

New insights into *Gymnopus* s.l.: its systematic rearrangements and novel taxa

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The above article by Hu et al. (2024) has been retracted as the new combinations did not follow the nomenclatural codes and there was duplicate registration of the new combinations.

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A corrected version of the article will be resubmitted for review shortly.

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Abstract

Gymnopus (sensu lato) is significant both economically and ecologically. However, the boundaries that demarcate these genera are indistinct, partly because of limited taxa sampling, and, also due to the insufficient use of gene fragments employed for phylogenetic analyses. Furthermore, species diversity in *Gymnopus* s.l. is likely to have been vastly underestimated, due to the lack of its detailed investigation outside of America and Europe, including in China and other countries. In this study, we examined 527 gymnopoid collections from China and performed a comprehensive phylogenetic analysis of both these collections and related genera within *Omphalotaceae* combined with ITS and nLSU sequences data. In this dataset, 159 sequences from 93 species were provided. Furthermore, sect. *Levipedes* and sect. *Impudicae* were newly recognized as independent genera by combined morphological and phylogenetic evidences and the relationships within *Omphalotaceae*, thus we propose accepting them as separate genera, namely: *Impudipilus* and *Levipedipilus*. Section *Vestipedes* was also found to share close affinity with *Collybiopsis*, which nests with it, while divided into three independent clades, for the reasons we propose accepting them as separate genera, namely: *Neomarasmius*, *Ligymopus*, and *Vestipedipilus*. The infrageneric analyses within *Impudipilus*, *Levipedipilus*, and *Gymnopus* were also performed. *Impudipilus* was divided into three sections – sect. *Impudicae*, sect. *Dysodes*, and sect. *Similis*. *Levipedipilus* was divided into three sections, namely sect. *Levipedes*, sect. *Erythropus*, and sect. *Alkalivirens*. *Gymnopus* was divided into six sections, based on the reactions with Melinda's reagent, namely sect. *Gymnopus*, sect. *Androsacei*, sect. *Efibulatus*, sect. *Omphalinooides*, sect. *Irresolutus*, and sect. *Brunneiniger*. Fifty-seven species of *Gymnopus* s.l. and allied from China were recorded, including 11 novel species and seven new records from China. In addition, we performed the first comprehensive divergence-times estimation between the genera within *Omphalotaceae*. Data from our molecular clock analyses suggest that the divergence of *Omphalotaceae* probably occurred during the Jurassic period, while the divergence of *Gymnopus* s.l. likely occurred

during the early Cretaceous period. This study also provides keys for the identification of the *Gymnopus* s.l. species.

Keywords – Biogeographic analysis – *Collybiopsis* – *Gymnopus* – *Impudipilus* – *Ligymnopus* – New genera and species – *Vestipedipilus*