

Charles University, Faculty of Science
Department of Zoology
PhD study program: Zoology



Matthias Seidel, MSc.

**Evolutionary history, systematics and biogeography of Southern Hemisphere
hydrophilid beetles (Coleoptera)**

Summary of the Doctoral thesis

Supervisor: Martin Fikáček, PhD.

Prague, 2019

Summary

The research presented in my PhD thesis consists of phylogenetic, biogeographic, taxonomic and ecological research of Southern Hemisphere water scavenger beetles (Coleoptera: Hydrophilidae) with a special emphasis on New Zealand. The introductory chapter provides a brief outline on the break-up of Gondwana and geological processes that shaped New Zealand and its fauna. Furthermore, the diversity of New Zealand Hydrophilidae and worldwide diversity of the hydrophilid subfamily Cylominae and its taxonomic history are illustrated. The scientific part of the thesis contains 4 published papers and 2 manuscripts. The first study recalibrates the Coleoptera time tree, providing new age estimates for the Hydrophiloidea, among others. The new age estimate is implemented in the second study, a phylogenetic study that reconstructs the biogeography of the 'Gondwanan' Cylominae beetles. The Cylominae, whose name was reinstated through nomenclatural priority over Rygmodinae in a separate paper, are found to consist of two tribes, Andotypini and Cylomini. The disjunct distribution of Cylominae is shown to be partly the result of vicariance and partly of long-distance oversea dispersal. The most remarkable long-distance dispersal is that of the only African representative of the subfamily which reached Africa from Australia about 50 million years after Africa diverged from the remaining Gondwanan land masses. Based on morphological evidence, a new genus *Relictorygmus* is established for the two African species and is diagnosed from the Chilean *Cylorygmus*. The morphological and molecular studies of New Zealand cylomine beetles revealed a total of 13 genera and 61 species of which 3 genera and 25 species remain undescribed. The New Zealand genus *Saphydrus* is revised, revealing two new species, *S. moeldnerae* and *S. tanemahuta*, known from very few specimens indicating the extreme rarity of the genus. Furthermore, immature stages were associated with *Saphydrus* adults by DNA sequences and described. Another lineage genetically and morphologically distant to *Saphydrus*, is described as *Enigmahydrus larvalis*. It is the first hydrophilid genus and species described from immature stages only. Lastly, the ecology of *Rygmodus*, the enigmatic New Zealand hydrophilid with flower-visiting pollen-feeding adults and aquatic larvae, is studied and summarized. The genus is found to be unique within the Hydrophilidae in inhabiting different habitats as adult and larvae. The larvae of *Rygmodus* are described for the first time.

Papers and manuscripts included into the PhD thesis

Toussaint, E. A. F., Seidel, M., Arriaga-Varela, E., Hájek, J., Král, D., Sekerka, L., Short, A. E. Z. & Fikáček, M. (2017) **The peril of dating beetles.** *Systematic Entomology*, 42(1): 1-10.

Recently, McKenna et al., 2015 (MCK15 hereafter) investigated the higher level phylogenetic relationships of beetles (Insecta, Coleoptera) using the most comprehensive molecular dataset to date, and inferred the absolute ages of major groups using multiple fossil calibrations across the beetle tree of life. However, some of the age estimates found in MCK15 are in conflict with current knowledge of the beetle fossil record and with other recently published molecular age estimates for some major beetle clades. In some cases, the difference in age estimates is significant and might change our understanding of the mode and tempo of diversification dynamics of these groups. Based on a careful examination of the data and analyses performed in MCK15, we propose that the divergence time estimates which they found are likely to underestimate clade ages. We believe this is due to the subset of fossil Coleoptera that MCK15 selected as calibration points, as well as the methodological approach used in their analyses. To explore the impact of fossil selection on the age of Coleoptera, we derived an alternative set of fossil calibration points based on best-practice recommendations, and performed new molecular dating analyses to investigate the effect of fossil selection and maximum ages, on posterior estimates of divergence times

Seidel, M., Sýkora, V., Leschen, R. A. B., & Fikáček, M. **Systematics and biogeography of the Southern Hemisphere endemic Cylominae beetles (Coleoptera: Hydrophilidae)** (manuscript draft).

Cylominae is an enigmatic subfamily of water scavenger beetles (Coleoptera: Hydrophilidae) with a conspicuous Southern Hemisphere distribution. Here we present the first comprehensive molecular phylogeny of this subfamily and explore the historical biogeography and processes that led to the current disjunct distribution of the group in Australia, New Zealand, austral South America, and South Africa. Our results reveal the subfamily to consist of two principal clades whose reciprocal monophyly is supported by larval morphology; these clades are re-instated as tribes Cylomini stat. nov. (14 genera) and Andotypini stat. nov. (containing 9 genera including *Thomosis* Broun, 1904, stat. nov.). Three genera from New Zealand remain undescribed. Our study demonstrates that Cylominae originated in the Early Cretaceous in temperate southern Gondwana and subsequently reached their current distribution by a combination of vicariance and long-distance dispersal events. Most interestingly, the presence of the subfamily in South Africa is revealed as a result of a long-distance dispersal postdating the separation of the African continent from Southern Gondwana by more than 50 million years. The New Zealand fauna originated by a mixture of vicariance and long distance dispersal, all genera arriving prior to the Oligocene bottleneck.

Seidel, M., Arriaga-Varela, E. & Fikáček, M. (2016). **Establishment of Cylominae Zaitzev, 1908 as a valid name for the subfamily Rygmodinae Orchymont, 1916 with an updated list of genera (Coleoptera: Hydrophilidae).** *Acta Entomologica Musei Nationalis Pragae*, 56(1): 159-165.

Cylominae Zaitzev, 1908 is established as a valid subfamily name for Rygmodinae Orchymont, 1916, syn. nov., due to the recent transfer of *Cyloma* Sharp, 1872 to the subfamily. The history of nomenclature of the subfamily is reviewed and an updated overview of family-group and genus-group names currently assigned to the subfamily is provided.

Seidel, M., Minoshima, Y. N., Arriaga-Varela, E., & Fikáček, M. (2018). **Breaking a disjunct distribution: a review of the Southern Hemisphere genera *Cylorygmus* and *Relictorygmus* gen. nov. (Hydrophilidae: Cylominae).** *Annales zoologici*, 68(2): 375-403.

The southern hemisphere water scavenger beetle genus *Cylorygmus* Orchymont, 1933 (Coleoptera: Hydrophilidae: Cylominae) is revised. Three species are recognized, one in Chile and two in South Africa. The morphological differences indicate that the African species are not congeneric with the Chilean one. *Relictorygmus* gen. nov. is established for the African *R. trevornoahi* sp. nov. (type species) and *R. repentinus* (Hebauer, 2002), both known from few localities in the Western Cape province of the Republic of South Africa. The genus *Cylorygmus* with the only species *C. lineatopunctatus* Orchymont, 1933 is endemic to a small region in central Chile. Its larva is described in detail based on specimens collected in association with adults. Both genera and all species are diagnosed, described and illustrated, and an identification key for adults is provided. Our study demonstrates that the trans-Atlantic disjunct distribution of *Cylorygmus* was based on inaccurate taxonomic treatment and did not reflect the real evolutionary history of these beetles.

Seidel, M., Minoshima, Y. N., Leschen, R. A. B., & Fikáček, M. **Phylogeny, systematics and rarity assessment of New Zealand endemic *Saphydrus* beetles and related enigmatic larvae (Coleoptera: Hydrophilidae: Cylominae)** (manuscript draft).

The New Zealand endemic beetle genus *Saphydrus* Sharp, 1884 (Coleoptera: Hydrophilidae: Cylominae) is studied in order to understand its phylogenetic position, species-level systematics, biology and distribution, and to reveal reasons for its rarity. The first complete genus-level phylogeny of Cylominae based on two mitochondrial (*cox1*, 16S) and two nuclear genes (18S, 28S) covering 18 of 19 genera of the subfamily reveals *Saphydrus* as an isolated lineage situated in a clade with *Cylorygmus* (South America), *Relictorygmus* (South Africa) and *Eurygmus* (Australia). We use DNA to associate two larval morphotypes with *Saphydrus*: one of them represents the larvae of *S. suffusus* Sharp, 1884; the other, characterized by unique characters of the head and prothorax morphology, is revealed as sister but not closely related to *Saphydrus*. It is described here as *Enigmahydrus* gen. nov. with a single species, *E. larvalis* sp. nov., whose adult stage remains unknown. *Saphydrus* includes five species, two of which (*S. moeldnerae* sp. nov. and *S. tanemahuta* sp. nov.) are described as new. Larvae of *Enigmahydrus larvalis* and

Saphydrus suffusus are described and illustrated in detail based on DNA-identified specimens, candidate larvae for *Saphydrus obesus* Sharp, 1884 and *S. tanemahuta* are illustrated and diagnosed. Specimen data are used to evaluate the range, altitudinal distribution, seasonality and population dynamics over time for all species. Strongly seasonal occurrence of adults combined with other factors (winter occurrence in *S. obesus*, occurrence at high altitudes in *S. tanemahuta*) is hypothesized as the primary reason of the rarity for *Saphydrus* species. In contrast, *Enigmahydrus larvalis* underwent a massive decline in population number and size since the 1970s and is currently known from a single, locally limited population; we propose the 'nationally threatened' status for this species.

Minoshima, Y. N., Seidel, M., Wood, J. R., Leschen, R. A., Gunter, N. L., & Fikáček, M. (2018). **Morphology and biology of the flower-visiting water scavenger beetle genus *Rygmodes* (Coleoptera: Hydrophilidae).** *Entomological Science*, 21(4): 363-384.

Hydrophilidae (water scavenger beetles) is well known as an aquatic beetle family; however, it contains ca. 1,000 secondarily terrestrial species derived from aquatic ancestors. The New Zealand endemic genus *Rygmodes* White is a member of the hydrophilid subfamily Cylominae, which is the early-diverging taxon of the largest terrestrial lineage (Cylominae + Sphaeridiinae) within the Hydrophilidae. In this paper we report that *Rygmodes* beetles are pollen-feeding flower visitors as adults, but aquatic predators as larvae. Based on analyses of gut contents and a summary of collecting records reported on museum specimen labels, adult *Rygmodes* beetles are generalists feeding on pollen of at least 13 plant families. *Rygmodes* adult mouthparts differ from those of other (saprophagous) hydrophilid beetles in having the simple scoop-like apex and mola with roughly denticulate surface, resembling the morphology found in pollen-feeding staphylinid beetles. Larvae were found along the sides of streams, under stones and in algal mats and water-soaked moss; one collected larval specimen was identified using DNA barcoding of two molecular markers, mitochondrial cytochrome oxidase 1 (*cox1*) and nuclear histone 3 (H3). Larvae of two species, *Rygmodes modestus* and *Rygmodes* sp., are described in detail and illustrated; they closely resemble ambush-type predatory larvae of the hydrophilid tribe Hydrophilini in the head morphology. *Rygmodes* is the only known hydrophilid beetle with adults and larvae inhabiting different environments.

Curriculum vitae

Born: 1989 in Gera (Germany)

Education

2014 BSc. in Biochemistry at Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

BSc. Thesis: *The influence of RRP6 and PAPD5 on the abundance of small nucleolar RNAs in osteosarcoma cells.*

2015 MSc. in Biology at Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

MSc. Thesis: *Molecular phylogenetics, systematics and evolution of the Sub-Saharan Cetoniinae genus Eudicella.*

Current positions

since 2015: PhD student in Zoology at Charles University, Prague, Czechia.

since 2015: Associated researcher, National Museum, Entomology Department, Prague, Czechia.

since 2019: Entomological preparator, National Museum, Entomology Department, Prague, Czechia.

Past professional experience

2011: Research assistant (Biochemical lab work: cell culture, molecular genetics, 4 months) at Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

2013: Teaching assistant (Insect identification, 3 months) at Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

2014: Research assistant (field work: insect sampling, pollination experiments, 3 months) at Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

2014: Teaching assistant (Insect identification, 2 months) at Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

Publications

- [15] **Seidel M.**, Arriaga-Varela E., & Sousa R. (2018). Catalogue of the Incini with the description of the first *Archedinus* species from Honduras (Coleoptera: Scarabaeidae: Cetoniinae). *Acta Entomologica Musei Nationalis Pragae*, 58(2): 389-405.
- [14] Minoshima Y. N., **Seidel M.**, Wood J. R., Leschen R. A., Gunter N. L., & Fikáček M. (2018). Morphology and biology of the flower-visiting water scavenger beetle genus *Rygmodes* (Coleoptera: Hydrophilidae). *Entomological Science*, 21(4): 363-384.
- [13] Szczepański W. T., Vondráček D., **Seidel M.**, Wardhaugh C., & Fikáček M. (2018). High diversity of *Cetiocyon* beetles (Coleoptera: Hydrophilidae) along an elevational gradient on Mt. Wilhelm, New Guinea, with new records from the Bird's Head Peninsula. *Arthropod Systematics and Phylogeny*, 76: 323-347.
- [12] Arriaga-Varela E., **Seidel M.**, & Fikáček M. (2018). A new genus of coprophagous water scavenger beetle from Africa (Coleoptera, Hydrophilidae, Sphaeridiinae, Megasternini) with a discussion on the *Cercyon* subgenus *Acycreon*. *African Invertebrates*, 59(1): 1-23.
- [11] **Seidel M.**, Minoshima Y. N., Arriaga-Varela E., & Fikáček M. (2018). Breaking a disjunct distribution: a review of the Southern hemisphere genera *Cylorygmus* and *Relictorygmus* gen. nov. (Hydrophilidae: Cylominae). *Annales zoologici* 68(2): 375-403.
- [10] Arriaga-Varela E., Tomaszewska W., Huo L., & **Seidel M.** (2018). On Neotropical Merophysinae with descriptions of a new genus and new species (Coleoptera: Endomychidae). *ZooKeys* 736: 1-41.
- [9] **Seidel M.**, Arriaga-Varela E., & Vondráček D. (2017). Abstracts of the Immature Beetles Meeting 2017 October 5- 6, Prague, Czech Republic. *Acta Entomologica Musei Nationalis Pragae*, 57(2): 835-859.
- [8] Deler-Hernández A., Sýkora V., **Seidel M.**, Cala-Riquelme F., & Fikáček M. (2017). Multiple origins of the *Phaenonotum* beetles in the Greater Antilles (Coleoptera: Hydrophilidae): phylogeny, biogeography and systematics. *Zoological Journal of the Linnean Society*, 183(1): 97-120
- [7] Arriaga-Varela E., **Seidel M.**, Deler-Hernández A., Senderov V. & Fikacek M. (2017). A review of *Cercyon* Leach (Coleoptera, Hydrophilidae, Sphaeridiinae) of the Greater Antilles. *ZooKeys* 681: 39-93.
- [6] **Seidel M.**, Jameson M. L. & Stone R. (2017). A new cryptic species and review of the east-Andean leaf chafer genus *Mesomerodon* Ohaus, 1905 (Coleoptera, Scarabaeidae, Rutelinae). *ZooKeys* 671(2): 61-85.

[5] Moore M. R., Jameson M. L., Garner B. H., Audibert C., Smith A. B. T. & **Seidel M.** (2017). Synopsis of the pelidnotine scarabs (Coleoptera, Scarabaeidae, Rutelinae, Rutelini) and annotated catalogue of the species and subspecies. *ZooKeys* 666(11): 1-349.

[4] Toussaint E. A. F., **Seidel M.**, Arriaga-Varela E., Hájek J., Král D., Sekerka L., Short A. E. Z. & Fikáček M. (2017) The peril of dating beetles. *Systematic Entomology* 42(1): 1-10.

[3] Ray J. W., **Seidel M.**, & Husemann M. (2017). A new melanistic variant of the caterpillar hunter *Calosoma wilcoxi* LeConte, 1848 from Texas, United States of America and a preliminary phylogeny of the genus *Calosoma* Weber, 1801 (Coleoptera: Carabidae). *The Canadian Entomologist*, 149(1): 1-7.

[2] **Seidel M.**, Arriaga-Varela E. & Fikacek M. (2016). Establishment of *Cylominae* Zaitzev, 1908 as a valid name for the subfamily *Rygmodyinae* Orchymont, 1916 with an updated list of genera (Coleoptera: Hydrophilidae). *Acta Entomologica Musei Nationalis Pragae* 56(1): 159-165.

[1] **Seidel M.** (2016). Morphology and DNA barcoding reveal a new species of *Eudicella* from East Africa (Coleoptera: Scarabaeidae: Cetoninae). *Zootaxa* 4137(4): 535-544.

Conference presentations

- 2014 First Scarab Symposium, London, United Kingdom (oral presentation)
- 2014 11. Hymenopterologen-Tagung, Stuttgart, Germany (oral presentation)
- 2015 16. Jahrestagung der Gesellschaft für Biologische Systematik, Bonn, Germany (poster presentation)
- 2015 7th Dresden Meeting on Insect Phylogeny, Dresden, Germany (poster presentation)
- 2016 XXV International Congress of Entomology, Orlando, Florida, USA (oral presentation)
- 2017 Zoological Days 2017, Brno, Czechia (oral presentation)
- 2017 8th Dresden Meeting on Insect Phylogeny (poster presentation)
- 2017 7th Immature Beetles Meeting. Prague, Czechia (organization)
- 2018 ESA, ESC, and ESBC Joint Annual Meeting, Vancouver, Canada (oral presentation)

Univerzita Karlova, Přírodovědecká fakulta

Katedra zoologie

Doktorský studijní program: Zoologie



Matthias Seidel, MSc.

**Evoluce, systematika a biogeografie vodomilovitých brouků
(Coleoptera: Hydrophilidae) jižní polokoule**

Autoreferát disertační práce

Školitel: Martin Fikáček, PhD.

Praha, 2019

Souhrn

Výzkum prezentovaný v mé dizertační práci je složen z výsledků studia fylogeneze, biogeografie, taxonomie a ekologie vodomilovitých brouků (Coleoptera: Hydrophilidae) jižní polokoule se zaměřením na Nový Zéland. Úvodní kapitola stručně shrnuje rozpad Gondwany a geologické procesy, které ovlivnily Nový Zéland a jeho faunu. Je charakterizována fauna vodomilovitých brouků Nového Zélandu a divezita podčeledi Cylominae na Novém Zélandu a celosvětově. Výzkumná část zahrnuje čtyři publikované práce a dva rukopisy. První práce rekalibruje datovanou fylogenezi brouků a poskytuje tak mimo jiné nový odhad stáří nadčeledi Hydrophiloidea. Tento odhad je následně využit v druhé studii týkající se fylogeneze a biogeografie gondwanských Cylominae. Tato podčeď, jejíž jméno bylo obnoveno díky prioritě před jménem Rygmodinae, se skládá ze dvou tribů: Andotypini a Cylomini. Disjunktní rozšíření podčeledi Cylominae je z části výsledkem vikariance a z části disperze na dlouhou vzdálenost mezi kontinenty. Nejpozoruhodnějším příkladem disperze je případ jediného afrického zástupce podčeledi, který kolonizoval Afriku z Austrálie ca před 50 miliony let, tj. dlouho po oddělení Afriky od zbytku Gondwany. Na základě morfologie je popsán nový rod *Relictorygmus* se dvěma africkými druhy a oddělen od chilského rodu *Cylorygmus*. Morfologické a molekulární studie novozélandských Cylominae odhalily existenci celkem 13 rodů a 61 druhů, z nichž tři rody a 25 druhů zůstává nepopsáno. Revidován je novozélandský rod *Saphydrus*, se dvěma novými druhy, *S. moeldnerae* a *S. tanemahuta*, známými pouze z několika jedinců. To ukazuje na extrémní vzácnost celého rodu. Pomocí sekvencí DNA byly k dospělcům tohoto rodu přiřazeny larvy, která jsou následně popsány. Další linie, která je geneticky i morfologicky vzdálená od rodu *Saphydrus*, je popsána jako *Enigmahydrus larvalis*. Jedná se o první rod vodomila popsáný pouze na základě larvy. Nakonec je studována a shrnuta ekologie rodu *Rygmodus*, zvláštní novozélandské skupiny, jejíž dospělci navštěvují květy a živí se pylem, zatímco larvy žijí ve vodním prostředí. Dospělec a larva tedy obývají zcela různé habitaty, což je v rámci vodomilů unikátní. Součástí práce je rovněž první popis larev tohoto rodu.

Publikované články a rukopisy, které jsou součástí disertační práce

Toussaint, E. A. F., Seidel, M., Arriaga-Varela, E., Hájek, J., Král, D., Sekerka, L., Short, A. E. Z. & Fikáček, M. (2017) **Úskalí datování brouků**. *Systematic Entomology*, 42(1): 1-10.

Recently, McKenna et al., 2015 (MCK15 hereafter) investigated the higher level phylogenetic relationships of beetles (Insecta, Coleoptera) using the most comprehensive molecular dataset to date, and inferred the absolute ages of major groups using multiple fossil calibrations across the beetle tree of life. However, some of the age estimates found in MCK15 are in conflict with current knowledge of the beetle fossil record and with other recently published molecular age estimates for some major beetle clades. In some cases, the difference in age estimates is significant and might change our understanding of the mode and tempo of diversification dynamics of these groups. Based on a careful examination of the data and analyses performed in MCK15, we propose that the divergence time estimates which they found are likely to underestimate clade ages. We believe this is due to the subset of fossil Coleoptera that MCK15 selected as calibration points, as well as the methodological approach used in their analyses. To explore the impact of fossil selection on the age of Coleoptera, we derived an alternative set of fossil calibration points based on best-practice recommendations, and performed new molecular dating analyses to investigate the effect of fossil selection and maximum ages, on posterior estimates of divergence times

Seidel, M., Sýkora, V., Leschen, R. A. B., & Fikáček, M. **Systematika a biogeografie endemických brouků podčeledi Cylominae jižní polokoule (Coleoptera: Hydrophilidae)** (rukopis)

Cylominae is an enigmatic subfamily of water scavenger beetles (Coleoptera: Hydrophilidae) with a conspicuous Southern Hemisphere distribution. Here we present the first comprehensive molecular phylogeny of this subfamily and explore the historical biogeography and processes that led to the current disjunct distribution of the group in Australia, New Zealand, austral South America, and South Africa. Our results reveal the subfamily to consist of two principal clades whose reciprocal monophyly is supported by larval morphology; these clades are re-instated as tribes Cylomini stat. nov. (14 genera) and Andotypini stat. nov. (containing 9 genera including *Thomosis* Broun, 1904, stat. nov.). Three genera from New Zealand remain undescribed. Our study demonstrates that Cylominae originated in the Early Cretaceous in temperate southern Gondwana and subsequently reached their current distribution by a combination of vicariance and long-distance dispersal events. Most interestingly, the presence of the subfamily in South Africa is revealed as a result of a long-distance dispersal postdating the separation of the African continent from Southern Gondwana by more than 50 million years. The New Zealand fauna originated by a mixture of vicariance and long distance dispersal, all genera arriving prior to the Oligocene bottleneck.

Seidel, M., Arriaga-Varela, E. & Fikáček, M. (2016). **Stanovení Cylominae Zaitzev, 1908 jako platného jména podčeledi Rygmodinae Orchymont, 1916 s aktualizovaným seznamem rodů (Coleoptera: Hydrophilidae).** *Acta Entomologica Musei Nationalis Pragae*, 56(1): 159-165.

Cylominae Zaitzev, 1908 is established as a valid subfamily name for Rygmodinae Orchymont, 1916, syn. nov., due to the recent transfer of *Cyloma* Sharp, 1872 to the subfamily. The history of nomenclature of the subfamily is reviewed and an updated overview of family-group and genus-group names currently assigned to the subfamily is provided.

Seidel, M., Minoshima, Y. N., Arriaga-Varela, E., & Fikáček, M. (2018). **Zrušení disjunktí distribuce: revize rodů Cylorygmus a Relictorygmus gen. nov. (Hydrophilidae: Cylominae) z jižní polokoule.** *Annales zoologici*, 68(2): 375-403.

The southern hemisphere water scavenger beetle genus *Cylorygmus* Orchymont, 1933 (Coleoptera: Hydrophilidae: Cylominae) is revised. Three species are recognized, one in Chile and two in South Africa. The morphological differences indicate that the African species are not congeneric with the Chilean one. *Relictorygmus* gen. nov. is established for the African *R. trevernoahi* sp. nov. (type species) and *R. repentinus* (Hebauer, 2002), both known from few localities in the Western Cape province of the Republic of South Africa. The genus *Cylorygmus* with the only species *C. lineatopunctatus* Orchymont, 1933 is endemic to a small region in central Chile. Its larva is described in detail based on specimens collected in association with adults. Both genera and all species are diagnosed, described and illustrated, and an identification key for adults is provided. Our study demonstrates that the trans-Atlantic disjunct distribution of *Cylorygmus* was based on inaccurate taxonomic treatment and did not reflect the real evolutionary history of these beetles.

Seidel, M., Minoshima, Y. N., Leschen, R. A. B., & Fikáček, M. **Fylogeneze, systematika a zhodnocení vzácnosti novozélandských endemických brouků rodu Saphydrus a příbuzných záhadných larev (Coleoptera: Hydrophilidae: Cylominae)** (rukopis)

The New Zealand endemic beetle genus *Saphydrus* Sharp, 1884 (Coleoptera: Hydrophilidae: Cylominae) is studied in order to understand its phylogenetic position, species-level systematics, biology and distribution, and to reveal reasons for its rarity. The first complete genus-level phylogeny of Cylominae based on two mitochondrial (*cox1*, 16S) and two nuclear genes (18S, 28S) covering 18 of 19 genera of the subfamily reveals *Saphydrus* as an isolated lineage situated in a clade with *Cylorygmus* (South America), *Relictorygmus* (South Africa) and *Eurygmus* (Australia). We use DNA to associate two larval morphotypes with *Saphydrus*: one of them represents the larvae of *S. suffusus* Sharp, 1884; the other, characterized by unique characters of the head and prothorax morphology, is revealed as sister but not closely related to *Saphydrus*. It is described here as *Enigmahydrus* gen. nov. with a single species, *E. larvalis* sp. nov., whose adult stage remains unknown. *Saphydrus* includes five species, two of which (*S. moeldnerae* sp. nov. and *S. tanemahuta* sp. nov.) are described as new. Larvae of *Enigmahydrus larvalis* and *Saphydrus suffusus* are described and illustrated in detail based on DNA-identified specimens,

candidate larvae for *Saphydus obesus* Sharp, 1884 and *S. tanemahuta* are illustrated and diagnosed. Specimen data are used to evaluate the range, altitudinal distribution, seasonality and population dynamics over time for all species. Strongly seasonal occurrence of adults combined with other factors (winter occurrence in *S. obesus*, occurrence at high altitudes in *S. tanemahuta*) is hypothesized as the primary reason of the rarity for *Saphydus* species. In contrast, *Enigmahydus larvalis* underwent a massive decline in population number and size since the 1970s and is currently known from a single, locally limited population; we propose the ‘nationally threatened’ status for this species.

Minoshima, Y. N., Seidel, M., Wood, J. R., Leschen, R. A., Gunter, N. L., & Fikáček, M. (2018). **Morfologie a biologie květy navštěvujících vodomilů rodu *Rygmodus* (Coleoptera: Hydrophilidae).** *Entomological Science*, 21(4): 363-384.

Hydrophilidae (water scavenger beetles) is well known as an aquatic beetle family; however, it contains ca. 1,000 secondarily terrestrial species derived from aquatic ancestors. The New Zealand endemic genus *Rygmodus* White is a member of the hydrophilid subfamily Cylominae, which is the early-diverging taxon of the largest terrestrial lineage (Cylominae + Sphaeridiinae) within the Hydrophilidae. In this paper we report that *Rygmodus* beetles are pollen-feeding flower visitors as adults, but aquatic predators as larvae. Based on analyses of gut contents and a summary of collecting records reported on museum specimen labels, adult *Rygmodus* beetles are generalists feeding on pollen of at least 13 plant families. *Rygmodus* adult mouthparts differ from those of other (saprophagous) hydrophilid beetles in having the simple scoop-like apex and mola with roughly denticulate surface, resembling the morphology found in pollen-feeding staphylinid beetles. Larvae were found along the sides of streams, under stones and in algal mats and water-soaked moss; one collected larval specimen was identified using DNA barcoding of two molecular markers, mitochondrial cytochrome oxidase 1 (*cox1*) and nuclear histone 3 (H3). Larvae of two species, *Rygmodus modestus* and *Rygmodus* sp., are described in detail and illustrated; they closely resemble ambush-type predatory larvae of the hydrophilid tribe Hydrophilini in the head morphology. *Rygmodus* is the only known hydrophilid beetle with adults and larvae inhabiting different environments.

Životopis

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Publikace

- [15] **Seidel M.**, Arriaga-Varela E., & Sousa R. (2018). Catalogue of the Incini with the description of the first *Archedinus* species from Honduras (Coleoptera: Scarabaeidae: Cetoniinae). *Acta Entomologica Musei Nationalis Pragae*, 58(2): 389-405.
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- [11] **Seidel M.**, Minoshima Y. N., Arriaga-Varela E., & Fikáček M. (2018). Breaking a disjunct distribution: a review of the Southern hemisphere genera *Cylorygmus* and *Relictorygmus* gen. nov. (Hydrophilidae: Cylominae). *Annales zoologici* 68(2): 375-403.
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- [8] Deler-Hernández A., Sýkora V., **Seidel M.**, Cala-Riquelme F., & Fikáček M. (2017). Multiple origins of the *Phaenonotum* beetles in the Greater Antilles (Coleoptera: Hydrophilidae): phylogeny, biogeography and systematics. *Zoological Journal of the Linnean Society*, 183(1): 97-120
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[4] Toussaint E. A. F., **Seidel M.**, Arriaga-Varela E., Hájek J., Král D., Sekerka L., Short A. E. Z. & Fikáček M. (2017) The peril of dating beetles. *Systematic Entomology* 42(1): 1-10.

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Prezentace na konferencích

2014	First Scarab Symposium, London, United Kingdom (ústní prezentace)
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2015	16. Jahrestagung der Gesellschaft für Biologische Systematik, Bonn, Germany (prezentace posteru)
2015	7th Dresden Meeting on Insect Phylogeny, Dresden, Germany (prezentace posteru)
2016	XXV International Congress of Entomology, Orlando, Florida, USA (ústní prezentace)
2017	Zoological Days 2017, Brno, Czechia (ústní prezentace)
2017	8th Dresden Meeting on Insect Phylogeny (prezentace posteru)
2017	7th Immature Beetles Meeting. Prague, Czechia (organizace)
2018	ESA, ESC, and ESBC Joint Annual Meeting, Vancouver, Canada (ústní prezentace)