



Review

of the doctoral dissertation by **Alexandra Tokareva**, M.Sc. entitled

A comprehensive genus-level phylogeny of Paederinae (Coleoptera: Staphylinidae) based on combined genomic and morphological data

The review was carried out on the basis of the resolution of the Scientific Council of the Museum and Institute of Zoology of the Polish Academy of Sciences No. 2/VII/2024 adopted at its meeting on 10 December 2024.

Introduction

The thesis presented for review, authored by **Alexandra Tokareva**, M.Sc., of the BioPlanet Doctoral School, was written at the Museum and Institute of Zoology of the Polish Academy of Sciences in Warsaw under the supervision of **Prof. Dr. Kazimiera Wioletta Tomaszewska**. The thesis was supervised by **Dr Dagmara Żyła** from the Leibniz Institute for the Analysis of Biodiversity Changes, Museum of Nature Hamburg.

Evaluation of the editorial side of the dissertation

The dissertation, in the form of a compact print, based on the author's own graphic design, consists of a comprehensive summary - including an introduction, a discussion of the purpose of the research, the materials and methods used, and a summary of the results and conclusions.

Subsequent chapters are reprints of publications.

Chapter 1 contains the publication:

Żyła D., **Tokareva A.** & Koszela K. 2022. Phylogenetic position of genera *Acrostilicus* Hubbard and *Pachystilicus* Casey (Staphylinidae, Paederinae) and their redescription. *European Journal of Taxonomy* 819(1): 1–22. DOI: [10.5852/ejt.2022.819.1773](https://doi.org/10.5852/ejt.2022.819.1773)

This publication provides a redescription of three species from the genera *Acrostilicus* Hubbard and *Pachystilicus* Casey distributed in North America. It also tests the phylogenetic position of the two genera as assessed by combinations of morphological characters and molecular data against 49 taxa, mainly from the subfamily Paederinae, but also from Staphylininae and Tachyporinae.

Chapter 2 contains the publication:

Tokareva, A., Koszela, K., Ferreira, V.S., Yamato, S., Żyła, D. 2023. The oldest case of paedomorphosis in rove beetles and description of a new genus of Paederinae from Cretaceous amber (Coleoptera: Staphylinidae). *Sci Rep* 13, 5317. <https://doi.org/10.1038/s41598-023-32446-2>

This publication contains the description of a new genus and species *Midinudon juvenis* Tokareva & Żyła gen. et sp. nov. The small body size of the described species and peculiar features allowed defining the specimen as an example of pedomorphosis in the Staphylinidae. An important result of the publication is the phylogenetic analysis and presentation of the phylogenetic tree of Paederinae with positioning of the new genus within the tribe Scopaeina and the entire subfamily Paederinae.

Chapter 3. is a monographic publication:

Guzman, Y. C., **Tokareva, A.**, Koszela, K., & Żyła, D. 2024. Twenty-one new species of the neotropical rove beetle genus *Neolindus* Scheerpeltz (Coleoptera, Staphylinidae, Paederinae). *European Journal of Taxonomy*, 942(1), 1–76. <https://doi.org/10.5852/ejt.2024.942.2581>

The monographic publication includes a redescription of the neotropical genus *Neolindus* Scheerp., descriptions of 21 new species, and an updated key to identify 39 previously described and new species.

Chapter 4 “Comparative morphology of mesoventrite in Paederinae: insights for subtribal-level phylogenetic reconstructions” by **Alexandra Tokareva** and Dagmara Żyła is an original typescript and contains the results of a morphological study of mesoventral sclerites in different subfamilies and genera of Paederinae against analogous features in Staphylininae and Xantholininae. A specific revision of the morphological terminology for the mesoventral area in the Paederinae was made and hypotheses were proposed for the homology of features within the subfamily and between the mentioned subfamilies ‘Staphylinomorphes’. Importantly, the results were based on a survey of representatives of 155 genera of the Paederinae, and the main groups are illustrated with schematic drawings and SEM (Scanning Electron Microscopy) micrographs. In addition, new characters of potential importance for the phylogenetic reconstruction of the Paederinae at the subfamily level are presented.

Chapter 5, titled ‘A comprehensive genus-level phylogeny of Paederinae (Coleoptera: Staphylinidae) based on combined genomic and morphological data’, is also the original typescript prepared for publication. The typescript was prepared by the author team: **Alexandra Tokareva**, Katarzyna Koszela, Yoan Camilo Guzman Sarmiento, Dagmara Żyła.

The paper contains the first presentation of the phylogeny of Paederinae at the genus level based on genomic and morphological data. For the first time, ultraconservative elements (UCEs) were used for phylogenetic analysis and a morphological matrix was constructed for 161 lineages of species, genera, subtribes and tribes of modern and fossil Paederinae. The results revealed the need to revise and reclassify tribes at the level of genus affiliation.

Chapter 6 describes plans for further research. The results of this PhD project are part of a wider study to determine whether the Palaeocene-Eocene Thermal Maximum (PETM), which occurred around 55.9 million years ago, led to the diversification of the Paederinae.



An errata has been appended to the dissertation, modifying the title to: 'A comprehensive genus-level reconstruction phylogeny of Paederinae (Coleoptera: Staphylinidae) based on combined genomic and morphological data'.

Evaluation of the merits of the thesis

Originality of the research. The Paederinae are one of 37 subfamilies of the Staphylinidae, a family of beetles considered to be the richest in species in the animal world. The subfamily includes nearly 8,000 described species classified in 230 genera. The subfamily, with its well-established taxonomic position and undisputed morphological features, has not been the subject of deep taxonomic and phylogenetic studies. In fact, the first comprehensive reconstructions of the phylogeny of Paederinae based on genetic data appeared only a few years ago (e.g. Schonnan & Solodovnikov, 2016 - Phylogenetic placement of the austral rove beetle genus *Hyperomma* triggers changes in classification of Paederinae (Coleoptera: Staphylinidae). *Zoologica Scripta*, 46: 336-347). Subsequent work in this area is already based on comprehensive (so-called total-evidence approaches) using genomic, morphological traits and fossil data.

The reviewed work is part of this trend and presents the results of analyses for the largest number of developmental lineages of Paederinae to date.

The work, which actually consists of a series of publications (published and prepared for publication), contributes a number of new and original achievements. These include descriptions and redescrptions of new genera and species of Paederinae, both contemporaneous (Chapters 1, 2) and extinct (Chapter 3). The descriptions of species and genera, which are themselves an original achievement, are at the same time positioned within the phylogenetic structure of the entire subfamily. The authors have consistently aimed at understanding the phylogeny of the subfamily Paederinae based on a set of morphological characters specific to the subfamilies Paederinae. Taking into account additionally the genomic data of 180 taxa, the phylogenetic analysis allowed redefining the classification of the Paederinae tribes, i.e. raising the subtribe *Sphaeronina* to the level of tribe (*Sphaeronini* stat. rev.), designating a new subtribe *Scymbaliina* subtrib. nov. and redefining the subtribes *Astenina* sensu nov., *Echiasterina* sensu nov., *Lathrobiina* sensu nov., *Lithocharina* sensu nov., *Medonina* sensu nov., *Scopaeina* sensu nov. and *Stilicopsina* sensu nov., together with new species compositions and updated diagnoses.

Scientific value of the dissertation. The first three chapters of the dissertation lead consistently to, in the reviewer's opinion, the most important scientific achievement of the dissertation: the description of the differentiation of the mesoventrite (23 types of mesoventrite) with its external and internal structures and its applicability in the trait matrix for the Paederinae tribes, as well as the first reconstruction of the phylogeny of the Paederinae at genus level based on genetic and morphological traits.

Bibliometric data of the published papers comprising the dissertation:

total iF = 6.0,

number of ministerial points: 280,

number of citations (according to Web of Sciences and ResearchGate) - 5,

number of page views of publications - 2763.

Critical remarks

The reviewer sees no shortcomings or errors throughout the dissertation.

Ms **Alexandra Tokareva's** dissertation consists of:

- an introductory chapter with a clearly declared aim of the research and the hypotheses posed, a described scope and methodology of the work (especially laboratory work), a scheme of results and conclusions
- three publications in indexed scientific journals; in one of them **A. Tokareva** is a corresponding author,
- two typescripts prepared for publication in a taxonomic journal, containing the main results of the research, in which A. Tokareva is a corresponding author
- a summary that also includes a perspective on broader research in speciation and phylogeny of Paederinae. These are features that indicate a very carefully considered and consistently executed research project.

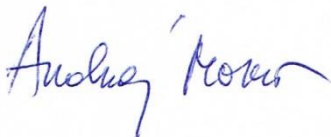
The perceived ability to work in a close research team in the dissertation, the use of various image visualisation techniques to illustrate traits, the ability to use molecular techniques to obtain genetic information and extensive international research contacts indicate that Ms **Alexandra Tokareva** is very well prepared for further scientific work.

Final evaluation

In summary, the subject of the doctoral dissertation is an original solution to a scientific problem and **Alexandra Tokareva's** skills and general theoretical knowledge in the field of biological sciences presented in the doctoral dissertation are sufficient to independently conduct scientific work.

In view of the above, I conclude that the evaluated doctoral dissertation of **Alexandra Tokareva** fully meets the conditions specified in art. 187 of Act of 20 July 2018, Law on Higher Education and Science (Journal of Laws of 2018, item 1668, as amended). I therefore request the Scientific Council of the Museum and Institute of Zoology of the Polish Academy of Sciences to admit Ms **Alexandra Tokareva** to the further stages of the doctoral dissertation.

Furthermore, recognising the very high level of taxonomic and phylogenetic research carried out by Ms **Alexandra Tokareva**, I request that the dissertation be awarded.



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