

Letter to the editor

Open Access

## Unknown species from China: The case of phrurolithid spiders (Araneae, Phrurolithidae)

### DEAR EDITOR,

Three new genera and 46 new species of phrurolithid spiders (Araneae, Phrurolithidae) are described from Jiangxi Province, southern China. These results support our hypothesis that a large percentage of China's species remain unknown (Li, 2020).

Some 250 years after Swedish biologist Carl Linnaeus devised a formal system for classifying the diversity of nature, more than two million accepted species have been listed in the recent Catalogue of Life (COL) (Costello et al., 2022). However, 86% of the Earth's species are yet to be fully described (Mora et al., 2011), indicating that less than 15% of extant species are catalogued. For example, 146 154 fungal species have been recorded (COL, 2022), but an estimated 2.2–5.1 million species remain undescribed (Hawksworth & Lücking, 2017; O'Brien et al., 2005). Furthermore, within the animal kingdom, 1.5 million species have been described in 40 phyla (Zhang, 2013), but an estimated 7.8 million terrestrial species and 2.2 million oceanic species remain undiscovered (Mora et al., 2011).

In China, approximately 250 000 species have been catalogued, including 164 182 species of animals, 8 610 species of bacteria, 1 970 species of Chromista, 27 900 species of fungi, 38 394 species of plants, 2 897 species of protozoa, and 2 800 species of viruses (Figure 1; Supplementary Material I), with an average increase of 6 500 species per year over the last 20 years. According to the unknown species percentage determined by Mora et al. (2011), there are likely to be 1.4 million unknown species in China. This high prediction of unknown species is supported by previous research on spiders within a 11 km<sup>2</sup> peninsular area in Xishuangbanna, China, where 782 spider species were described (Li, 2020), with at least 200 more awaiting description. Of note, only 66 spider species were known from the same area in 2006.

Our current study on the spider family Phrurolithidae Banks,

1892 from Jiangxi provides additional support for the high percentage of unknown species in China. The spider family Phrurolithidae includes 261 species in 15 genera (Li, 2020), with 124 species reported from Asia in the last 20 years alone. An extensive survey of phrurolithid spiders from October 2020 to May 2021 in south Jiangxi yielded 46 new species. For detailed morphological descriptions, diagnoses, and illustrations of the new species, please see Supplementary Material II.

### NOMENCLATURAL ACTS REGISTRATION

The type material in this paper is housed in the Animal Specimen Museum, College of Life Science, Jingtangshan University (ASM-JGSU). The electronic version of this article in portable document format represents a published work according to the International Commission on Zoological Nomenclature (ICZN), and hence the new names contained in the electronic version are effectively published under the Code from the electronic edition alone (see Articles 8.5–8.6 of the Code). This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved, and the associated information can be viewed through any standard web browser by appending the LSID to the prefix <http://zoobank.org/>.

Publication LSID: urn:lsid:zoobank.org:pub: FDF4A17E-410B-478E-BAC7-7D45CB8B7374

*Acrolithus* Liu & S. Li **gen. nov.**

LSID: urn:lsid:zoobank.org:act:43333E35-08EC-44CB-B0A9-B53BA0FE4DCF

*Aculithus* Liu & S. Li **gen. nov.**

LSID: urn:lsid:zoobank.org:act:E791258D-471C-4BE2-ADDE-866B052D1AFA

*Grandilithus* Liu & S. Li **gen. nov.**

LSID: urn:lsid:zoobank.org:act:E86C1445-8C13-4B70-A37F-

This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Copyright ©2022 Editorial Office of Zoological Research, Kunming Institute of Zoology, Chinese Academy of Sciences

Received: 27 February 2022; Accepted: 29 March 2022; Online: 30 March 2022

Foundation items: This study was supported by the Strategic Priority Research Program of the Chinese Academy of Sciences (XDB31000000) and National Natural Science Foundation of China (32100363, 31970396)

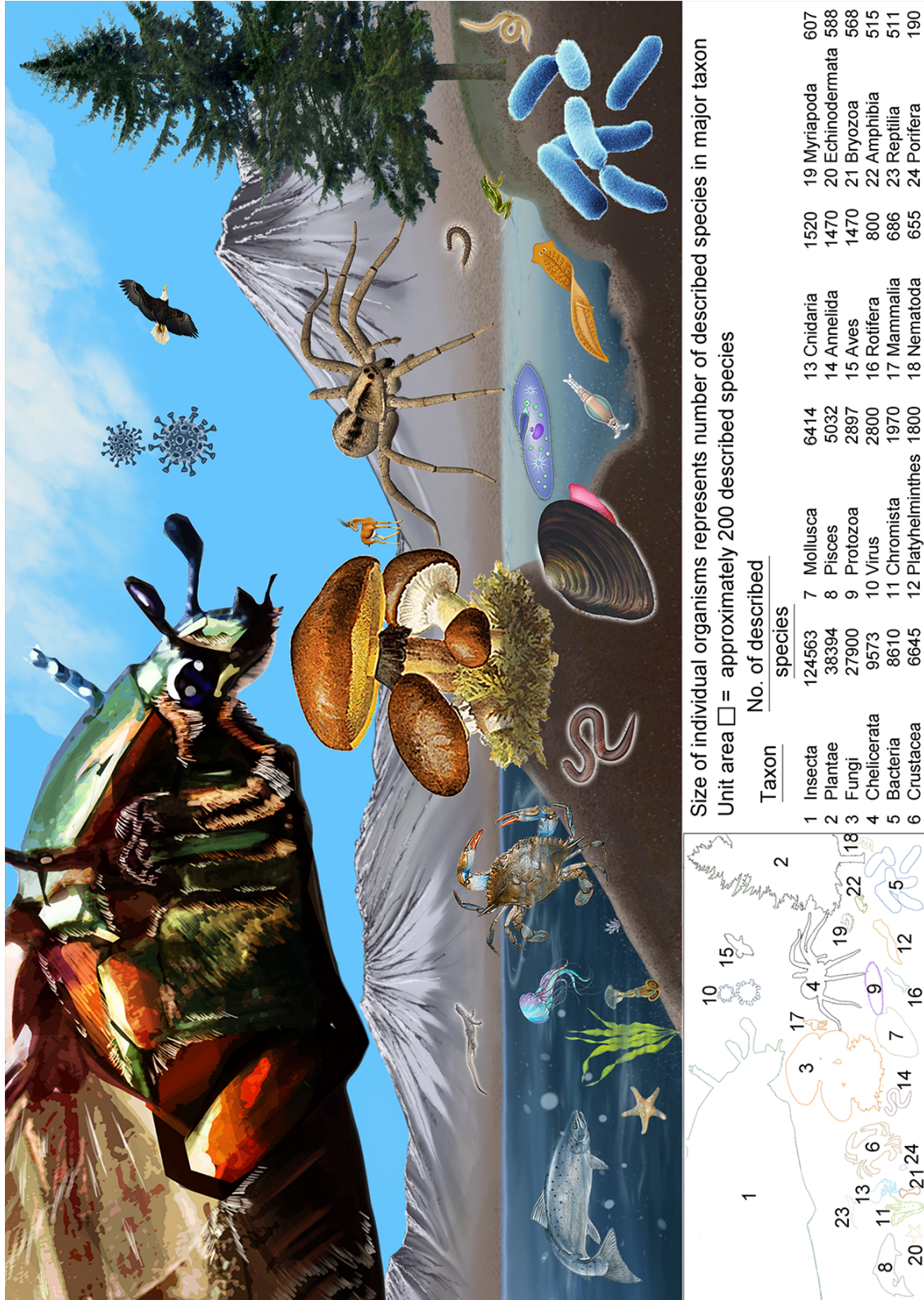


Figure 1 Species scape in China, where the size of individual organisms approximately corresponds to the number of species described in the higher taxon they represent (For data sources, please see Supplementary Material I)

34953D16482D  
*Acrolithus jiuolong* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:9E5DB0F8-2D82-41D4-9C8C-C0C8E3A5E630

*Acrolithus linyun* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:EFEA7456-4732-41BF-8EDD-7C7EBA5C3845

*Acrolithus ruyii* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:4F47F1BD-A7A5-4EEB-9242-76E6BF04F448

*Acrolithus shijiao* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org :act:5B044830-29BB-403B-A983-4DA52D6A14F7

*Acrolithus xiajing* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:B6FE4180-1714-4F2E-9E88-25D657F67BBC

*Acrolithus xiaojing* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:2BBBD95C-2384-4592-B6D3-A0999F1890B5

*Acrolithus yeniu* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:A4D84817-08EE-47E0-AD74-98B83DBDD626

*Aculithus chongyi* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:541F820C-4F09-46C0-A304-20177345984A

*Aculithus taishan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:801ACFBF-C2A7-4657-8295-CD8BFB4C37C4

*Aculithus xunwu* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:5EB848C6-D27A-403A-A617-0B1148C16784

*Grandilithus anyuan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:3F35FA25-844B-416A-BC32-7D947252E86F

*Grandilithus aobei* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:C91717AE-ADFF-4894-88C0-E7E626C88E08

*Grandilithus dingnan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:9E15E878-06CF-4BA9-879C-DB4419F394D6

*Grandilithus dongguling* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:D5655AB0-95CA-484B-BF9E-3B5F838DB72B

*Grandilithus fengshan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:D9FF99FC-7D1D-4341-B598-2BDE5FDC6102

*Grandilithus jiangshan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:083E1A03-4A12-4AD2-93EA-0DEB3FEC5B85

*Grandilithus jingshi* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:B3B2171F-0AA6-4172-850E-5B9E0341C643

*Grandilithus longjiatang* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:6F5A724F-6D8F-49C9-82F7-23D27E3C531B

*Grandilithus nanan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:EEBECB78-3AEF-4E38-814E-22BEC413F691

*Grandilithus ningdu* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:CE18E532-6185-4D2D-848C-CFAC8C727D06

*Grandilithus taihe* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:A0BF9FB0-C4EC-4E33-A347-4669EE860CBF

*Grandilithus tianyushan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:C9EC8668-6E4C-4976-8C25-092A34F61EE1

*Grandilithus tudingao* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:2EB90110-6063-409D-98C6-613655A7199B

*Grandilithus wanzili* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:62CFB297-E10A-4AC4-910B-03DF6C3ED822

*Grandilithus yunyin* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:BA594D13-A3FF-408F-9808-55778C107513

*Otacilia aotou* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:DDB54867-36D2-4A10-9780-BCE53AF214F1

*Otacilia dawushan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:698815B9-B3E8-4BF6-BBD9-A3AA6A4EE448

*Otacilia dongshang* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:2FF3CC04-4D47-4A39-9D0A-0A306083912D

*Otacilia fuxi* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:A9351E35-67B1-4DA0-B29F-179833767D9A

*Otacilia guizhumao* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:B58AD573-1BFD-48E7-A542-D1D680D03F9A

*Otacilia hushandong* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:C7579EDC-5D08-4FD8-B3B4-BB6560E7E738

*Otacilia juliashan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:F858B48D-991B-461A-81E9-C7D6563861B0

*Otacilia linghua* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:BB9E76DB-903E-47EE-9E22-37BDAF49E20A

*Otacilia longbu* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:547645BE-2DE7-4927-8153-A4F2DE6F5D5C

*Otacilia ping* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:24A98906-BB03-4D5C-B0E9-322A74F2D90D

*Otacilia qingyuan* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:50F996CE-26AE-4C4C-8209-4384BE350EFC

*Otacilia sanbai* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:688B93D9-8D33-4E70-AE01-F43B89D898F2

*Otacilia shuijiang* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:EEBED5E6-4D33-48F4-B4FF-CD4EAD65D653

*Otacilia tianhua* Liu & S. Li **sp. nov.**  
 LSID: urn:lsid:zoobank.org:act:11A8B3A3-8FA4-4EA1-9597-A0404167FA8C

*Otacilia wanshi* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:D9634EA4-3DAF-43F1-9003-B0466DE9888B

*Otacilia wuzhifeng* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:AA1BCEB4-5C00-432E-83E8-287AB14CCE89

*Otacilia xiangshan* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:2058E95E-BA8F-4F84-AAC4-492669E22D60

*Otacilia xiaobu* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:61FCAF83-4856-4B2A-ACE1-4A8BBD27DB16

*Otacilia xingguo* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:C6FEE5F8-FBBC-48FD-8C64-CBDC2A0ABD97

*Otacilia yangming* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:5C558155-19B1-4A05-B7FD-68CEDCCB14DE

*Otacilia zhonglong* Liu & S. Li **sp. nov.**

LSID: urn:lsid:zoobank.org:act:7B0EB34B-68E6-43FC-A05D-5B2EA4FDEA54

#### SCIENTIFIC FIELD SURVEY PERMISSION INFORMATION

Permission for field surveys in Jiangxi was granted by the Jiangxi Provincial Department of Forestry, Nanchang, China.

#### SUPPLEMENTARY DATA

Supplementary data (I, Figure 1 source of data; II, taxonomy of Phrurolithidae from Jiangxi, China) to this article can be found online.

#### COMPETING INTERESTS

The authors declare that they have no competing interests.

#### AUTHORS' CONTRIBUTIONS

Y.H.X. and S.Q.L. designed the study. K.K.L., Y.H.Y., Z.Y.M.,

M.H.F., W.H.L., and X.X. contributed to fieldwork and performed morphological species identification. K.K.L., S.Q.L., and X.Q.Z. drafted and revised the manuscript. All authors read and approved the final version of the manuscript.

Ke-Ke Liu<sup>1,2</sup>, Shu-Qiang Li<sup>3</sup>, Xiao-Qing Zhang<sup>3</sup>, Yuan-Hao Ying<sup>1</sup>, Ze-Yuan Meng<sup>1</sup>, Ming-Hui Fei<sup>1</sup>, Wen-Hui Li<sup>1</sup>, Yong-Hong Xiao<sup>1,\*</sup>, Xiang Xu<sup>4</sup>

<sup>1</sup> College of Life Science, Jinggangshan University, Ji'an, Jiangxi 343009, China

<sup>2</sup> Key Laboratory of Agricultural Environmental Pollution Prevention and Control in Red Soil Hilly Region of Jiangxi Province, Jinggangshan University, Ji'an, Jiangxi 343009, China

<sup>3</sup> Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China

<sup>4</sup> College of Life Science, Hunan Normal University, Changsha, Hunan 410081, China

\*Corresponding author, E-mail: yonghongxiao01@126.com

#### REFERENCES

- COL. 2022. Fungi. <https://www.catalogueoflife.org/>.
- Costello MJ, DeWalt RE, Orrell TM, Banki O. 2022. Two million species catalogued by 500 experts. *Nature*, **601**(7892): 191.
- Hawksworth DL, Lücking R. 2017. Fungal diversity revisited: 2.2 to 3.8 million species. *Microbiology Spectrum*, **5**(4): 79–80.
- Li SQ. 2020. Spider taxonomy for an advanced China. *Zoological Systematics*, **45**(2): 73–77.
- Mora C, Tittensor DP, Adl S, Simpson AGB, Worm B. 2011. How many species are there on Earth and in the Ocean. *PLoS Biology*, **9**(8): e1001127.
- O'Brien HE, Parrent JL, Jackson JA, Moncalvo JM, Vilgalys R. 2005. Fungal community analysis by large-scale sequencing of environmental samples. *Applied and Environmental Microbiology*, **71**(9): 5544–5550.
- Zhang ZQ. 2013. Animal biodiversity: an outline of higher-level classification and survey of taxonomic richness (Addenda 2013). *Zootaxa*, **3703**: 1–82.