauxilla* auct. nec MULSANT & REY as conspecific with *A. binotata*. A lectotype of *A. pauxilla* is designated.

Zusammenfassung

Identität und taxonomischer Status von *Aleochara pauxilla* (MULSANT & REY, 1874) werden aufgrund der morphologischen Merkmalen und DNA-Sequenzdaten (COI/II- und 18S rRNA-Gene) untersucht. *A. pauxilla* (MULSANT & REY, 1874) ist ein Synonym von *A. verna*, *A. pauxilla* auct. nec MULSANT & REY ist konspezifisch mit *A. binotata*. Ein Lectotypus für *A. pauxilla* wird designiert.

Keywords

Coleoptera, Staphylinidae, Aleocharinae, *Aleochara*, *Coprochara*, taxonomy, molecular systematics, COI/II, 18S rRNA

Introduction and taxonomic history

Several recent publications (LOHSE 1986, 1989, MAUS 1998, MAUS & ASHE 1998) have led to an almost complete clarification of the previous taxonomic confusion in the European species of the *Aleochara* GRAVENHORST, 1802 subgenus *Coprochara* MULSANT & REY, 1874. One of the last unsolved problems within *Coprochara* in Europe was the identity and taxonomic status of *Aleochara* (*C.*) *pauxilla* (MULSANT & REY, 1874), which had previously been treated controversially in the literature. A clarification of the identity and specific status of this taxon based on morphological characteristics alone has so far not been possible, and previous studies have not led to consistent and unambiguous results. Here I present the results of a combined morphological and molecular systematic approach with the aim of settling this question.

[1] 15th taxonomical contribution to the subgenus *Coprochara* MULSANT & REY, 1874 of the genus *Aleochara* GRAVENHORST, 1802

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MULSANT & REY (1874) described this species as *Baryodma pauxilla* from the environs of Lyon and from the Beaujolais, France. In older publications it is either considered an aberration of *A. bipustulata* (LINNAEUS, 1761) characterized by minute body size (e. g. REITTER 1909, KUHNT 1911, PORTEVIN 1929), or a species propria (e. g. BERNHAUER 1901, PORTA 1926). More recent publications mostly treated *A. pauxilla* as a distinct species (e. g. LIKOVSKY 1974, LOHSE 1986, 1989).
LIKOVSKY (1974) compared *A. pauxilla* with *A. bipustulata* and distinguished it from this species by smaller body size, a broad head and diffuse elytral terminal spots. He also gave an illustration of the spermatheca of *A. pauxilla*, according to which the duct has four coils. LOHSE (1986, 1989) largely adopted this species concept, pointed out some similarities in elytral pubescence and punctation to *A. binotata* KRAATZ, 1856, and indicated the impressed pronotal dorsal rows as additional character. He furthermore gave an illustration of the aedeagal median lobe and a new illustration of the spermatheca with a duct with eight coils. *A. pauxilla* sensu LOHSE (1986, 1989) is thus defined by the following characteristics: small, 1.8-2.5 mm, head broad, ¾ as wide as pronotum, pronotal dorsal rows impressed, abdominal punctures more sparse apically than basally, abdomen slightly tapering apically, spermathecal duct with about eight coils. The distribution range indicated includes the Mediterranean Region and the Atlantic Islands; Central European records were considered doubtful. However, based on the distinguishing characteristics indicated above, a separation of *A. pauxilla* and *A. binotata* proved difficult or even impossible. In addition, the question whether *A. pauxilla* sensu LOHSE (1986, 1989) really corresponds to the original concept of this taxon required clarification.

Materials and methods

Numerous specimens of *A. binotata* and *A. pauxilla* sensu LOHSE (1986, 1989) from several museum and private collections which were collected in most parts of the Palaearctic Region were investigated. These specimens were dissected, the genitalia embedded in water soluble polyvinyl pyrrolidone and mounted on transparent plastic microslides attached to the pins of the respective specimens. The morphological terminology used follows KLIMASZEWSKI (1984) and MAUS (1998). Labels of type specimens are cited using quotation marks separating different labels, and a slash (/) separating different lines on a label.
From four specimens identified as *A. binotata* and *A. pauxilla*, DNA was extracted and fragments of the mitochondrial COI/II genes (2022 bp) and the nuclear 18S rRNA gene (ca 1600 bp) were amplified by PCR and sequenced: one specimen of *A. binotata* and one specimen identified as *A. pauxilla* (sensu LOHSE 1986, 1989) from Roque Nublo, Gran Canaria, Canary Islands, Spain, 22.VI.1998, leg. Ch. Maus, in human dung (both genes sequenced), one specimen of *A. binotata* from Illmitz, Burgenland, Austria, V.1995, leg. K. Peschke (only COI/II sequenced), and one specimen of *A. binotata* from Mellum Island, Niedersachsen, Germany, 15.VIII.1994, leg. A. Rose (only 18S sequenced). Phylogenetic analysis of the sequence data was carried out using PAUP 4.0b2 (SWOFFORD 1999). The analyses performed included maximum parsimony (with different weighting schemes), minimum evolution, and maximum likelihood analyses. The molecular studies were carried out as a part of a project reconstructing the phylogeny of the genus *Aleochara* on the basis of DNA sequences (Maus et al. submitted, in prep.); the molecular results presented here are excerpts from the analysis of a larger sequence data set of about 60 *Aleochara* and outgroup species. For details of techniques and phylogenetic analyses see MAUS et al. (submitted, in prep.).

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Abbreviations

MHNL = Museum d'Histoire Naturelle, Lyon (France)
NHMW = Naturhistorisches Museum Wien, Vienna (Austria)

Results and discussion

Morphology

Based on an investigation of numerous *Coprochara* from all of the Palaearctic Region (Maus unpublished data), the definition of *A. pauxilla* sensu LOHSE (1986, 1989) could be further specified: this name characterizes specimens which are very similar to *A. binotata* but differ from this species by the following complex of characteristics: head broader and body smaller on average, abdomen on average with finer and less dense punctation, and spermathecal duct on average with fewer coils. No differences were observed in the shape of the abdomen. Of the Palaearctic material investigated by the author, 217 specimens were identified as *A. binotata*, and 88 as *A. pauxilla*. Some specimens with intermediate characteristics, however, could not be attributed to either of the taxa with certainty. While specimens of *A. binotata* were present in the investigated material from nearly the whole Palaearctic region, *A. pauxilla* specimens were found almost exclusively in the Mediterranean Region and the Atlantic Islands, the northernmost records were from Hungary and Czechia. Some intermediate specimens were also collected in other areas, such as Sweden, northern Germany, and Siberia.

Although a distinction of the larger part of the material based on the above characteristics was not problematic, an identification of some specimens proved difficult due to pronounced variation in both taxa and consequently considerable overlap. Instead of two distinct classes of states in the distinguishing characteristics, a continuous cline of character states was observed. In addition, there are, as mentioned above, specimens which show intermediate states in all or most characteristics, and the distinguishing characteristics are not consistent; for instance, several specimens of *A. binotata* with a rather sparse abdominal punctation were observed, especially in the Mediterranean Region.

Considering all these facts, it was not possible to make a well-founded decision about the taxonomic status of *A. pauxilla* based on morphological investigations. This taxon could be interpreted as a distinct species which is extremely similar to *A. binotata*. Arguments supporting this interpretation are the distribution of *A. pauxilla* which apparently occurs only (or mainly) in a certain part of the area of *A. binotata*, and the fact that the characteristics distinguishing *A. pauxilla* from *A. binotata* mostly occur in combination, and do not show a random distribution. *A. pauxilla* could also be considered a synonym of *A. binotata*; this view would be supported by the lack of unambiguous, discrete characteristics that distinguish both species. The restriction of *A. pauxilla* to the Mediterranean Region could be explained by an extended host range in these areas, since there is a correlation between body size of the beetle and the size of the host puparium (see for instance LIKOVSKY (1974). The "specific characteristics", which mostly occur in combination, may be due to allometric effects.

Treating *A. pauxilla* as a subspecies of *A. binotata* would not be appropriate, since both taxa occur sympatrically in many localities within the range of *A. pauxilla*.

Type material and original description of *A. pauxilla*

The long and comprehensive original description of *A. pauxilla* contains only very few characteristics that could help interpret which species Rey actually dealt with when he described his *A. pauxilla*. The pronotum is stated to have dorsal rows consisting of

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rather coarse, partially confluent punctures; the dorsal rows are, however, stated not to be impressed as in *A. binotata*, only sometimes basally deepened. The taxon currently interpreted as *A. pauxilla* (sensu LOHSE 1986, 1989) usually has impressed dorsal rows like *A. binotata*. Basally impressed rows also occur in *A. verna* SAY, 1836 and *A. bipustulata*, especially in small specimens. The apical margin of the male sternum VIII is described as angularly produced; this feature is always present in the taxon currently regarded as *A. pauxilla* (sensu LOHSE 1986, 1989) and in *A. binotata*, frequently in *A. verna*, and very rarely in *A. bipustulata*. In the description of *A. pauxilla*, Rey describes the elytral terminal spots as rather well-defined and more or less orbicular, but in some cases blurred and extending over most of the elytra. A well-defined terminal spot is mostly present in *A. bipustulata* and *A. verna*, while *A. pauxilla* sensu LOHSE (1986, 1989) mostly has a rather diffuse terminal spot which frequently takes up the whole elytra except for the basal and lateral margins. The abdomen of the latter taxon is mostly subparallel, but usually tapering apically to a greater or lesser extent in *A. bipustulata* and *A. verna*. According to MULSANT & REY (1874) it is tapering in *A. pauxilla*, even in comparison with *A. bipustulata*. These characteristics of *A. pauxilla* are the only hints at the identity of this taxon, but due to the overall variability of all *Coprochara* species, they do not allow a safe identification of *A. pauxilla*. The most likely interpretation of the description is that Rey´s *A. pauxilla* is identical with *A. verna*, but the possibility that specimens of *A. pauxilla* sensu LOHSE (1986, 1989) also belonged to the type series, cannot be ruled out.

In coll. Rey (MHNL), no material of *A. pauxilla* was found, nor is this taxon listed in the historical catalogue of the Rey collection (Clary pers.comm.). According to Clary (pers. comm.), some types of species described by Rey are housed in coll. Guillebeau (MHNL). Seven specimens named *A. pauxilla* are present in the Guillebeau collection. Except for one specimen from Vienna, all of them were collected in Southern and Central France; two specimens belong to *A. verna*, four are small *A. bipustulata*, and one belongs to *A. pauxilla* sensu LOHSE (1986, 1989). As Clary (pers.comm.) states, they are not syntypes of *A. pauxilla*, and they do not bear the kind of labels which MUONA (1979) and ZERCHE (1994) describe as typical of the Rey collection. Thus, all the type material of *A. pauxilla* in coll. Rey is apparently lost.

There is one specimen in the Scheerpeltz collection (NHMW) which is labelled as "cotype" of *A. pauxilla* and which is conspecific with *A. verna*. According to the labels, it was collected at Bugey (Ain, France) by Rey (or it originally belonged to the Rey collection); Scheerpeltz had received it via coll. Skalitzky. Its labels do not correspond to those described by MUONA (1979), and on rare occasions, Scheerpeltz apparently labelled specimens that came (or that he assumed to come) from the collection of the author of the respective species as cotypes irrespective of their real status (Maus, unpublished data). However, the different labels may result from later labelling by one of the subsequent owners of the specimen, and in the case of this specimen there is no evidence that the type labelling was incorrect. Additionally, the specimen was collected in the area *A. pauxilla* was described from. Additional support for the hypothesis that the specimen from the Scheerpeltz collection in fact belongs to the type series comes from a notebook in the bequest of Rey housed in the MHNL in which Rey listed his exchange transactions. In this notebook, he noted down a specimen of *A. pauxilla* that he sent to K. Skalitzky in Prague at July 14th, 1879 (CLARY i.l.). Most probably, this specimen is the on which is now kept in coll. Scheerpeltz. Consequently, I consider the specimen in the

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Scheerpeltz collection a syntype and, in order to secure the present interpretation of the taxon, designate it here as lectotype. The label data are: "Bugey", "Rey", "Bernh. / vid.", "pauxilla Rey", "type", Cotypus / Aleochara / pauxilla / Rey", "ex coll. / Skalitzky", "ex coll. / Scheerpeltz", "Aleochara / verna Say / det. Ch. Maus 1996", "Baryodma (Coprochara) / pauxilla Mulsant & / Rey, 1874 Lectotypus / des. Ch. Maus 1999".

DNA sequence study

After clarifying the identity of *A. pauxilla*, the question of the identity of the taxon *A. pauxilla* sensu LOHSE (1986, 1989) (hereafter referred to as *A. pauxilla* auct.) still remained unsolved. As stated above, a solution by morphological investigations alone was virtually impossible.

As part of a project with the aim of reconstructing of the phylogeny of the genus *Aleochara* based on mitochondrial COI/II and nuclear 18S rDNA sequences (MAUS et al. submitted, in prep.), DNA of three specimens of *A. binotata* and one *A. pauxilla* auct. was sequenced and the sequences were analyzed.

As all investigations clearly showed, the similarity between the Canarian *A. binotata* specimen and the Canarian *A. pauxilla* auct. specimen is substantially greater than between the Canarian and the German or the Austrian *A. binotata* specimen. In the COI/II dataset, the uncorrected p-distance between the Canarian *A. binotata* and *A. pauxilla* auct. was 0.20%, between the Canarian and the Austrian *A. binotata* 3.19%, and between *A. pauxilla* auct. and the Austrian *A. binotata* 3.15%. In the 18S rDNA dataset, different p-distance values were calculated in different models of alignment. Between the Canarian *A. binotata* and *A. pauxilla* auct., the distance was consistently 0.06%, between the Canarian and the German *A. binotata*, it ranged from 0.26% to 1.10% , and between *A. pauxilla* auct. and the German *A. binotata* from 0.20% to 0.99%.

The trees resulting from the COI/II sequence datasets consistently reflected these sequence differences by suggesting a closer relationship between the Canarian *A. binotata* and *A. pauxilla* auct. than between the Canarian and the Austrian *A. binotata*, or between *A. pauxilla* auct. and the Austrian *A. binotata*. The topology of a tree containing the *A. pauxilla* auct. specimen and two *A. binotata* specimens was consistently as illustrated

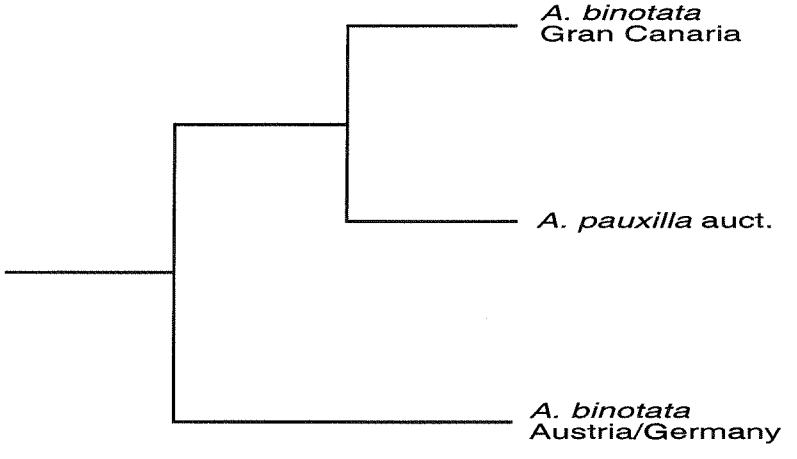

Fig. 1: Phylogenetic relationships between a a Canarian specimen of *A. pauxilla* auct., a Canarian and a German or Austrian specimen of *A. binotata* according to COI/II and 18S rDNA sequence data.

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in fig. 1 (this tree is a subtree of the trees presented in Maus et al. (submitted)). Irrespective of different algorithms and weighting schemes applied, all branches of the topology shown above were always supported by very high bootstrap values (94-100%) and Bremer indices. The number of base substitutions that occurred in the branches leading to *A. pauxilla* auct. and the Canarian *A. binotata* is two on each branch (in the trees resulting from an unweighted maximum parsimony analysis). In contrast, 32 and 30 substitutions have occurred between the common ancestor of the two Canarian *A. pauxilla* auct. and *A. binotata* specimens and the Austrian *A. binotata* specimen, respectively. The trees generated from the 18S rDNA dataset support the same tree topology as outlined above and resolve *A. pauxilla* auct. and *A. binotata* from the Canaries as closest relatives. The substitutions between the Canarian *A. binotata* and *A. pauxilla* were always 1 and 0, between this species pair and the German *A. binotata*, there were 1 to 12 and 2 to 4 substitutions, depending on the alignment scheme applied. In general, the 18S rRNA gene is evolving too slowly to resolve recent branching events, the support for the sister group relationship of *A. pauxilla* auct. and the Canarian *A. binotata* can therefore be regarded as further evidence for their close relationship relative to the two *A. binotata* populations. The fact that the two sympatric specimens of *A. binotata* and *A. pauxilla* auct. are obviously much more closely related to each other than are *A. binotata* specimens from different localities, is clear evidence that the two Canarian specimens belong to the same population and are thus conspecific.

Conclusions

As a consequence of the above results, the following synonymies are established here:

Aleochara verna SAY, 1836: 156.
Baryodma pauxilla MULSANT & REY, 1874: 443, new synonymy
Aleochara binotata, KRAATZ 1856: 106.
Aleochara pauxilla auct. nec MULSANT & REY, 1874.

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References

BERNHAUER, M. 1901: Die Staphyliniden der paläarktischen Fauna. - Verhandlungen der zoologisch-botanischen Gesellschaft in Wien **51**: 430-506.

KUHNT, P. 1911: Illustrierte Bestimmungstabellen der Käfer Deutschlands. - Stuttgart: E. Schweizerbart - 1138 pp.

KRAATZ, G. 1856: Naturgeschichte der Insecten Deutschlands. Erste Abtheilung: Coleoptera, II. - Berlin: Nicolai - 376 pp.

LIKOVSKY, Z. 1974: 237. Gattung: *Aleochara*. - In: FREUDE, H., HARDE, K.W. & LOHSE, G.A. (eds.): Die Käfer Mitteleuropas. Vol. 5: Staphylinidae II (Hypocyphtinae und Aleocharinae), Pselaphidae. Krefeld: Goecke & Evers: 293-304.

LOHSE, G. A. 1986: *Aleochara*-Studien II: Die rotgefleckten Arten der Untergattung *Coprochara* MULSANT & REY. - Verhandlungen des Vereins für naturissenschaftliche Heimatforschung, Hamburg **39**: 95-98.

LOHSE, G. A. 1989: 23. Familie Staphylinidae (II) (Aleocharinae). - In: LOHSE, G.A. & LUCHT, W.H. (eds.): Die Käfer Mitteleuropas. Vol. 12 (1. Supplementband). Krefeld: Goecke & Evers: 185-240.

MAUS, CH. 1998: Taxonomical contributions to the subgenus *Coprochara* MULSANT & REY, 1874 of the genus *Aleochara* GRAVENHORST, 1802 (Coleoptera: Staphylinidae). - Koleopterologische Rundschau **68**: 75-94.

MAUS, CH. & ASHE, J. S. 1998a: *Aleochara* (*Coprochara*). – In: MADDISON, D.R. &. MADDISON, W. P. (eds.): The Tree of Life: A distributed internet project containing information about phylogeny and biodiversity. Internet address: http://ag.arizona.edu/tree/phylogeny.html.

MAUS, CH.; PESCHKE, K. & DOBLER, S. (submitted): Phylogeny of the genus *Aleochara* inferred from mitochondrial cytochrome oxidase sequences (Coleoptera: Staphylinidae). - Molecular Phylogenetics and Evolution.

MAUS, CH.; PESCHKE, K. & DOBLER, S. (in prep.): Phylogeny of the genus *Aleochara* inferred from nuclear 18S ribosomal DNA sequences (Coleoptera: Staphylinidae).

MUONA, J. 1979: The aleocharine types of Mulsant & Rey (Coleoptera, Staphylinidae) I. - Annales Entomologici Fennici **45**: 47-58.

MULSANT, E. & REY, C. 1874: Tribu des Brevipennes. Famille des Aleochariens (suite), sixieme branche: Aleocharaires. - Annales de la Société Linnéenne de Lyon N.S. **20** (Annee 1873): 285-447.

PORTA, A. 1926: Fauna Coleopterorum Italica. Vol. 2: Staphylinoidea. - Piacenza: Stabilimento Tipografico Piacentino - 405 pp.

PORTEVIN, G. 1929: Histoire naturelle des Coleopteres de France. Vol. 1: Adephaga, Polyphaga: Staphylinoidea. - Paris: P. Lechevalier - 649 pp.

REITTER, E. 1909: Fauna Germanica. Die Käfer des Deutschen Reiches. Vol. 2. - Stuttgart: K. G. Lutz - 392 pp.

SAY, TH. 1836: Description of new North American insects and observations on some already described. - Transactions of the American Philosophical Society (ser. 2) **6**: 155-190.

SWOFFORD, D. L. 1999: "PAUP": Phylogenetic Analysis Using Parsimony and other Methods", Version 4.0b2 for Macintosh, Sinauer, Sunderland, Mass.

ZERCHE, L. 1994: Die Revision der *Oxypoda*-Typen aus der Sammlung Claudius Rey im Musée Guimet d´Histoire naturelle de Lyon und einiger anderer Typen der Gattung sowie die Beschreibung von vier neuen *Oxypoda*-Arten (Coleoptera, Staphylinidae, Aleocharinae). - Coleoptera - Schwanfelder Coleopterologische Mitteilungen **6**: 1-36.

Author's address:

CHRISTIAN MAUS
Institut für Biologie I (Zoologie),
Hauptstraße 1
D – 79104 Freiburg
Deutschland
e-mail: mauschri@sun2.ruf.uni-freiburg.de

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