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COMMUNICATION

Challenges confronting spider taxonomy in Asia

As the largest continent in the world, bound by the Pacific, Indian, and Arctic Oceans and the Mediterranean Sea, Asia is well-endowed in its geological and biological diversity. Not surprisingly, spiders abound in the vast expanses of its tropic and temperate forests, lofty mountain ranges and plateaus, and flood plains of its many river systems. However, it is only over the past two decades that we have begun to make a concerted effort to undertake the study of spider taxonomy, and correspondingly, to discuss the issue of conservation of their habitats.

The study on spider taxonomy in Asia began not long after Clerck described the first spider under the binomial system in 1757. However, progress had been slow, sporadic, and completely driven by a few European arachnologists. Fabricius described a number of Chinese and Indian spiders in 1793, including what are known today as *Nephila pilipes* (Fabricius, 1793) and *Macracantha arcuata* (Fabricius, 1793). Highlights of early history of Asian spider taxonomic research include the description of what are known today as *Hasarius adansoni* (Audouin, 1826) from Syria, *Macracantha hasselti* (C. L. Koch, 1837) from Indonesia, and *Hyllus diardi* (Walckenaer, 1837) from Vietnam. Among the Indian spiders described in the 19th century are *Myrmarachne melanocephala* MacLeay, 1839, *Nephilengys malabarensis* (Walckenaer, 1841), and *Myrmarachne manducator* (Westwood, 1841). Cantor (1842) described nine spiders from “Chusan” in China (now Zhoushan Island in Zhejiang Province). C. L. Koch described many species from Indonesia during the same period, including *Poltys illepidus* C.L. Koch, 1843, *Bavia capistrata* (C.L. Koch, 1846), *Carrhotus viduus* (C.L. Koch, 1846), *Cosmophasis thalassina* (C.L. Koch, 1846), *Rhene flavigera* (C.L. Koch, 1846), and *Toxeus maxillosa* (C.L. Koch, 1846). In 1878, L. Koch reported 28 spider species from Japan, and provided fairly detailed and diagnostic figures of the sex organs. Karsch (1879) described 52 spider species from Japan, also with recognizable figures acceptable for subsequent taxonomic research. Pickard-Cambridge (1885) described 108 new spider species from material collected by Ferdinand Stoliczka on the Second Yarkand Expedition 1873–1874. Most of the species were collected in Sache County (in southwest Xinjiang, China), with others from Afghanistan, India, Pakistan, and Tajikistan. In the first half of the 20th century, Asian arachnologists, principally Japanese, came into the picture, but progress was still tardy compared with the rapid advancement in Western Europe and North America. It was only towards the end of the century that the spiders of Japan (along with those in Western Europe) were deemed to be “most completely known” while those in the developing countries were “much more poorly known” (Coddington & Levi, 1991).

Times are changing. Progress in spider taxonomy in Asia has surged ahead over the last two decades. For instance, the first author (S. Li) described 186 new spider species from 2011 to 2013, 292 new species from 2014 to 2016, 379 new species from 2017 to 2019, and 729 new species from 2020 to 2023. With the joint efforts of Chinese and foreign colleagues, the number of spider species in China increased from 2,361 species in 1999 to 6,344 species, spanning across 928 genera and 75 families by the end of 2023. The other countries with more than a thousand valid species documented in the WSC (2023) are Japan, India, Indonesia, and Kazakhstan. See Figure 1 for the statistics of these countries and the rest of Asia. Based on the WSC (2023), the number of Asian spiders reached 17,095 species in 1,696 genera and 92 families by the end of 2023, which is about 34% of the global tally. Struck by such newly documented multitude of Asian spiders, Wayne Maddison, the former President of International Society of Arachnology, jocularly characterised it as “Asia Rising” (personal communication).

Notwithstanding such pronounced strides over the past two decades, there remains significant hurdles impeding a more vigorous progress of Asian spider taxonomy. At the root of the problem is the outmoded notion of taxonomy as a “descriptive science” has remained entrenched. It is most lamentable because modern spider taxonomy has already evolved into a more holistic, dynamic, and empirical discipline: meticulous and accurate observations and descriptions are integrated with state-of-the-art technologies and advanced methodologies. These have included bioinformatics, DNA barcoding, comparative genomics, molecular phylogenetics, high-resolution imaging, micro-CT scans, and even artificial intelligence and machine learning (Zhang *et al.*, 2008).

The low esteem of taxonomy, albeit unjustifiably outmoded, can become a damper to attracting young talent to embrace

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taxonomy as their career choice. This will only exacerbate the current shortage of taxonomists in Asia, with grave and long-term implications on the succession issue. Already, more than 80% of taxonomic graduate students trained by the state in China have switched career paths away from taxonomy. With the ongoing and impending retirement of the many distinguished Asian taxonomists, the future of sustaining a vibrant milieu for spider taxonomic research in Asia will be bleak, unless the trends of falling recruitment of young and talented taxonomists are reversed.

The mistaken image of taxonomy as an old-fashioned descriptive science also means that it is increasingly difficult to attract funding for taxonomic research from governments, and research and academic institutions. The financial hurdle is more than just a bread-and-butter issue for the taxonomists. It will have a grave impact on the quality of research dependent on modern curation facilities and sophisticated laboratory logistics supporting cutting-edge research such as those involving molecular analysis. It will also adversely diminish the quality for taxonomic research at the operational level, like limiting what an arachnologist can achieve by way of field trips at home and abroad, especially to those biodiversity hotspots in Asia where much work is required to expand their spider inventories. Shortage of fund will further dwindle travel expenses to European museums where most of the Asian type materials (often poorly described without illustrations by pioneer arachnologists) are deposited.

In recent years, another problem has emerged to hinder the further advancement of spider taxonomy research in Asia: the unintended consequences arising from the implementation of the *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization*. The problems have been discussed extensively by numerous taxonomists around the world (Deplazes-Zemp *et al.*, 2018; Prathapan *et al.*, 2018; Britz *et al.*, 2020; Löbl *et al.*,

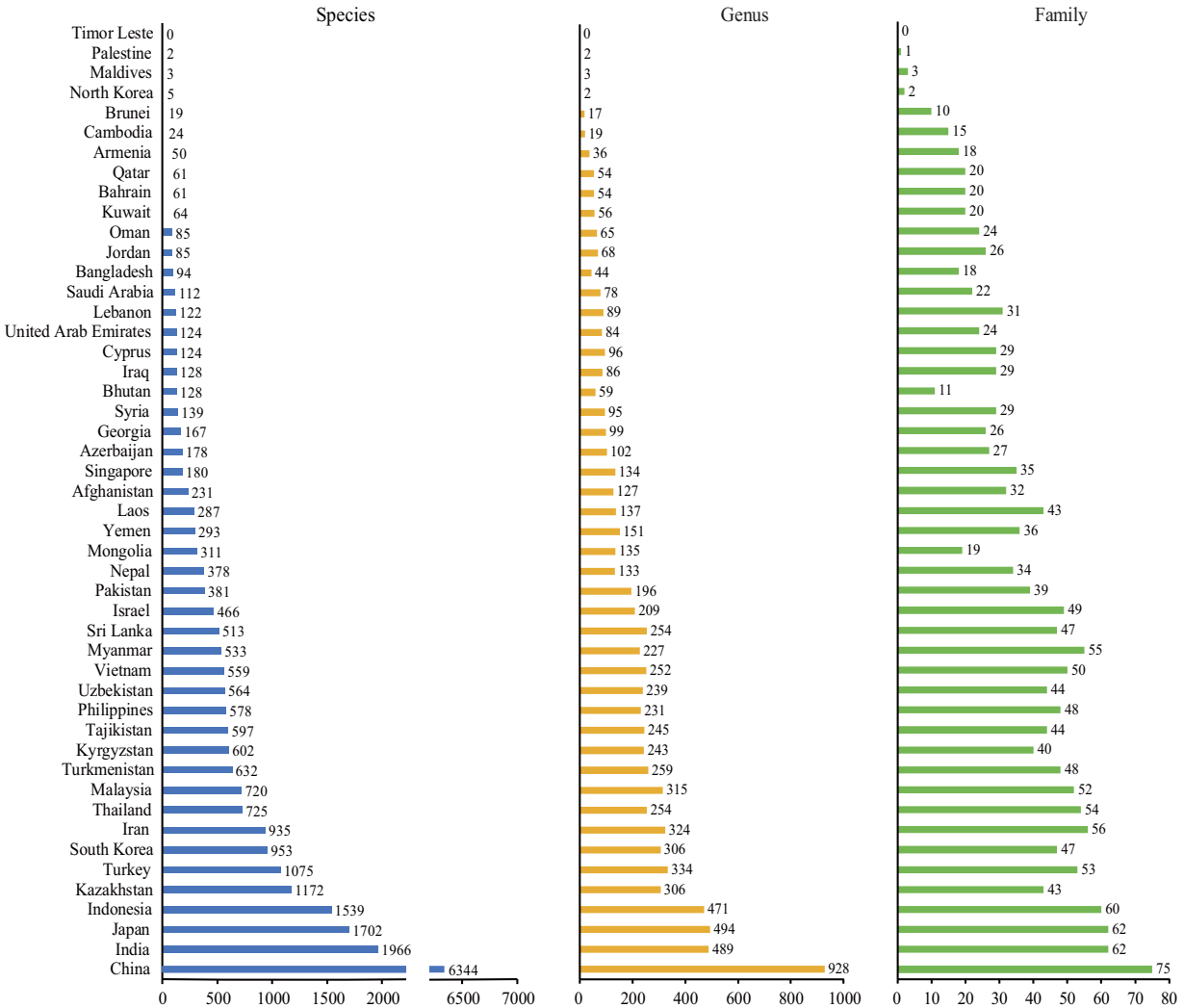

Figure 1. Number of spider species, genera and families in Asian countries. Data based on WSC (2023), detailed information see online attached appendix table.

2023), but the difficulties are particularly acute in Asia and other regions with megadiverse hotspots in the Global South. As spelt out in the full title of the agreement, its intentions are noble and goals laudable, but it requires scientists to obtain permits just to collect specimens — even for purely non-commercial taxonomic research. In many Asian countries, the bureaucratic processes of obtaining such permits are onerous and often time-consuming. In some cases, the administrative barriers can be so restrictive that make it extremely difficult for foreign taxonomists to obtain collection permits. This adds a new barrier against transboundary studies of specific taxa in monographs or major revisions. The problem is compounded as scientific journals have begun to reject manuscripts or retract published papers in which type material or examined specimens were collected without permit.

Given the problems discussed in the four paragraphs above, the rapid development of spider taxonomy in Asia over recent decades may not necessarily continue.

We need to forge greater understanding of the importance and relevance of advanced taxonomic research through more effective communication with all stakeholders, including leaders in government, research and educational institutions, and regulatory authorities. We also need to reshape attitude in society-at-large. If we are concerned about the need to reverse biodiversity loss in Asia, then it is imperative that all parties must work together to make it conducive for taxonomists to inventory them.

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