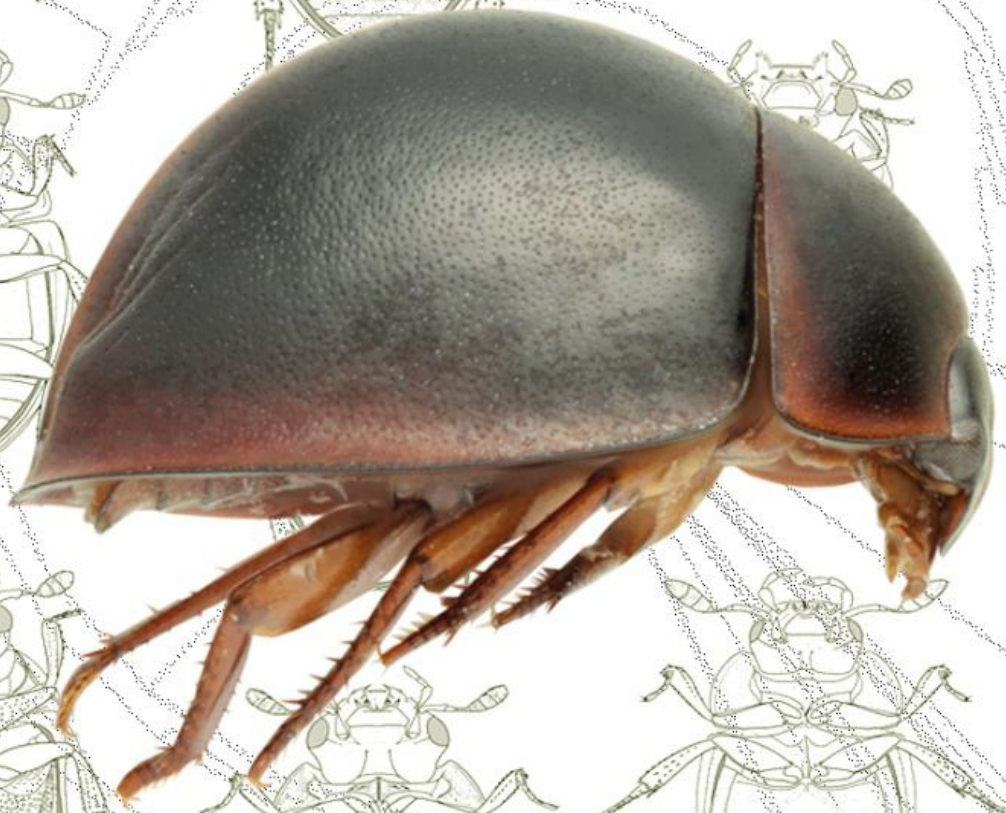
BIG4 Progress Report: Understanding the biodiversity boom in terrestrial hydrophilid beetles (Coleoptera: Hydrophilidae: Megasternini)



Emmanuel Arriaga Varela, MSc.

Supervisor: Martin Fikáček, PhD

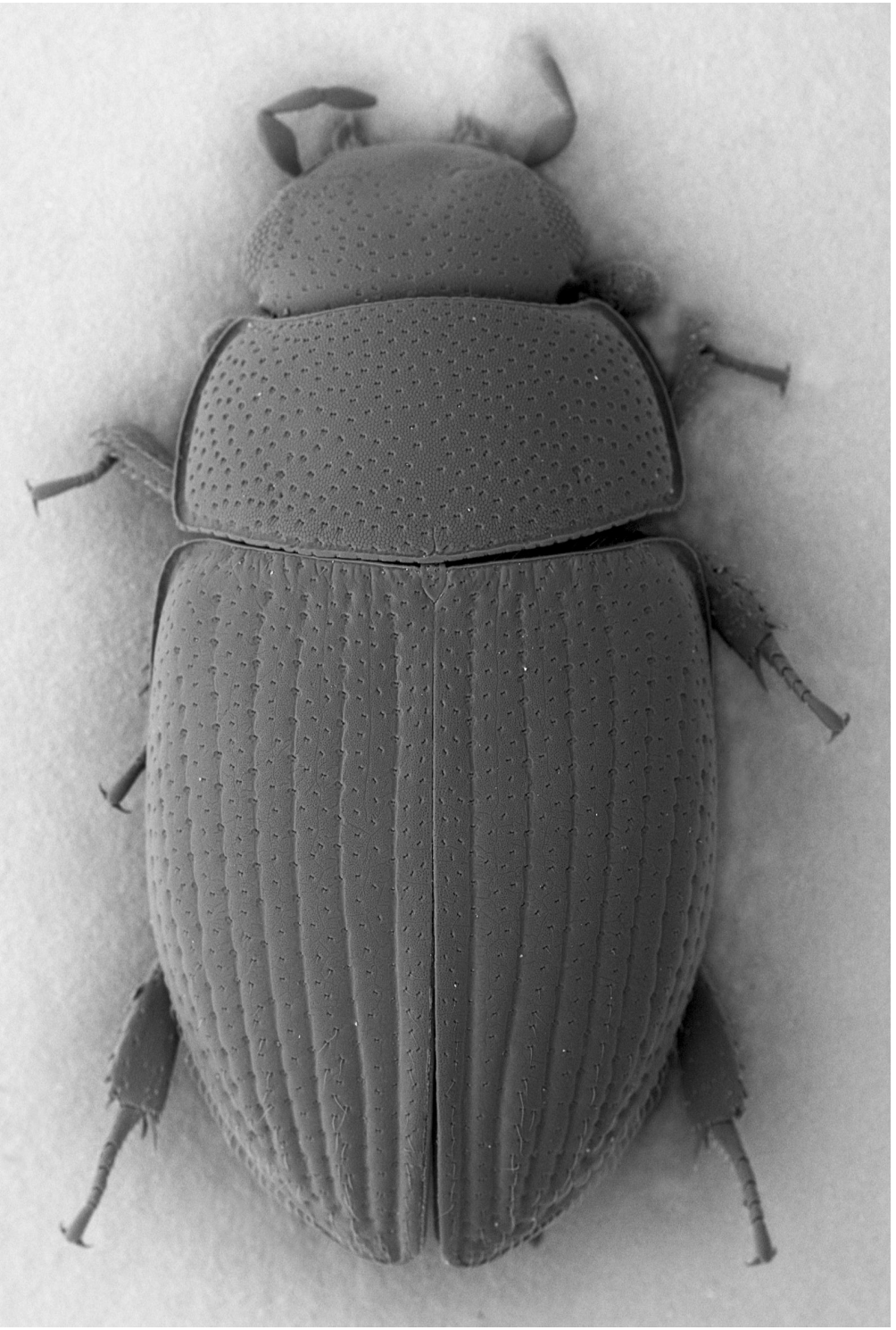
NATIONAL MUSEUM

BIG4
Biosystematics, Informatics, Genomics

Objectives

(1) To propose a phylogenetic hypothesis for the tribe, based on both molecular and morphological data.

(2) To obtain phylogenetically relevant data from different sources, like nuclear and mitochondrial genes, micro-computerized tomography, etc.



Objectives

- To redefine the generic boundaries for troublesome genera.

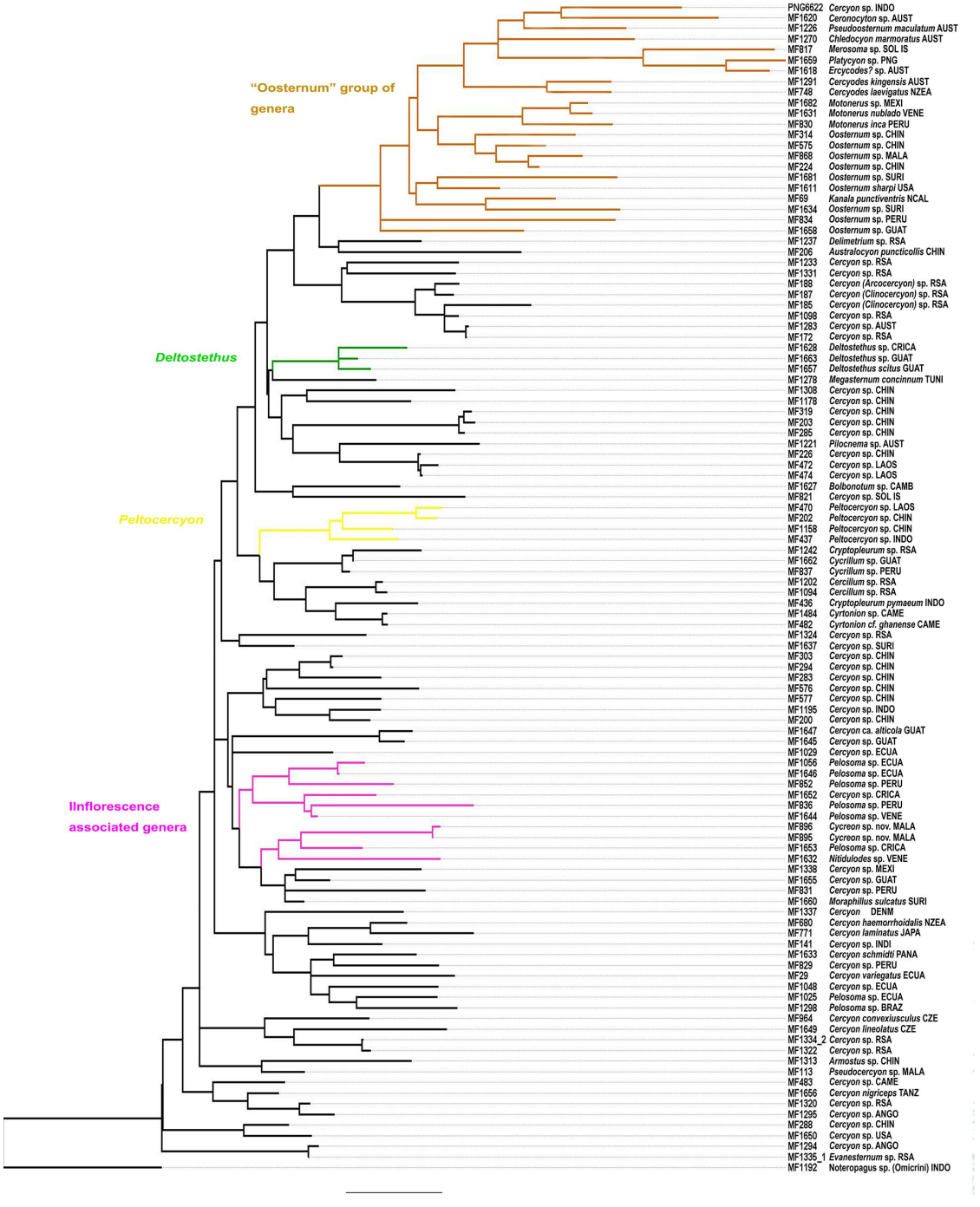
- To test the role of habitat shifts on the diversification processes within the tribe.

- To test the correlation between morphological evolution and the ecological shifts.

- To make systematic treatments on selected groups

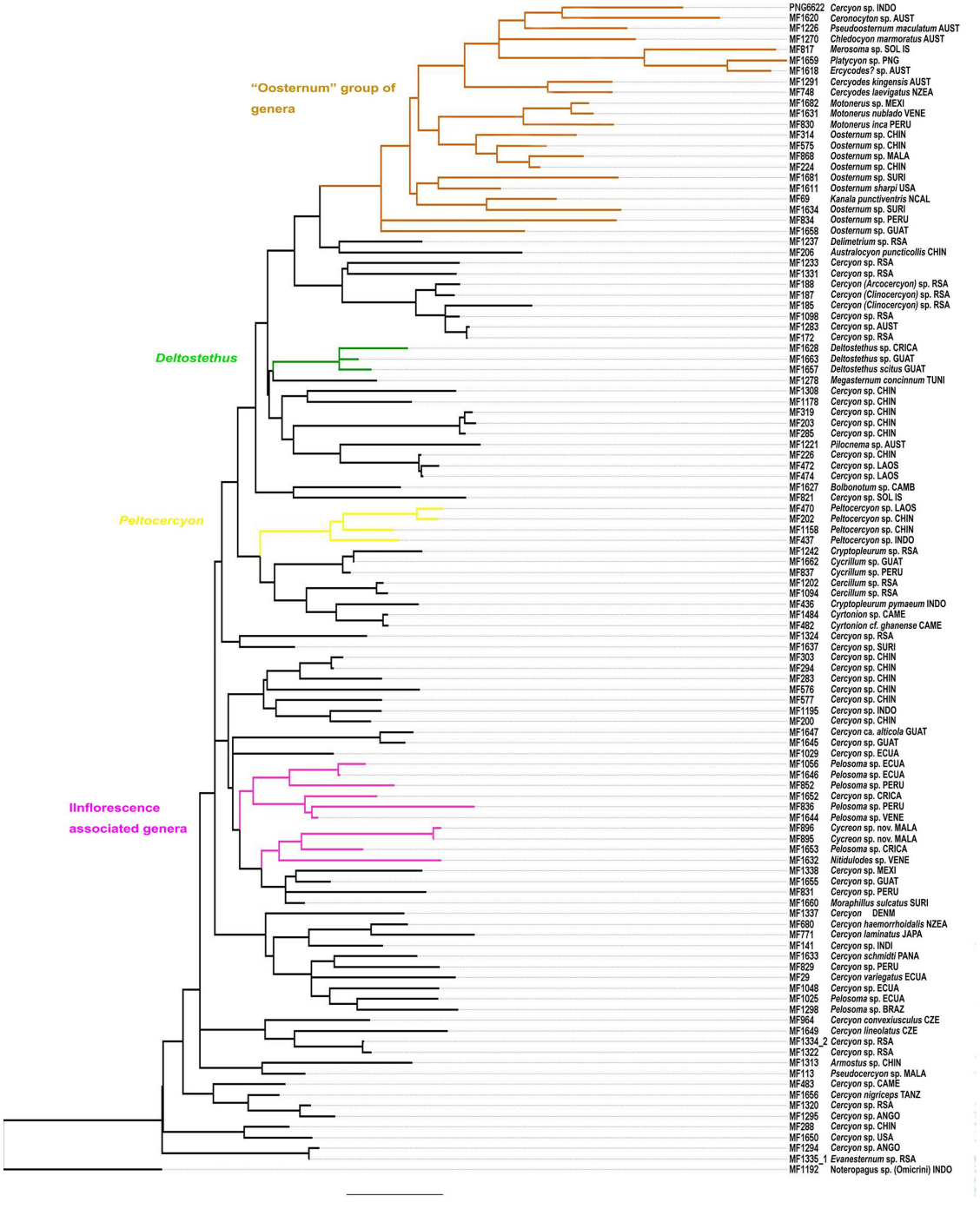
- To publish taxonomic identification resources, morphological and molecular

Phylogeny of Megasternini



Maximum likelihood tree from sequences of COI, H3, 28s, 18s

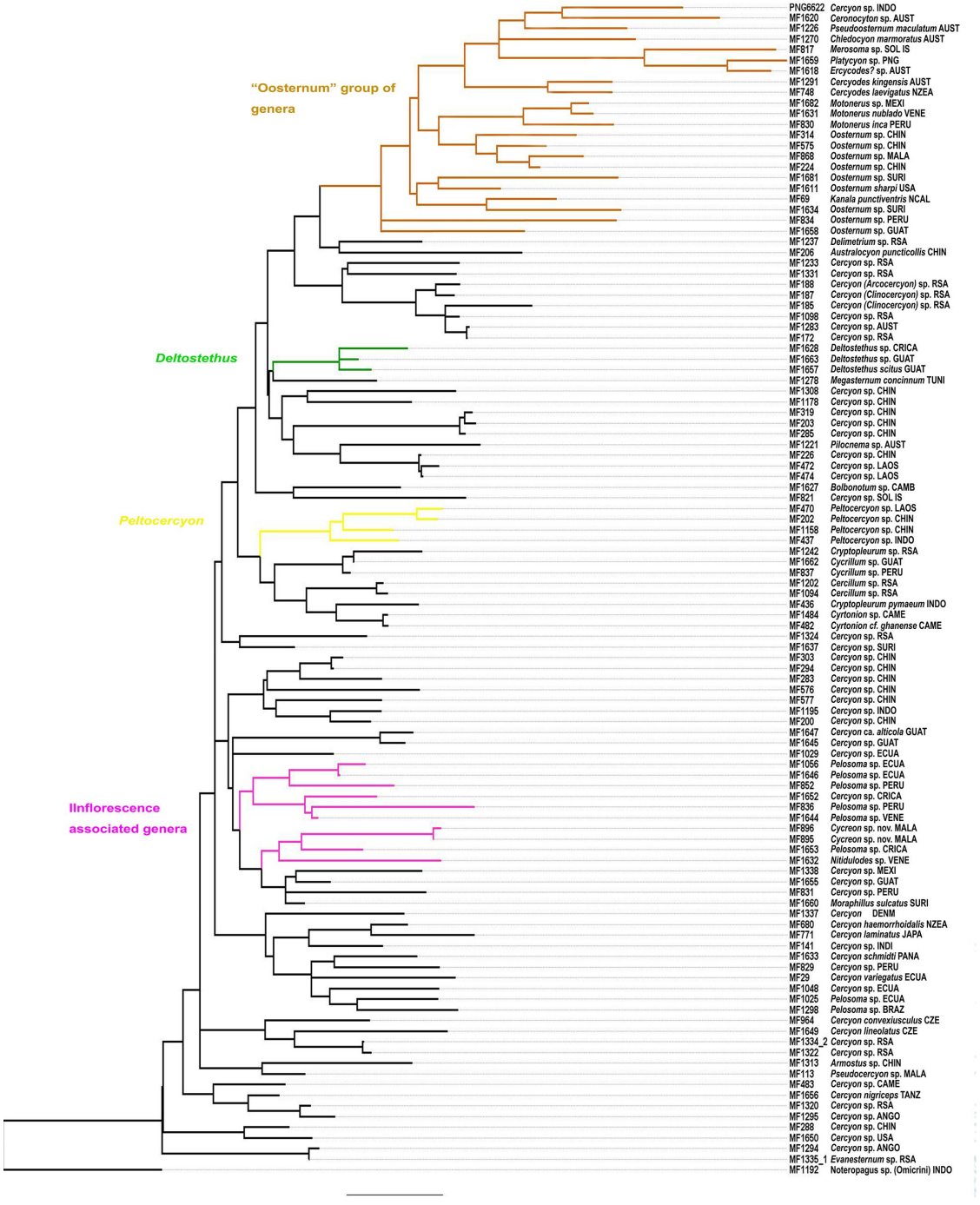
What's Cercyon, anyway?

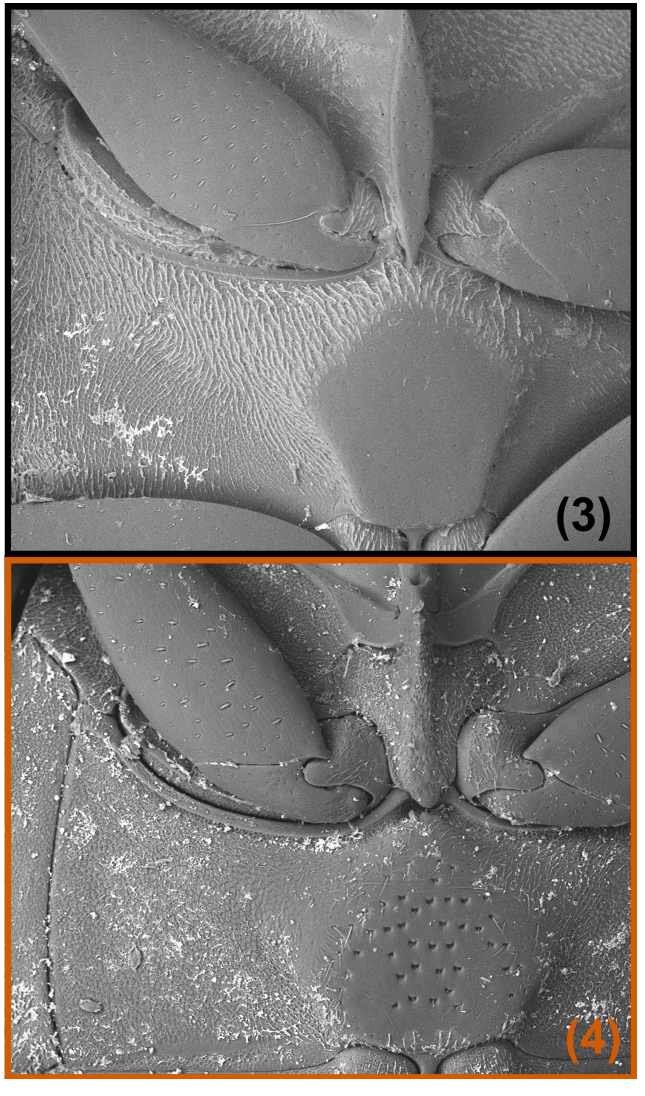


A *Cercyon* species

Whatever it means

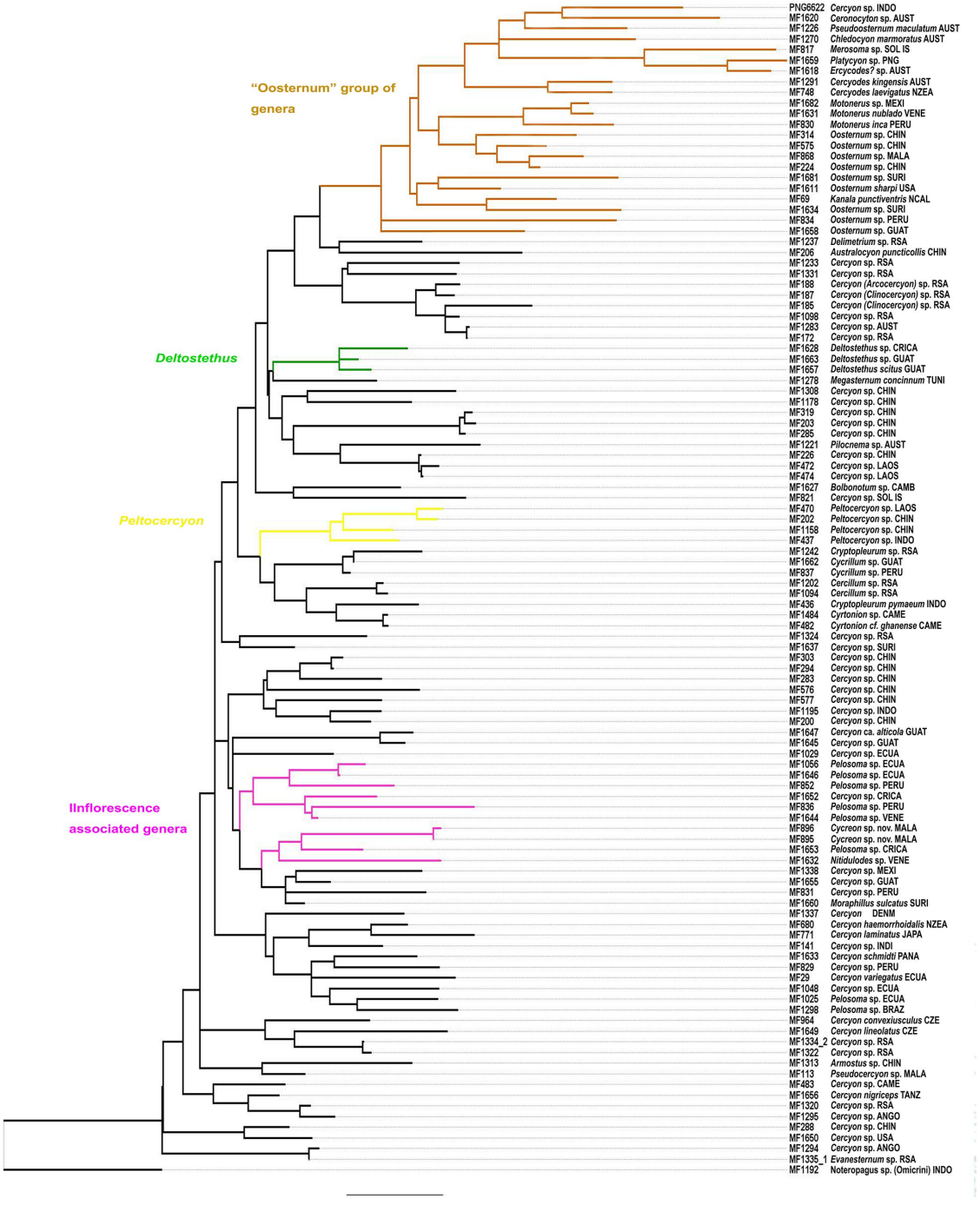
High convergence in morphology





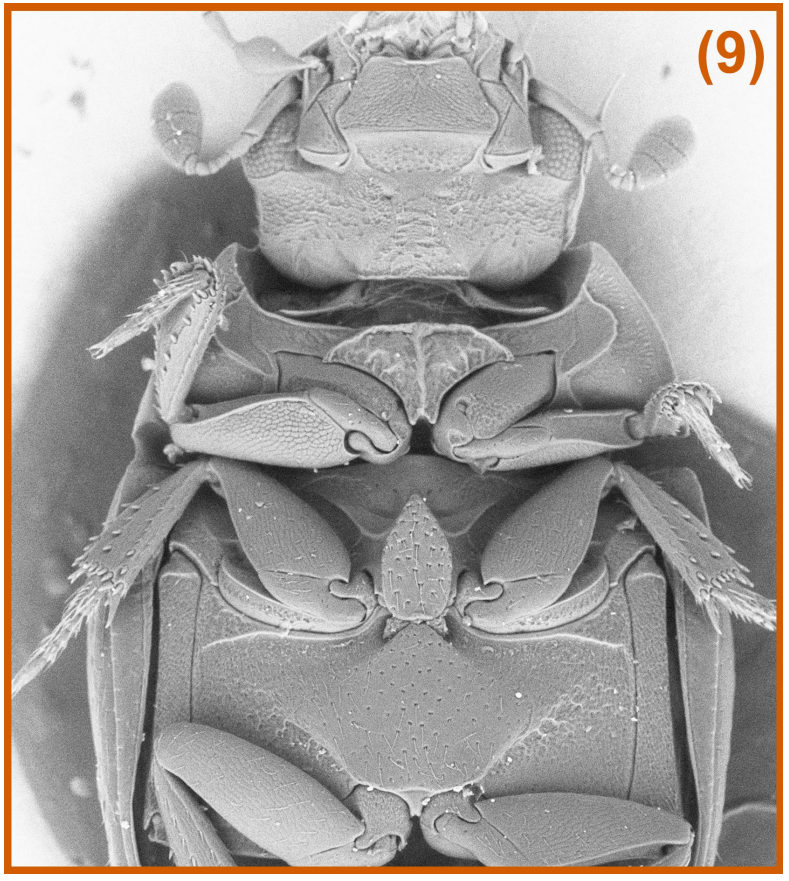
(3) *Cercyon* species from Dominican Republic

(4) *Cercyon* species from Papua New Guinea



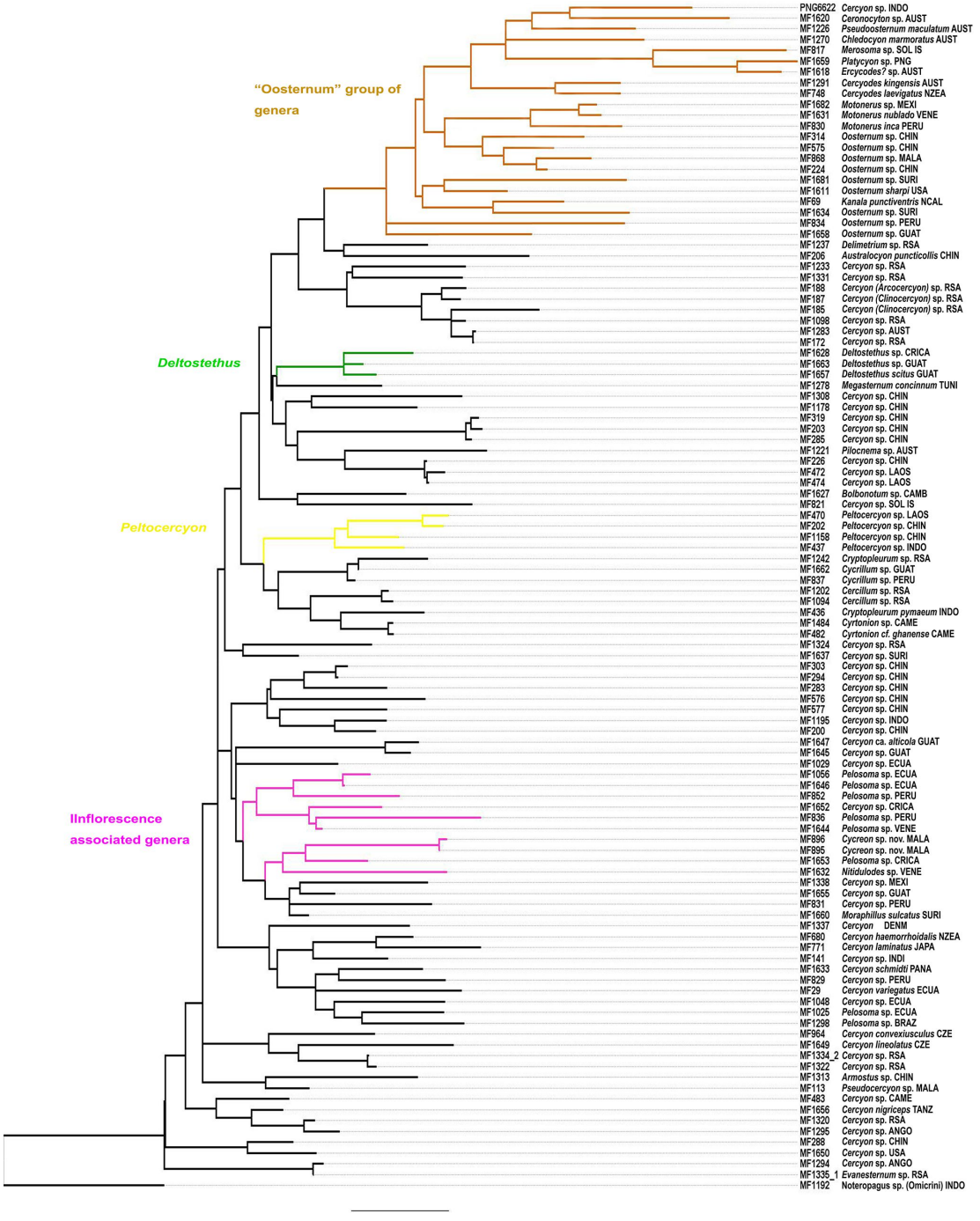
(5) *Cycreon* new species from Malaysia

(6) *Cercyon* species from Papua New Guinea



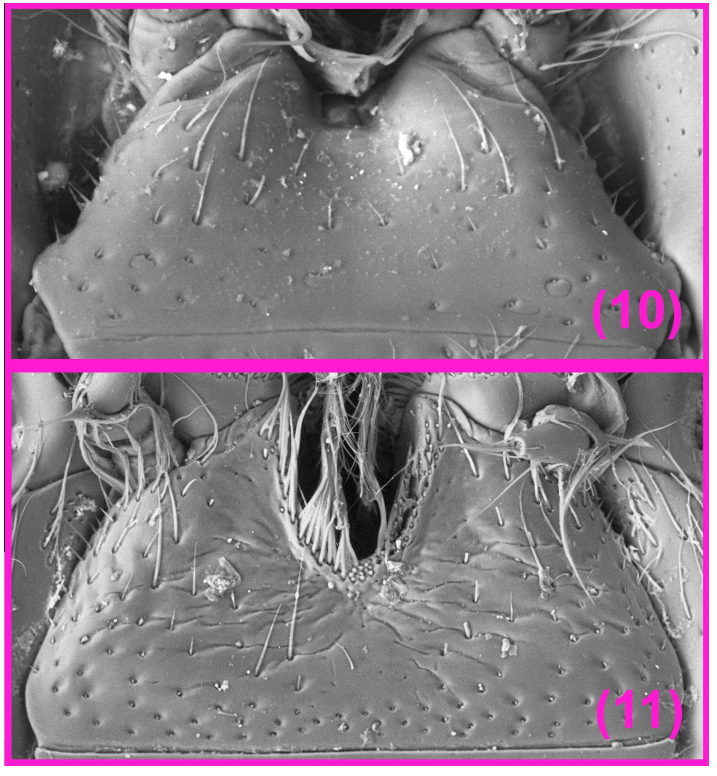
(9) *Oosternum* sp.

Some less diverse genera seem to be monophyletic, though



(7) ***Peltocercyon* sp.**

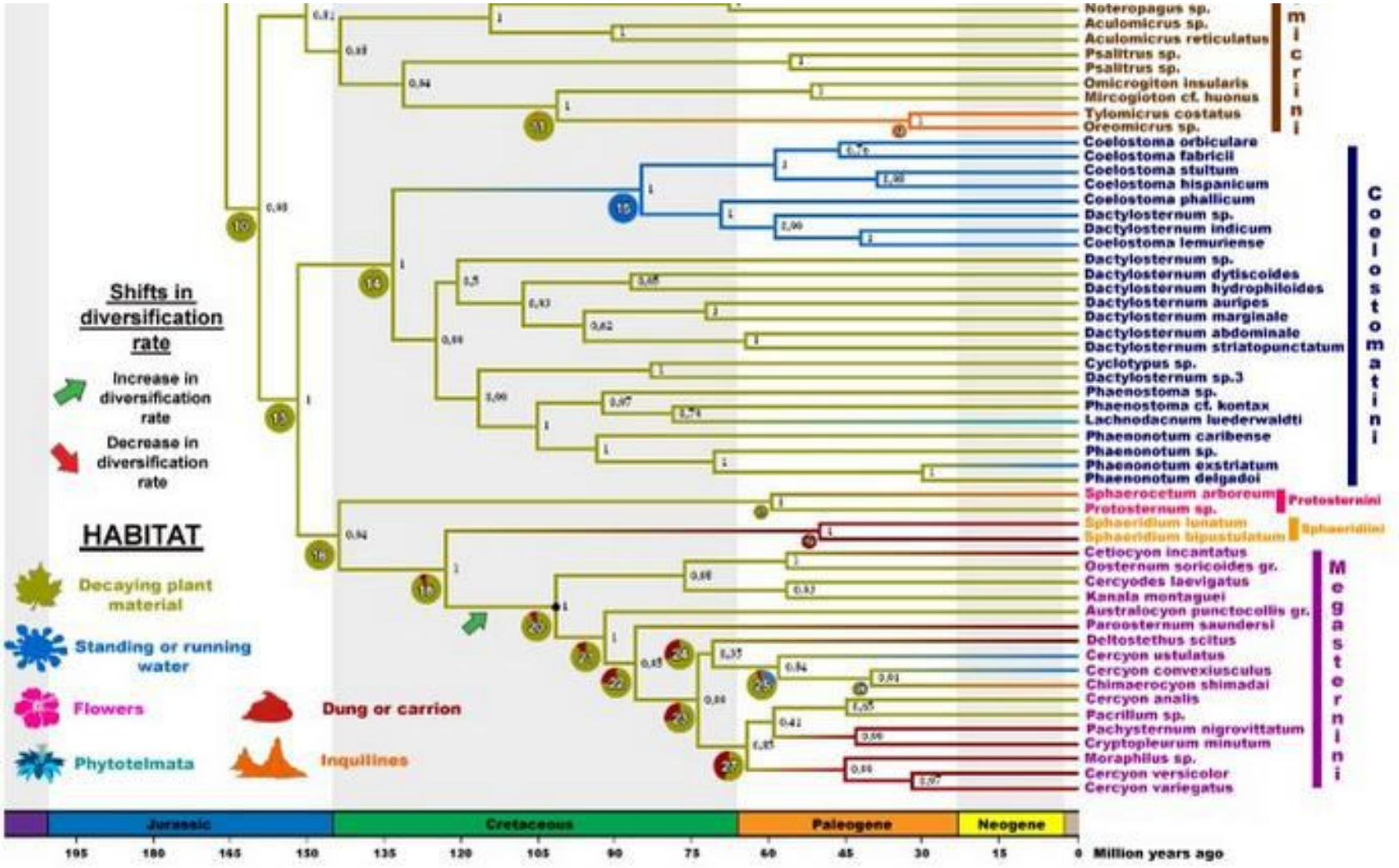
(8) ***Deltostethus* sp.**



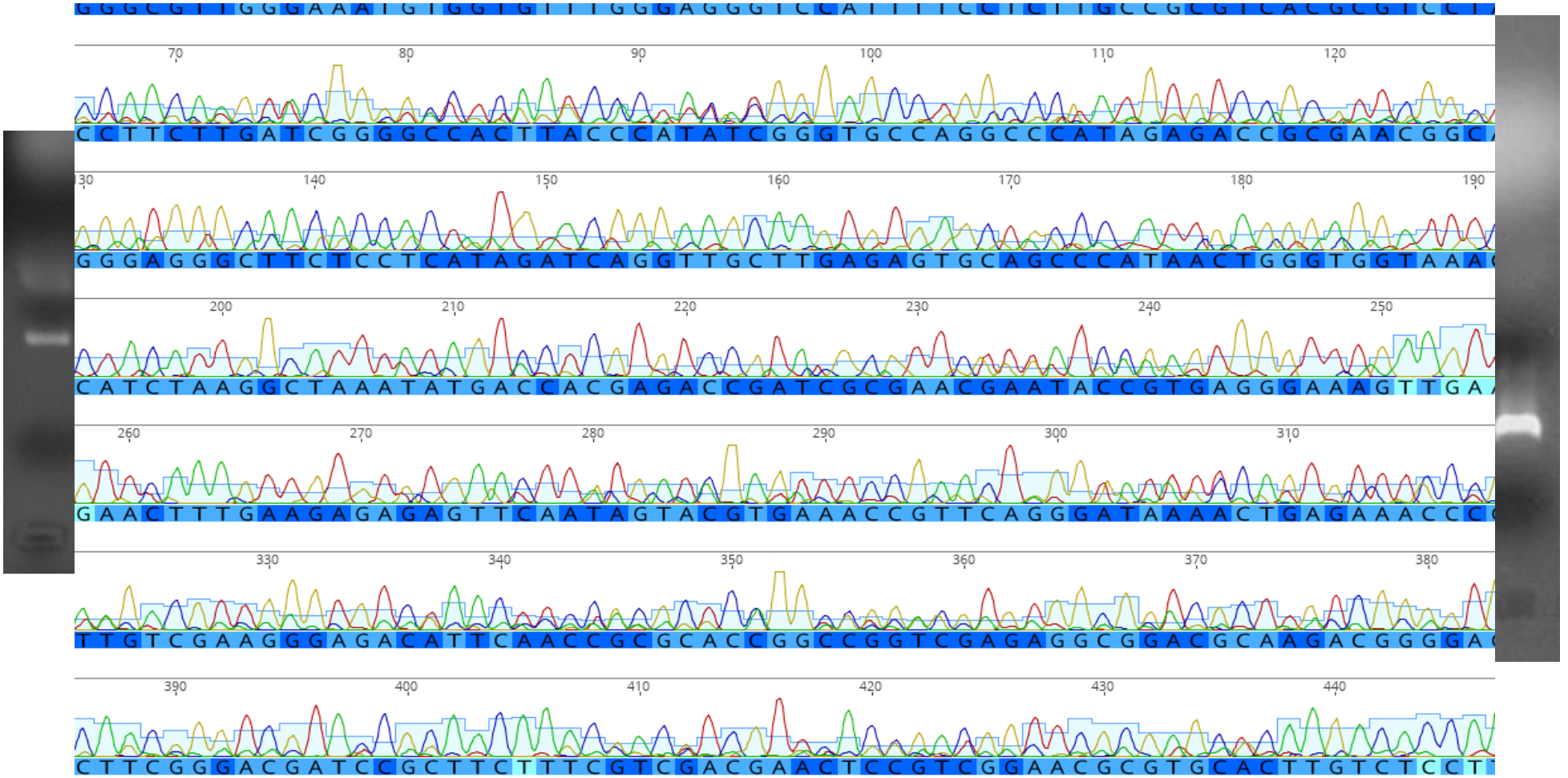
(10) *Cycreon* sp. nov.

(11) *Nitidulodes* sp.

To complete the dataset of Vit Sýkora in the Megasternini clade in order to test the role of habitat shifts in the diversification



However, I have had problems with the amplification



Taxonomical treatment of selected groups

Basically it is a matter of choosing which groups to review

ZooKeys 681: 39–93 (2017)
doi: 10.3897/zookeys.681.12522
http://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

A review of the *Cercyon* Leach (Coleoptera, Hydrophilidae, Sphaeridiinae) of the Greater Antilles

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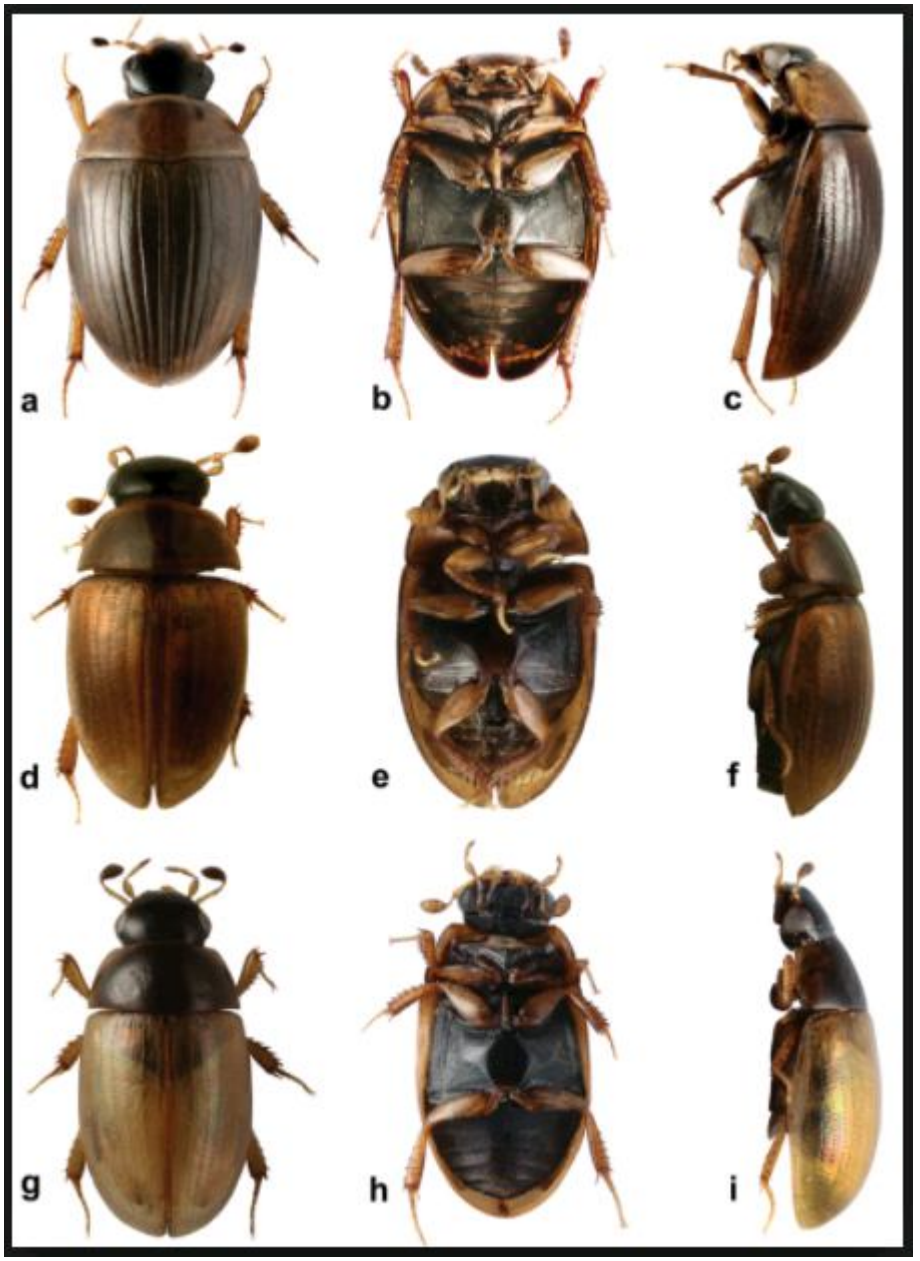
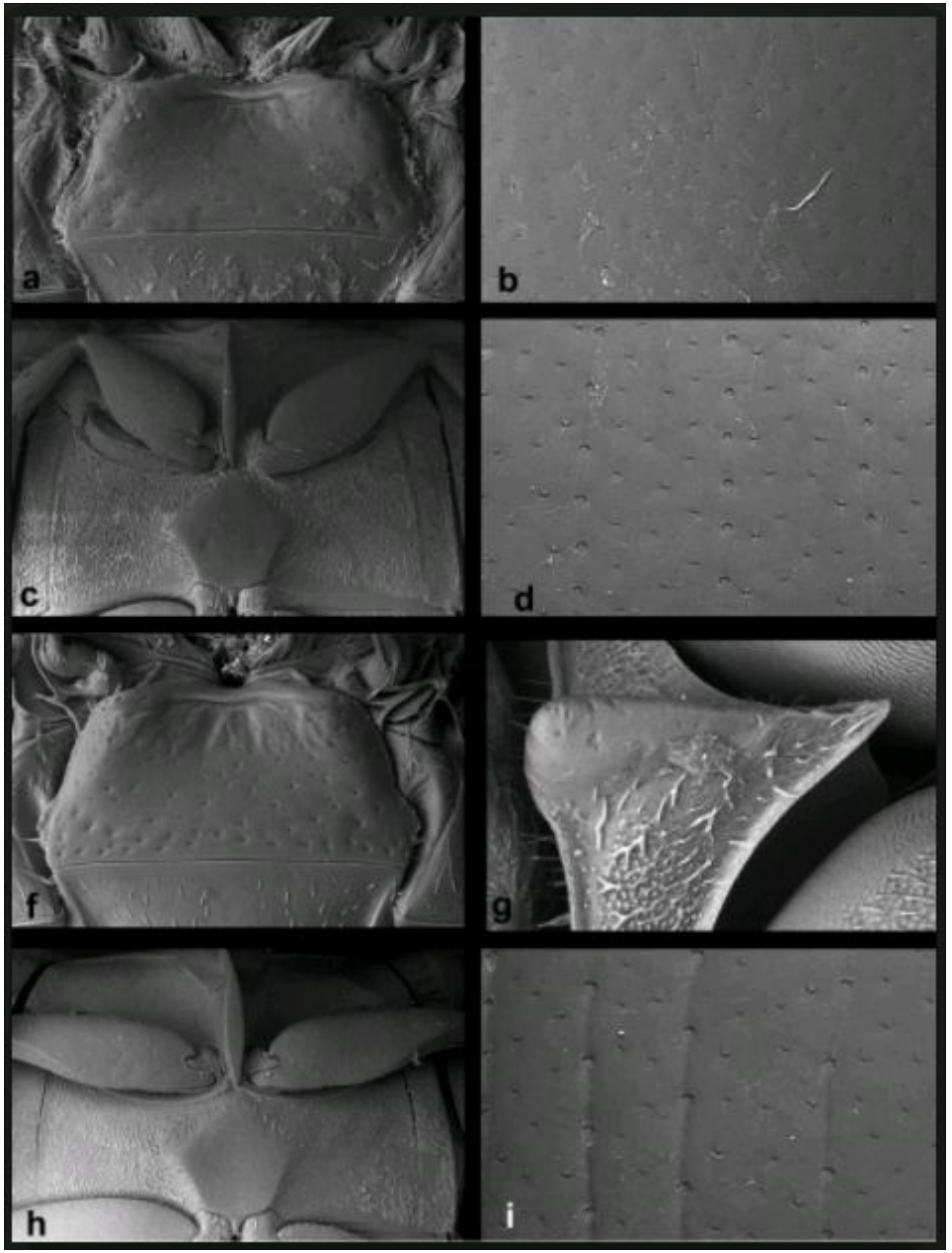
Academic editor: *M. Michat* | Received 3 March 2017 | Accepted 21 May 2017 | Published 21 June 2017

http://zoobank.org/439764EC-BA05-4D8A-815A-FC48E5D57FE4

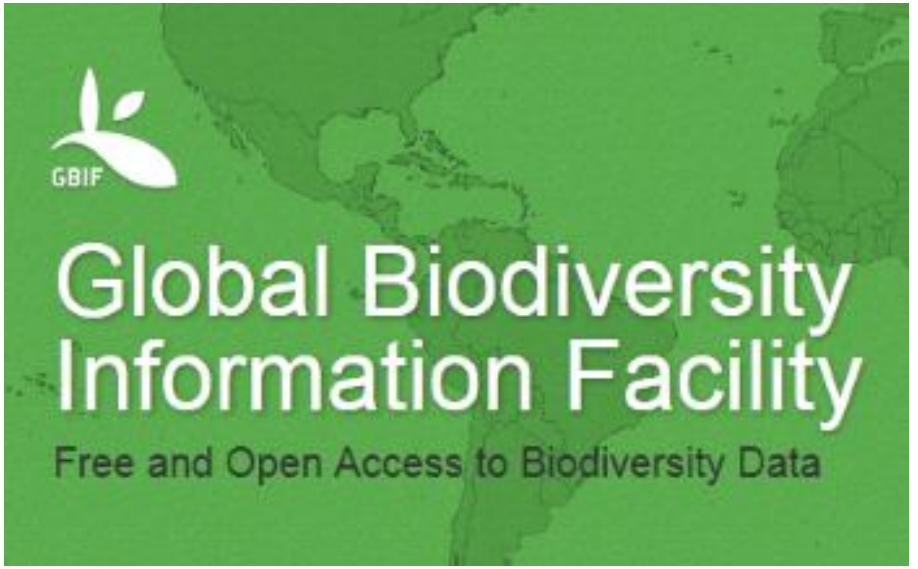
Citation: Arriaga-Varela E, Seidel M, Deler-Hernández A, Senderov V, Fikáček M (2017) A review of the *Cercyon* Leach (Coleoptera, Hydrophilidae, Sphaeridiinae) of the Greater Antilles. ZooKeys 681: 39–93. https://doi.org/10.3897/zookeys.681.12522





I'm not going to talk about this

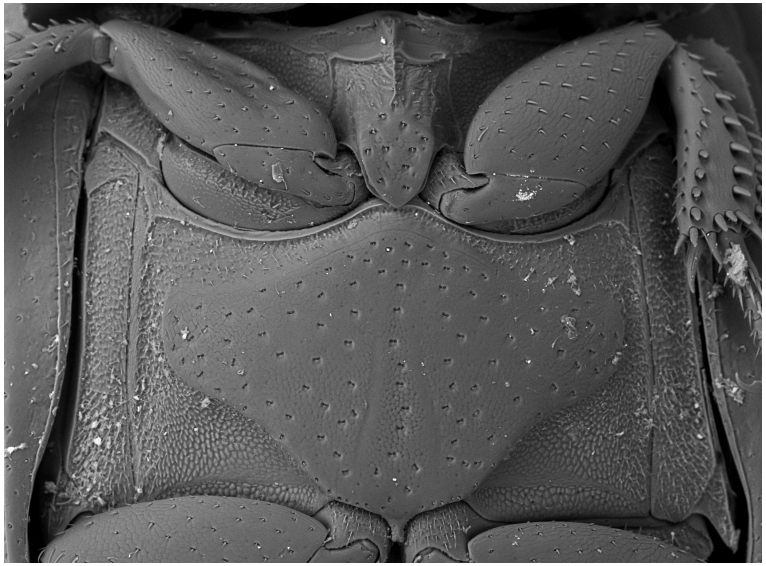
Publication of suplementary data and images



This gentleman

A new genus of coprophagous hydrophilid beetle from South Africa (Coleoptera: Hydrophilidae: Sphaeridiinae)

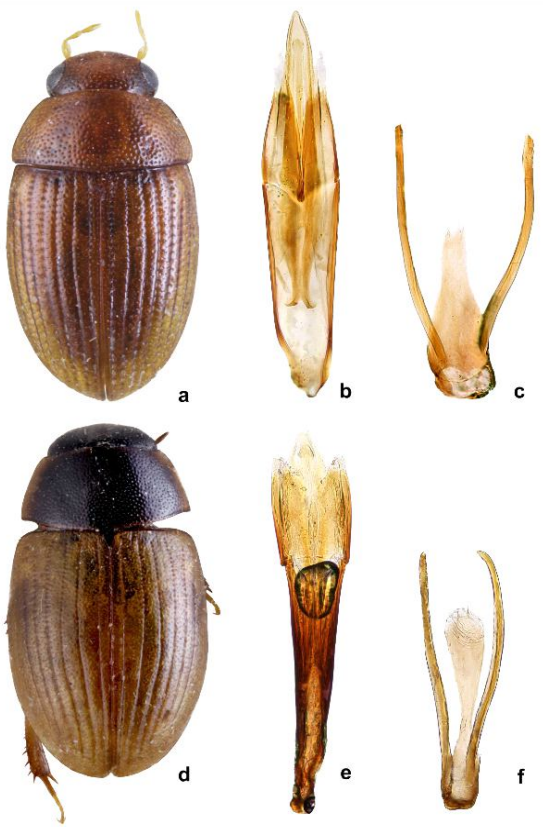
Accepted in: African Invertebrates

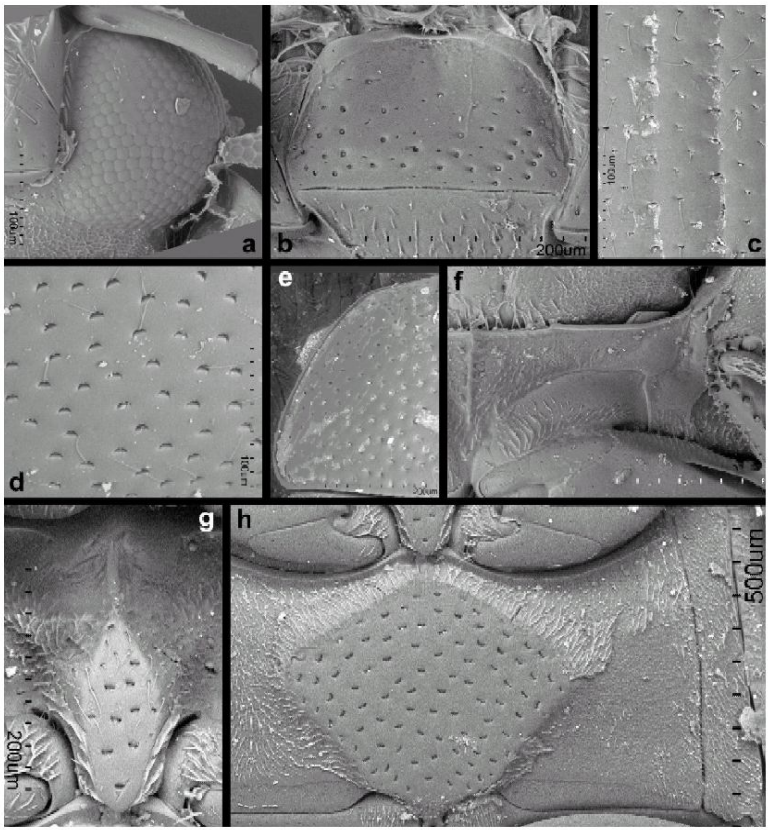


A new genus of coprophagous water scavenger beetle from Africa (Coleoptera: Hydrophilidae: Sphaeridiinae: Megasternini) with a discussion on *Cercyon* subgenus *Acycreon*

Turns out that the species was already described

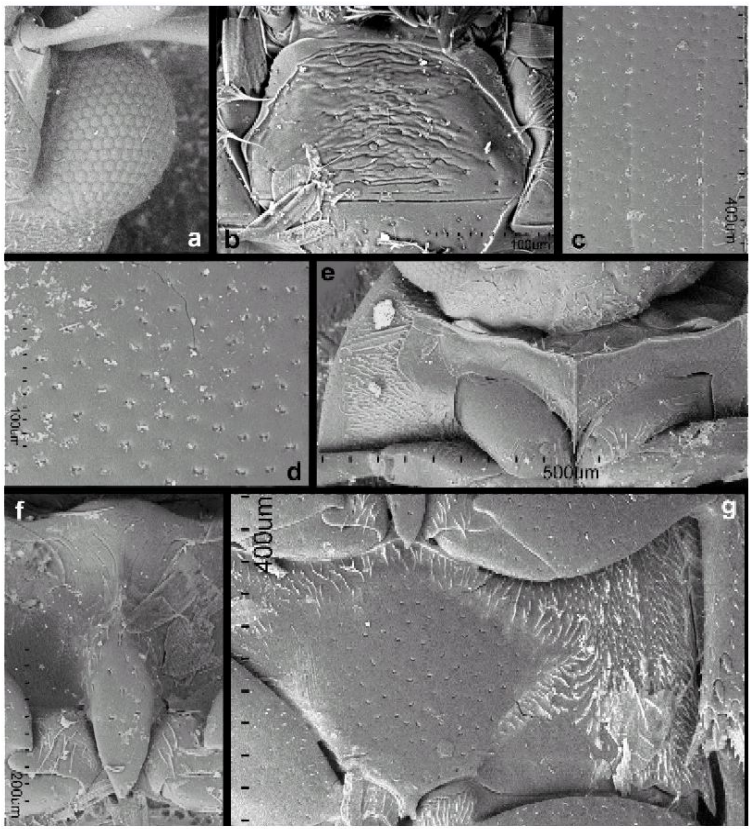
A new genus of coprophagous water scavenger beetle from Africa (Coleoptera: Hydrophilidae: Sphaeridiinae: Megasternini) with a discussion on *Cercyon* subgenus *Acycreon*





Cercyon (Acycreon) punctiger

type species



Cercyon (Acycreon) collarti

Description of three new species of *Cycreon*

To be submitted in December

Only two species are registered in the literature.
With a total of two specimens.

Hundreds of specimens collected in inforescences of Araceae

Low S.L., Wong S.Y. & P.C. Boyce. Schottarum (Schismatoglottideae: Araceae) substantiated based on combined nuclear and plastid DNA sequences. Pl. Syst. Evol. 299(7)

h Nitidulid

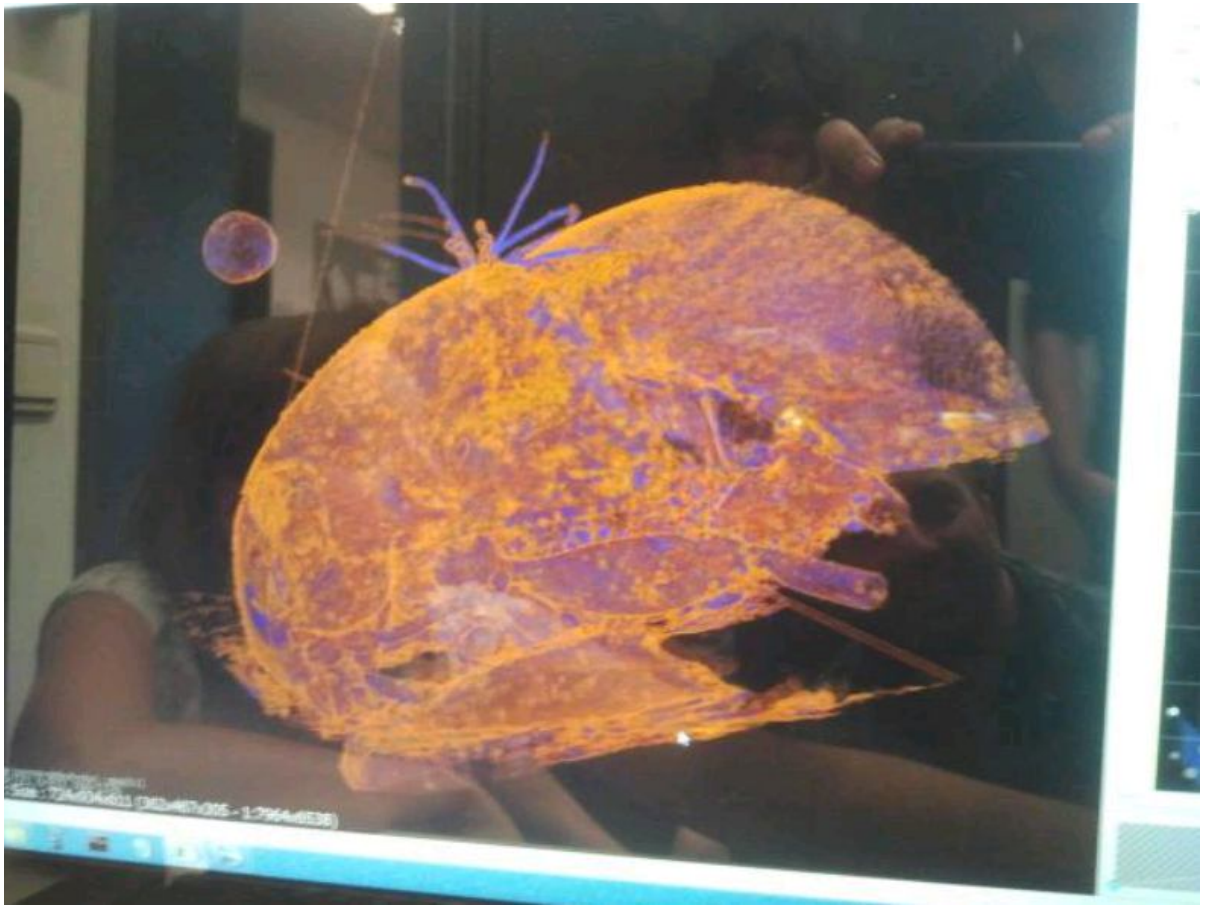
A new species of *Agna* from Mexico

To be submitted in January

Fossil hydrophilids

Secondment in Ottawa next spring

I haven't been able to make the programs run in my computer :(



Preliminary phylogenetic insights into the megadiverse group of terrestrial hydrophilid beetles (Hydrophilidae: Sphaeridiinae: Megasternini)

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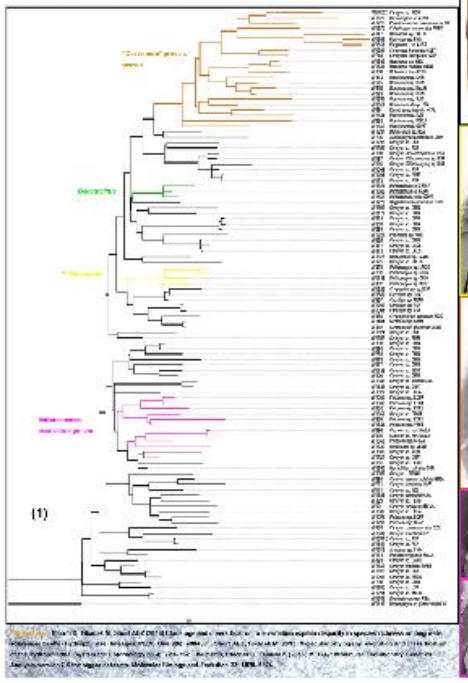
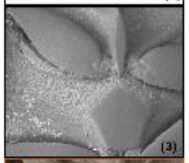
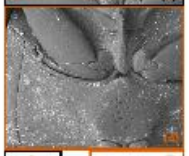
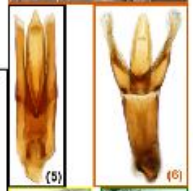
INTRODUCTION

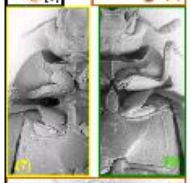
The majority of the members of Hydrophilidae are associated to a wide array of aquatic and semiaquatic habitats. More than 3,000 species have been described and classified into 6 subfamilies and 12 tribes (Short and Fikáček 2014). The tribe Megasternini (Sphaeridiinae) stands as the most speciose, with over 540 described species, whilth many other undescribed species. In contrast to the high species diversity of the group, Megasternini has been proven to be one of the most recent clades within Hydrophilidae. Consequently, the diversification rate of Megasternini is higher than that of any other hydrophilid lineage (Bloom et al. 2014). Besides of the number of species, megasternines stand out for the variety of environments colonized, some of them being highly specialized terrestrial microhabitats, like elephant dung, refuse piles of leaf-cutter ants or inflorescences of plants like *Heliconia*, *Calathea* or *Costus*. However, the internal classification within the group is in dire need of revision due to probable morphological homoplasy that could have leaded to polyphyletic groupings. Beside the dubious taxonomic status of widespread and speciose genera such *Cercyon* and *Oosternum*, the situation hampers any effort of finding the relationship between the morphological evolution, the habitat shifts and the diversification patterns.











MATERIAL AND METHODS

In order to propose a preliminar phylogenetic hypothesis we isolated genomic DNA from a total of 110 specimens representing 28 of the XX recognized genera. Employing standar PCR protocol we amplified four molecular markers: one mitochondrial (COI: 329bp) and three nuclear (18s: 561bp, 28s: 1060bp and H3: 310bp) to infer the basic relationships inside the tribe. We analysed the database using Maximum Likelihood criterion (MEGA7).

RESULTS AND DISCUSSION

- The "Oosternum" group of genera (Short of Fikáček 2014) is recovered as monophyletic (Fig. 1). This group is characterized by having the a aedeagus with median lobe fused to parameral tube and not reaching its base (Fig. 6). In contrast, the "Cercyon" group of genera, previously hypothesized to be the sister clade of the "Oosternum" group is recovered as paraphyletic with respect of it. This group is characterized by having the a aedeagus with median lobe not fused to parameral tube and reaching its base (Fig. 5).
- The most speciose generain the tribe, *Cercyon* (Fig. 2) and *Oosternum* (Fig. 3), are recovered as polyphiletic. The diagnostic configuration of thoracic ventrites in *Cercyon* (Fig. 3) seems to be highly homoplasic, found even in members of the "Oosternum" group of genera (Fig. 4).
- Conversely, moderately speciose genera like *Peltocercyon* (Fig. 7) and *Deltostethus* (Fig. 8) are retrieved as potentially monophyletic.
- The genera associated to plant living inflorescences, *Pelosoma*, *Nitidulodes* (Fig. 11) and *Cycreon* (Fig. 10) seat together in closely related clades. The deeply emarginate mentum stands as a potential apomorphy for this group.
- More sampling is needed in morphologically diverse and widespread genera like *Cryptopleurum* and *Pachysternum* in order to confirm their monophyly.

ACKNOWLEDGEMENTS

This work was supported by the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska-Curie grant agreement No. 642241 to E. Arriaga-Varela and M. Seidel, and the Ministry of Culture of the Czech Republic (DKRVO 2017/14, National Museum, 00023272) to Martin Fikáček. The work of the authors at the Department of Zoology, Charles University in Prague was partly supported by grant SVV 260 434 /2017.

BIG4

FIGURE CAPTIONS. (1) Phylogenetic tree by Maximum Likelihood in MEGA7. (2) Dorsal habitus *Cercyon* sp.nov. (3) Meso and Metaventrites *Cercyon* sp.nov. (4) Meso and Metaventrites *Cercyon* sp. INDO; (5) Aedeagus *Cycreon* sp. nov. MALA; (6) Aedeagus *Cycreon* sp. INDO; (7) Ventral view *Peltocercyon* sp. CHIN; (8) Ventral view *Deltostethus acifer* GUAT; (9) Ventral view *Oosternum* sp. MALA; (10) Mentum *Cycreon* sp. nov. MALA; (11) Mentum *Nitidulodes* sp. VENE.

- 8th Dresden Meeting on Insect Phylogeny

- Zoologické Dny, 2017

Fieldwork

This work was supported by the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No. 642241

Thank you