Yu et al. *Zool. Res.* 2022, 43(6): 1009−1010
https://doi.org/10.24272/j.issn.2095-8137.2022.313

ZR | Zoological Research

Letter to the editor Open Access

A glimpse into the biodiversity of insects in Yunnan: An updated and annotated checklist of butterflies (Lepidoptera, Papilionoidea)

DEAR EDITOR,

We provide an annotated checklist of the butterflies of Yunnan, which includes 356 genera and 1 300 species in six families. The number of butterfly genera and species in Yunnan accounts for 79.8% and 58.6% of China's total records, respectively. Thus, our study reveals that Yunnan has the highest butterfly diversity in China. This updated checklist also reports two genera and 18 species newly recorded from China as well as 36 species first recorded from Yunnan, suggesting that species diversity for all insect fauna in Yunnan may be underestimated. Therefore, a systematic survey of insects is essential to better assess the biodiversity of Yunnan.

Yunnan is located at the intersection of three global biodiversity hotspots: i.e., Indo-Burma region, mountains of Southwest China, and eastern Himalayas region (CEPF, 2020; Myers et al., 2000). Although land area in Yunnan accounts for only 4.1% of the country, its higher plant and vertebrate species account for more than half of all species recorded in China. Moreover, this area harbors more than 3 400 endemic species, 242 national key protected species, and about 60% of the endangered species in China (Liu et al., 2021; Yang et al., 2004). Notably, recent studies further suggest that a large percentage of species are still waiting to be discovered and described (Liu et al., 2022; Yao et al., 2021). Undoubtedly, Yunnan contains many unknown and undiscovered species. Insects are the most significant component of ecosystems, accounting for about 60%–80% of all animal species on Earth (Stork, 2018). However, known insect species in Yunnan account for only 23.5% of China's total records (Yang et al., 2004), suggesting that insect diversity in Yunnan remains underestimated. Therefore, a comprehensive and systematic investigation of insect diversity in Yunnan is necessary and urgent.

As important biodiversity indicators, butterflies have received increasing attention in biodiversity assessment (Thomas, 2016). Furthermore, due to their high public acceptance, butterflies play crucial roles in promoting conservation actions and protecting entire species communities and ecosystems (Barua et al., 2012). Of concern, however, the effects of climate change, natural habitat loss, and human disturbance have accelerated the decline in butterfly diversity to a greater extent than previously estimated (Forister et al., 2010; Habel et al., 2019). As such, accurate and detailed data are crucial for biodiversity conservation and butterfly diversity evaluation. However, the comprehensive butterfly checklist in Yunnan is still lacking.

Here, we conducted a continuous survey of butterfly species and collected a large number of specimens from different habitats in Yunnan. We checked all collected butterfly specimens in the Kunming Institute of Zoology (KIZ) and in the private collection of Zhou Chang (CZC) (Supplementary Information: Materials and Methods). We also retrieved and reviewed relevant literature and the Zoological Record database. In total, 356 genera and 1 300 species of butterflies were included in our Yunnan checklist (Table 1; Supplementary Tables S1–S8), including 89 species endemic to Yunnan (Supplementary Table S2), two genera and 18 species newly recorded from China, and 36 species first recorded from Yunnan (Supplementary Information: Taxonomy).

Mountainous regions, particularly in the tropics, are characterized by extraordinarily high species richness, thus significantly enhancing overall terrestrial biodiversity (Rahbek et al., 2019). Yunnan contains many deep valleys, plateaus, and mountains created by tectonic upheavals, and is situated at the intersection of the East Asian monsoon region, Tibetan

Received: 23 September 2022; Accepted: 17 October 2022; Online: 19 October 2022

Foundation items: This work was supported by the National Natural Science Foundation of China (32070482), Yunnan Provincial Science and Technology Department (Talent Project of Yunnan: 202105AC160039), Biodiversity Conservation Program of the Ministry of Ecology and Environment, China (China BON-Butterflies), and Yunnan Forestry and Grassland Bureau

Table 1 Summary of butterflies from Yunnan

Family	Genus number	Species number	Endemic species number	New record in China	New record in Yunnan
Papilionidae	12	78	2	0	0
Hesperiidae	80	265	19	4	10
Pieridae	21	84	5	2	2
Nymphalidae	119	541	36	2	15
Lycaenidae	117	305	23	10	9
Riodinidae	7	27	4	0	0
Total	356	1 300	89	18	36

Plateau region, and tropical monsoon region of southern Asia and Indo-China (Chen & Xie, 1994; Metcalfe, 2013). Consequently, its peculiar geographic location, distinctive climate, and complex environment have produced a wide variety of habitats in which organisms can isolate, evolve, and diversify (Wang et al., 2022; Yang et al., 2004). Certainly, Yunnan harbors the richest biodiversity in China and should therefore be a major target for conservation. Comprehensive and reliable data on biological resources should facilitate the formulation of conservation policies in Yunnan and the accurate assessment of biodiversity in China.

SUPPLEMENTARY DATA

Supplementary data to this article can be found online.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

X.Y.L. and W.W. conceived the study, designed the scientific objectives, and led the project and manuscript preparation. Z.C., Z.W.D., and K.Q.L. conducted field surveys and checked specimens. Z.W.D. and F.Z.M. contributed to manuscript preparation. T.T.Y., Z.C., X.Y.L., and W.W. wrote the manuscript. All authors read and approved the final version of the manuscript.

ACKNOWLEDGEMENTS

We would like to thank Mr. Saito Motoki (Tokyo, Japan) and Mr. Motohiro Harada (Tokyo, Japan) for kindly providing important butterfly literature for this study. We are also grateful to Mr. Zhi-Qi Zhang (Chongqing Normal University, China) for providing an invaluable *Salanoemia tavoyana* specimen.

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