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The Lingzhi naming dilemma: Overlooked and long-forgotten names threaten nomenclatural stability

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ARTICLE INFO

Article history:

Received 6 May 2023

Received in revised form

13 July 2023

Accepted 27 September 2023

Keywords:

Dimidiatum

Ganoderma

Medicinal mushroom

Nomenclature

Reishi

Epitype

Sichuanense

ABSTRACT

The Lingzhi mushroom is a species of great economic importance that has been extensively researched, yet there is still no consensus on its scientific name. In a recent article based on new taxonomic results, the authors argued for using the name *Ganoderma sichuanense* instead of *G. lingzhi*, which has been widely accepted by the scientific community in the last ten years. However, replacing a stable and popular name based on current results may exacerbate the crisis surrounding the correct name of this species. Therefore, my aim is to review the situation with respect to the name *G. sichuanense*. To achieve this, it is necessary to carefully review whether it is indeed the earliest valid scientific name that can be applied to the Lingzhi mushroom. Moreover, in the interest of nomenclatural stability, we must consider whether the earliest published basionym is the best choice for the scientific name of this economically and culturally significant fungal species. The urgent clarification of this issue is necessary because only a widely accepted name has the possibility to compete with the still widely but incorrectly used name *G. lucidum* in many publications and on medicinal products.

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1. Introduction

The establishment of the correct scientific name for the Lingzhi mushroom has been a long-standing topic of discussion, marked by numerous dilemmas and controversies. Despite the prior knowledge that this culturally and economically important East Asian fungus differs genetically and taxonomically from the European *G. lucidum* s. str. (Moncalvo et al., 1995; Szedlay, 2002; Wang et al., 2009), Lingzhi was formally named as a separate species only in

2012 (Wang et al., 2012; Cao et al., 2012). The main reason for this was that finding the correct name poses serious challenges in a taxonomically complex and uncertain genus like *Ganoderma* (Richter et al., 2015; He et al., 2022). There were three possible solutions to give an appropriate scientific name for Lingzhi: (i) conserve the name *Ganoderma lucidum* with a different type as proposed by Hawksworth (2005); (ii) during examination and revision of the type materials of previously validly published names, it is possible to demonstrate identity with a species previously forgotten or considered as a

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<https://doi.org/10.1016/j.fbr.2023.100338>

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synonym; (iii) or it is possible to demonstrate that previously published names cannot be applied to the species and thus a new name must be proposed. The concern with option (i) arises from the inaccurate application of the name *G. lucidum*, which has been used not only to designate Lingzhi but also various other *Ganoderma* species (Papp et al., 2017). Consequently, the utilization of this name may not offer a comprehensive solution and could potentially lead to further confusion in the assessment of scientific findings. Regarding the other two options, Wang et al. (2012) followed option (ii), whereas Cao et al. (2012) advocated for the latter (iii). Therefore, the correct name of the species has not yet been resolved, as Wang et al. (2012) proposed using the name *G. sichuanense* J.D. Zhao & X.Q. Zhang, while Cao et al. (2012) suggested the new name *G. lingzhi* Sheng H. Wu & al.

Although the taxonomic position of the newly described *G. lingzhi* has been stable and well-documented, uncertainties have arisen regarding the taxonomic status of the type material of *G. sichuanense*, resulting in ambiguity in its nomenclature and applicability to Lingzhi fungi (Yao et al., 2013, 2020; Zhou et al., 2015; Dai et al., 2017). This issue has recently taken a new turn as Du et al. (2023) re-examined cryopreserved DNA extract from the type material of *G. sichuanense* for the study by Wang et al. (2012), and by using refined molecular genetic methods and concluded that it is, in fact, identical with *G. lingzhi*. While their results favor the use of the name *G. sichuanense* over *G. lingzhi* based on the principle of priority, they did not investigate or acknowledge previously described names that may also be relevant to Lingzhi (Moncalvo and Ryvarden, 1997; Dai et al., 2017). Therefore, before taking a stand in favor of supporting the forty years old name *G. sichuanense* and accepting the proposal for its widespread use based on the recent findings, two additional questions need to be addressed regarding appropriate nomenclature:

- i) Is *G. sichuanense* the earliest validly published scientific name that can be applied to Lingzhi?
- ii) Is it certain that the earliest published scientific name is the best choice for the scientific nomenclature of the widely cultivated and intensively researched Lingzhi?

Considering that uncertainties surrounding the nomenclature of Lingzhi can further reinforce the continued use of the incorrectly applied name *G. lucidum* in applied research and economic practices, stabilizing the nomenclature of the species is of significant importance for both the scientific community and economic stakeholders (Zhou, 2020). To promote this, the following comments are made regarding to the two questions mentioned above.

2. Earlier described potential synonyms of *G. sichuanense sensu* Du et al.

The distribution range of Lingzhi extends beyond the territory of China and the species is currently known to occur in Bangladesh, Japan, Korea, and Thailand as well (Kwon et al., 2016; Papp et al., 2017; Thawthong et al., 2017). Therefore, any earlier validly published basionym might compete with *G. sichuanense*. Those that have not yet been investigated using phylogenetic methods, but shows morphological similarities

with *G. sichuanense*, and are associated with a species concept that occurs in the natural distribution range of Lingzhi, must be considered. Moncalvo and Ryvarden (1997) identified 35 species morphologically belonging to the “*Ganoderma lucidum* complex *sensu lato*”, with their locus classicus being in Temperate Asia, and the subtropical region of China, or Taiwan. Of these, 30 species (including *G. sichuanense*) were designated as known only from the type locality and adjacent regions. Among the listed species, 15 have been earlier described than *G. sichuanense*. Molecular genetic methods have only been used to examine three species (*G. ahmadii* Steyaert, *G. multipileum* Ding Hou, and *G. sichuanense*) in the list based on their type material (Moncalvo et al., 1995; Wang et al., 2009), but sequences are also available in the GenBank database for three additional species: *G. calidophilum* J.D. Zhao & al., *G. neojaponicum* Imazeki, and *G. sinense* J.D. Zhao & al. (Hapuarachchi et al., 2019a; Wu et al., 2020). Furthermore, an ITS sequence is available in the GenBank database under the name “*Ganoderma luteomarginatum*” (GenBank no. KP226861), which originates from a sample (No. 2012HB01) collected from Hainan, the type locality of *G. luteomarginatum* J.D. Zhao, L.W. Hsu & X.Q. Zhang (Ma et al., 2022). Based on BLAST results, this ITS sequence shows high similarity to sequences from the holotypes of *G. lingzhi* (GenBank No. JQ781858, 99.3% similarity) and *G. sichuanense* (GenBank No. OP805620, 99.82% similarity), therefore taxonomic revision of the sample deposited in the Institute of Tropical Bioscience and Biotechnology, Chinese Academy of Tropical Agricultural Sciences and the type material of *G. luteomarginata* seems necessary. Furthermore, in case of other species that have been studied only based on morphology (Cao et al., 2012; Dai et al., 2017; Steyaert, 1980; Zhao, 1989; Ryvarden, 1990; Hapuarachchi et al., 2019b), some still have unclear taxonomic statuses, such as *G. hainanense* J.D. Zhao, L.W. Hsu & X.Q. Zhang, *G. rotundatum* J.D. Zhao, L.W. Hsu & X.Q. Zhang, *G. subumbraculum* Imazeki, *G. tenue* J.D. Zhao, L.W. Hsu & X.Q. Zhang, and *Polyporus duroporus* Lloyd (Moncalvo and Ryvarden, 1997).

In addition to the mentioned species, Moncalvo and Ryvarden (1997) classified *Ganoderma japonicum* (Fr.) Sawada as a “*nomen ambiguum*” due to the lack of examined material by Fries. However, Papp (2016) showed that *G. japonicum* is based on *Boletus dimidiatus* Thunb. (syn. *Ganoderma dimidiatum* (Thunb.) V. Papp), whose type specimen is preserved in the Thunberg’s Japanese Plants collection at the Museum of Evolution at Uppsala University (UPS) [<http://cpthunberg.eb-c.uu.se/>]. Dai et al. (2017) mentioned this species and highlighted that *Boletus dimidiatus* is “the first possible name applied to Lingzhi (Mannen-take or Reishi in Japanese) in East Asia”, and based on previous misinterpretations of the species under the name *G. japonicum*, it is not justified to conclude that *G. dimidiatum* is different from Lingzhi. Yao et al. (2020) refuted the possibility of the identity of the two species by pointing out that *G. dimidiatum* is obviously a dark-coloured species of *Ganoderma* that can be clearly distinguished from the red-coloured Lingzhi. Based on the colour of the basidiome and the previously suggested synonyms of *G. japonicum*, they concluded that *G. dimidiatum* is likely related to *G. sinense* J.D. Zhao & al. The colour of the basidiome alone is not sufficient for identifying a *Ganoderma* species, especially if we want to assess this based on a photo of a basidiome that is about 240

years old. Moreover, if we look at the photo documentation of the type specimens of *G. dimidiatum* and *G. sichuanense*, the difference indicated by Yao et al. (2020) is far from clear (Fig. 1). In Fig. 1C, it is undoubtedly visible that the lectotype of *G. dimidiatum* is in accordance with the original description, where Thunberg (1784) characterized the colour of the cap as “ferrugineo nitidus, margine luteo”. Furthermore, Hapuarachchi et al. (2019a) highlighted that the Chinese specimens previously known as *G. japonicum* were wrongly identified and not identical to *G. japonicum* s. str. described from Japan (i.e. *G. dimidiatum*). In addition, the difference between *G. dimidiatum* and *G. sinense* is further strengthened by that spores from the *G. dimidiatum* type measured by Åsa Krus (curator in Museum of Evolution, Uppsala University) were $9.5\text{--}11 \times 6.5 \mu\text{m}$ in size (personal communication), which shows a significant difference from the measurements of *G. sinense* (Hapuarachchi et al., 2019a). The average size of spores from 20 different *G. sinense* samples measured by Hapuarachchi et al. (2019a) was greater than this range; the average length of the 20 spores measured per sample ranged from 10.2 to $13.8 \mu\text{m}$ (average $11.95 \mu\text{m}$), while the average width of the spores was $8.3 \mu\text{m}$. However, the spore data measured from the type specimen of *G. dimidiatum* falls within the size range measured from the original collections of *G. sichuanense* and *G. lingzhi* (Cao et al., 2012; Du et al., 2023). Therefore, the available morphological data do not contradict the potential identity between *G. dimidiatum* and *G. sichuanense*, but rather support it. However, the exact taxonomic position of *G. dimidiatum* requires further morphological and, if possible, molecular genetic studies. Until then, the possibility that the earliest name of the Lingzhi mushroom is *G. dimidiatum*, cannot be dismissed.

3. The nomenclatural stability: priority of publication versus usage

The introduction of long-forgotten names that compete with existing names can jeopardize nomenclatural stability in certain cases (Smith et al., 2016). Therefore, the International Code of Nomenclature for algae, fungi, and plants (ICN) offers a solution to prevent unfavourable changes in nomenclature by the principle of priority (Turland et al., 2018). This solution involves the conservation of a non-priority name, which allows for the retention of a name that best serves the stability of nomenclature (ICN, Art. 14.2.). An example of this can also be found within the genus *Ganoderma*. The lectotype of *Boletus lipsiensis* Batsch [syn. *Ganoderma lipsiense* (Batsch) G.F. Atk.] is identical with the neotype of *Boletus applanatus* Pers. [syn. *Ganoderma applanatum* (Pers.) Pat.] (Niemelä and Miettinen, 2008), therefore, based on the priority of publication alone, the name *Ganoderma lipsiense* should be used as the valid name of the species (Demoulin, 2010). However, based on the proposal of Redhead et al. (2006), the Nomenclature Committee for Fungi voted for the conservation of *B. applanatus* over *B. lipsiensis*, which was supported by the widespread use of the name *Ganoderma applanatum* (Norvell, 2010, 2011). Recently, Papp et al. (2022) confirmed that *Fomes advena* Quélet is a validly published name and its lectotype is conspecific with *Ganoderma pfeifferi* Bres., which was described 17 years later. Given that the name *G. pfeifferi* is more widely used, Papp et al. (2022) concluded that it would be appropriate to propose the conservation of the name *G. pfeifferi* over the earlier name *Fomes advena*. The Lingzhi mushroom has significantly greater economic, social, and cultural significance

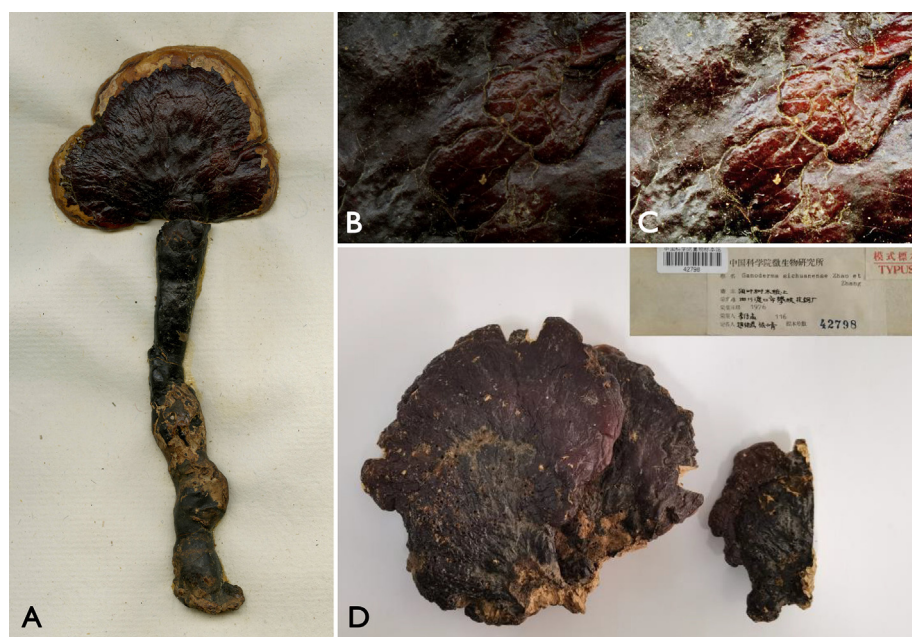


Fig. 1 – Type materials of *Ganoderma dimidiatum* and *G. sichuanense*. A) Lectotype specimen (UPS-THUNB 27230) of *Boletus dimidiatus* (source: herbarium and image database of Thunberg’s Japanese Plants, <http://cpthunberg.ebc.uu.se/>). B) A detail of the basidiome without modification of the original photo. C) The detail shown in figure B with only the intensity of the brightness being modified. D) Holotype specimen (HMAS 42798) of *G. sichuanense* (source: Du et al., 2023).

than the aforementioned *Ganoderma* species, therefore, finding the appropriate name requires even greater care. Thus, when deciding which name, either *G. sichuanense*, *G. lingzhi* (or *G. dimidiatum*), should take priority based on the ICN, popularity also plays a role. Since its description in 2012, the name *G. lingzhi* matches about 1500 results in Google Scholar searches. In contrast, the name *G. sichuanense* matches only 166 results in the last ten years. Additionally, it should be noted that while the name *G. lingzhi* unambiguously refers to the Lingzhi species in all cases, references to *G. sichuanense* in many works actually refer to a different species, which later on could lead to misinterpretation of the name. Therefore, based on current knowledge, priority of publication should be given to use the name *G. sichuanense* (assuming that it can be clearly demonstrated that there is no previously validly published synonymous name), while proposing to conserve the name *G. lingzhi* seems to be a reasonable choice based on popularity and the use of an unambiguous name.

4. Conclusion

Among poroid fungi, the identification of type specimens associated with old names is significantly challenging, especially in the case of the genus *Ganoderma*, as traditional macro-morphological characteristics and descriptions of old species often do not allow for unequivocal identification. Therefore, for finding the appropriate scientific name for Lingzhi, it is essential to typify potentially competing names and perform integrative taxonomic investigations of available type specimens. Yao et al. (2013) epitypified *G. sichuanense* due to the unsuccessful DNA extraction from the holotype, which they explained with the age of the specimen and its poor condition. However, Du et al. (2023) demonstrated that genetic analysis of older type specimens has become possible owing to the use of newer methods. The previously discussed type specimens of putative synonyms of *G. sichuanense* are mostly available for examination, including the lectotype of *G. dimidiatum*, which has been remarkably well-preserved at the Museum of Evolution at Uppsala University (UPS) despite its age. If DNA extraction proves unsuccessful even with newer methods, epitypification remains a viable option for clarifying the taxonomic status of *Boletus dimidiatus*.

If the scientific community prefers the principle of priority over ensuring stable name usage for the Lingzhi mushroom, this could cause problems in the future for the name *G. sichuanense*. This would go against the fundamental requirement of stable name usage, which is particularly important for such an economically significant and well researched species. Therefore, based on our current knowledge, it seems appropriate to support the proposal of Dai et al. (2017) to conserve the currently most widely accepted name *G. lingzhi*, over *G. sichuanense* and *Boletus dimidiatus*. Moreover, in the interest of nomenclatural stability, it may be valuable, to add *G. lingzhi* to the list of names proposed for protection (see Art. F.2). In that case it would be protected against any competing listed or unlisted synonyms, while based on the suggestion of Dai et al. (2017) it will be only

protected against names that has been listed as conserved over (*G. sichuanense* and *Boletus dimidiatus*). The urgent clarification of this issue is necessary because only a widely accepted name has the possibility to compete with the still widely but incorrectly used name *Ganoderma lucidum* in many publications and on medicinal products. Therefore, in my opinion, the nomenclatural uncertainties and potential further changes around the species reinforce scientifically incorrect nomenclature (see *G. lucidum*), especially in applied research. Therefore, a definite and stable solution through the “nom. cons. & nom. protect” approach is necessary, which will serve the interests of the entire scientific community and, more importantly, the user community.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The author would like to thank David L. Hawksworth, Scott A. Redhead, and Marc Stadler for their critical review and valuable suggestions, which enhanced the clarity and strengthened the conclusions of this paper. Furthermore, thanks are due to Ása Krúys for her assistance in measuring spores of the type of *Ganoderma dimidiatum*. The work of Viktor Papp was supported by the ÚNKP-22-5 New National Excellence Programme of the Ministry of Culture and Innovation from the source of the National Research, Development and Innovation fund. The support given to the author by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences is highly appreciated.

REFERENCES

- Cao, Y., Wu, S.H., Dai, Y.C., 2012. Species clarification of the prize medicinal *Ganoderma* mushroom “lingzhi”. *Fungal Divers.* 56, 49–62.
- Dai, Y.C., Zhou, L.W., Hattori, T., Cao, Y., Stalpers, J.A., Ryvarden, L., Buchanan, P., Oberwinkler, F., Hallenberg, N., Liu, P.G., Wu, S.H., 2017. *Ganoderma lingzhi* (Polyporales, Basidiomycota): the scientific binomial for the widely cultivated medicinal fungus lingzhi. *Mycol. Prog.* 16, 1051–1055.
- Demoulin, V., 2010. Why conservation of the name *Boletus applanatus* should be rejected. *Taxon* 59 (1), 283–286.
- Du, Z., Li, Y., Wang, X.C., Wang, K., Yao, Y.J., 2023. Re-Examination of the holotype of *Ganoderma sichuanense* (Ganodermataceae, Polyporales) and a clarification of the identity of Chinese cultivated Lingzhi. *J. Fungi* 9, 323.
- Hapuarachchi, K.K., Karunarathna, S.C., McKenzie, E.H.C., Wu, X.L., Kakumyan, P., Hyde, K.D., Wen, T.C., 2019a. High phenotypic plasticity of *Ganoderma sinense* (Ganodermataceae, Polyporales) in China. *Asian J. Mycol.* 2 (1), 1–47.
- Hapuarachchi, K.K., Karunarathna, S.C., Phengsintham, P., Yang, H.D., Kakumyan, P., Hyde, K.D., Wen, T.C., 2019b. Ganodermataceae (Polyporales): diversity in greater mekong subregion countries (China, Laos, Myanmar, Thailand and Vietnam). *Mycosphere* 10 (1), 221–309.

- Hawksworth, D.L., 2005. Reflections on changing names and related nomenclatural issues in edible and medicinal mushrooms. *Int. J. Med. Mushrooms* 7, 29–38.
- He, M.Q., Zhao, R.L., Liu, D.M., Denchev, T.T., Begerow, D., Yurkov, A., Kemler, M., Millanes, A.M., Wedin, M., McTaggart, A.R., Shivas, R.G., Buyck, B., Chen, J., Vizzini, A., Papp, V., Zmitrovich, I.V., Davoodian, N., Hyde, K.D., 2022. Species diversity of Basidiomycota. *Fungal Divers.* 114, 281–325.
- Kwon, O.C., Park, Y.J., Kim, H.I., Kong, W.S., Cho, J.H., Lee, C.S., 2016. Taxonomic position and species identity of the cultivated Yeongji '*Ganoderma lucidum*' in Korea. *Mycobiology* 44 (1), 1–6.
- Ma, Q., Zhang, S., Yang, L., Xie, Q., Dai, H., Yu, Z., Zhao, Y., 2022. Lanostane triterpenoids and ergostane steroids from *Ganoderma luteomarginatum* and their cytotoxicity. *Molecules* 27, 6989.
- Moncalvo, J.M., Ryvarden, L., 1997. A nomenclatural study of the Ganodermataceae Donk. *Syn. Fung.* 11, 1–114.
- Moncalvo, J.M., Wang, H.F., Hseu, R.S., 1995. Gene phylogeny of the *Ganoderma lucidum* complex based on ribosomal DNA sequences. Comparison with traditional taxonomic characters. *Mycol. Res.* 99 (12), 1489–1499.
- Niemelä, T., Miettinen, O., 2008. The identity of *Ganoderma applanatum* (Basidiomycota). *Taxon* 57 (3), 963–966.
- Norvell, L.L., 2010. Report of the nomenclature committee for fungi: 15. *Taxon* 59 (1), 291–293.
- Norvell, L.L., 2011. Report of the nomenclature committee for fungi: 18. *Taxon* 60 (4), 1199–1201.
- Papp, V., 2016. The first validly published laccate *Ganoderma* species from East Asia: *G. dimidiatum* comb. nov., the correct name for *G. japonicum*. *Stud. Bot. Hung.* 47 (2), 263–268.
- Papp, V., Barina, Z., Finy, P., Dima, B., Redhead, S., 2022. Nomenclature of the Beeswax bracket (*Ganoderma pfeifferi*), a European wood decay fungus with medicinal properties. *Taxon* 71 (6), 1299–1304.
- Papp, V., Dima, B., Wasser, S.P., 2017. What is *Ganoderma lucidum* in the molecular era? *Int. J. Med. Mushrooms* 19, 575–593.
- Redhead, S.A., Ginns, J., Moncalvo, J.M., 2006. Proposal to conserve the name *Boletus applanatus* against *B. lipsiensis* (Basidiomycota). *Taxon* 55 (4), 1029–1030.
- Richter, C., Wittstein, K., Kirk, P.M., Stadler, M., 2015. An assessment of the taxonomy and chemotaxonomy of *Ganoderma*. *Fungal Divers.* 71, 1–15.
- Ryvarden, L., 1990. Type studies in the Polyporaceae. 22. Species described by C.G. Lloyd in *Polyporus*. *Mycotaxon* 38, 83–102.
- Smith, G.F., Figueiredo, E., Moore, G., 2016. Increasing nomenclatural stability by preventing the introduction of long-forgotten names that will compete with ones in use: a solution must be found, and soon. *Taxon* 65 (6), 1385–1390.
- Steyaert, R.L., 1980. Study of some *Ganoderma* species. *Bull. Jard. Bot. Nat. Belg.* 50, 135–186.
- Szedlay, Gy., 2002. Is the widely used medicinal fungus the *Ganoderma lucidum* (Fr.) Karst. sensu stricto? *Acta Microbiol. Immunol. Hung.* 49, 235–243.
- Thawthong, A., Hapuarachchi, K.K., Wen, T.C., Raspé, O., Thongklang, N., Kang, J.C., Hyde, K.D., 2017. *Ganoderma sichuanense* (Ganodermataceae, Polyporales) new to Thailand. *MycKeys* 22, 27–43.
- Thunberg, C.P., 1784. *Flora Japonica, Sistens Plantas Insularum Japonicarum Secundum Systema Sexuale Emendatum Redactas*, p. 418. Mulleriano, J. G., Lipsiae.
- Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.H., Li, D.Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J., Smith, G.F. (Eds.), 2018. International Code of Nomenclature for Algae, Fungi, and Plants (Shenzhen Code) Adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Koeltz Botanical Books, Glashütten. *Regnum Vege-tabile* 159.
- Wang, D.M., Wu, S.H., Su, C.H., Peng, J.T., Shih, Y.H., Chen, L.C., 2009. *Ganoderma multipileum*, the correct name for '*G. lucidum*' in tropical Asia. *Bot. Stud.* 50, 451–458.
- Wang, X.C., Xi, R.J., Li, Y., Wang, D.M., Yao, Y.J., 2012. The species identity of the widely cultivated *Ganoderma*, '*G. lucidum*' (Lingzhi), in China. *PLoS One* 7e40857.
- Wu, S.H., Chern, C.L., Wei, C.L., Chen, Y.P., Akiba, M., Hattori, T., 2020. *Ganoderma bambusicola* sp. nov. (Polyporales, Basidiomycota) from southern Asia. *Phytotaxa* 451, 75–85.
- Yao, Y.J., Wang, X.C., Wang, B., 2013. Epitypification of *Ganoderma sichuanense* J.D. Zhao & X.Q. Zhang (Ganodermataceae). *Taxon* 62, 1025–1031.
- Yao, Y.J., Li, Y., Du, Z., Wang, K., Wang, X.C., Spooner, B.M., 2020. On the typification of *Ganoderma sichuanense* (Agaricomycetes) the widely cultivated lingzhi medicinal mushroom. *Int. J. Med. Mushrooms* 22, 45–54.
- Zhao, J.D., 1989. The Ganodermataceae in China. *Bibl. Mycol.* 132, 1–176.
- Zhou, L.W., 2020. Systematics is crucial for the traditional Chinese medicinal studies and industry of macrofungi. *Fungal Biol. Rev.* 34 (1), 10–12.
- Zhou, L.W., Cao, Y., Wu, S.H., Vlasák, J., Li, D.E., Li, M.J., Dai, Y.C., 2015. Global diversity of the *Ganoderma lucidum* complex (Ganodermataceae, Polyporales) inferred from morphology and multilocus phylogeny. *Phytochemistry* 114, 7–15.