**Plant and Fungal Systematics** 67(2): 86–87, 2022
DOI: https://doi.org/10.35535/pfsyst-2022-0010

ISSN 2544-7459 (print)
ISSN 2657-5000 (online)

**BOOK REVIEW**

# Diederich, P., A. M. Millanes, M. Wedin & J. D. Lawrey. 2022. Flora of Lichenicolous Fungi, Vol. 1, *Basidiomycota*. National Museum of Natural History, Luxembourg, 351 pages. ISBN: 978-2-919877-26-3. Price: 35 €.

Valerii Darmostuk*

Lichenicolous fungi are composed of a diverse and strongly host-specific group of species almost exclusively inhabiting lichens. Despite the significant role played by this ecological group in lichen-related mycobiota, it was neglected for a long time. Only in the first half of the XX century was there a new splash of interest which instantly improved our knowledge of this particular fungal group. Also, a few monumental monographs appeared then which summarized the knowledge of lichenicolous fungi from 1900–1950. After 1980, studying lichenicolous fungi became a regular part of scientific activities for numerous lichenologists. This is indicated by the fact that from 1980–1990 researchers published approximately the same number of works related to these fungi as there were published from 1880–1980. Subsequently, several comprehensive taxonomic studies and local inventories have resulted in a significant increase of the number of publications regarding lichenicolous fungi. We have gotten into a "snowball" situation where the information accumulated so fast that researchers needed to follow a tremendous amount of new literature to be up to date with the current knowledge. Based on the most recent checklist of lichenicolous fungi published in 2018 by P. Diederich and collaborators, this fungal group is known to have a large taxonomic diversity with more than 2,300 accepted species worldwide. Therefore, the emergence of modern taxonomic revisions and keys for species identification is of particular importance. In the summer of 2022, we received the first modern global monograph regarding lichenicolous fungi intended to summarize and substantially update our knowledge on lichenicolous fungi, as well as make certain conclusions about their diversity within a phylogenetic framework. Paul Diederich, Anna Millanes, Mats Wedin and James Lawrey published the first volume of a worldwide *Flora of Lichenicolous Fungi*. Also, 15 additional scientists made contributions to specific chapters in this monograph. This first volume is dedicated to *Basidiomycota* – one of the least numerous, but most challenging groups of lichenicolous fungi. The authors made an enormous effort in preparing this volume which finally characterized 197 species in detail. All of the species are described comprehensively and illustrated with high quality color photographs or detailed drawings. Also, identification keys are provided for each of the 24 genera described in this book. Species treated in the first volume of *Flora of Lichenicolous Fungi* belong to five different fungal classes: *Agaricomycetes*, *Agaricostilbomycetes*, *Cystobasidiomycetes*, *Microbotryomycetes*, and *Tremellomycetes*. The most diverse in terms of the number of lichenicolous fungi is the class *Tremellomycetes*. This class includes 137 species and almost half of them (64 species) are described as new to science in this monograph. The new genus *Zyzygomyces* (*Filobasidiales*) was described based on strong support of phylogenetic analyses and includes members previously treated as *Heterocephalacria*. Nevertheless, a substantial part of the book is dedicated to the most speciose genus, *Tremella* (*Tremellales*), and covers 117 lichenicolous species (53 of them are newly described). It was shown that strong morphological convergence of this genus significantly limits the number of features useful in taxonomy. Therefore, consideration of molecular data and host specificity is crucial to further studies of this group. In this monograph, the authors also included a group of lichenicolous species of *Agaricomycetes* characterized by the production of small sclerotia (bulbils) and the complete absence of basidiospores or conidia. These species belong to the order *Agaricales* (4 species), *Atheliales* (4), *Boletales* (1), *Cantharellales* (11), and *Corticiales* (12). A new monotypic genus, *Parmeliicida* (*Cantharellales*), was described in this volume, which is characterized by dark reddish brown bulbils and causing a strong pathogenic effect on the host lichen. Furthermore, lichenicolous fungi of the class *Agaricostilbomycetes* are represented by the single genus, *Crittendenia* (*Agaricostilbales*), containing 18 species. This genus has a surprisingly huge diversity which was recently discovered by P. Diederich and collaborators in their previous studies. The lichenicolous lifestyle was also found in *Cystobasidiomycetes* (*Pucciniomycotina*), a fungal class dominated by yeasts, and represented by the genus *Cyphobasidium* (*Cyphobasidiales*). The authors present data about 9 species of this

W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland
* Corresponding author e-mail: v.darmostuk@botany.pl

genus, with and eight of them newly described based on teleomorphic stages. Also, as an interesting result of the revision, a lichenicolous species of *Microbotryomycetes* was reported in this book for the first time. It is represented by the monotypic genus *Kriegeriopsis* (*Kriegeriales*) known from the thallus of *Tetramelas* aff. *graminicola* in Antarctica. In summarizing the outcomes resulting from this outstanding monographic treatment, I first have to emphasize the enormous taxonomic value of the first volume of the *Flora of Lichenicolous Fungi*. The authors describe 37% of currently known lichenicolous *Basidiomycota* in this volume, which substantially updates our knowledge on their biodiversity. This volume described three new genera, 74 new species, 1 new subspecies and proposed 3 new nomenclature combinations. At the same time, the authors identified species complexes that require further research, such as *Cyphobasidium hypotrachynicola*, *C. usneicola*, *Tremella caloplacae*, *T. lobariacearum* and *T. ramalinae*. Finally, an excellent addition to this endeavor was the inclusion of six types of *Tremella*-like galls which are probably induced by bacteria and seem to be host-specific. They are briefly described, illustrated and included in the general keys which will surely increase interest in these neglected organisms for lichenologists. Obviously, the important advantage of this monographic treatment is the emphasis placed on the inclusion of modern multi-locus phylogenetic analysis for each studied genus. Phylogenetic results are an important foundation to the taxonomic concepts proposed by the authors and are based not only on publicly available data, but in major part on newly generated sequences. Due to thorough sampling, the included phylogenies cover most lineages of *Basidiomycota* in which a lichenicolous lifestyle emerged. These results fill existing knowledge gaps and are undoubtedly an important basis for further studies on the evolution of lichenicolous fungi and the phylogeny of *Basidiomycota* in general. This volume of *Flora of Lichenicolous Fungi* provides a great source of information about the current geographical distribution of lichenicolous *Basidiomycota* on a global scale. The authors summarized information about the species occurence from variable sources, e.g., their own observations, dozens of scientific articles and monographs, hundreds of specimens from public herbaria and private collections, as well as data from several citizen science platforms and the Global Biodiversity Information Facility. Species distribution is shown on maps to help readers better understand the current distributional ranges of each species. Beyond the undeniable value of the taxonomic novelties and phylogenetic insights, an important goal of this volume (and the entire *Flora* series), as the authors declare, is to allow both professional and amateur lichenologists to recognize in the field and later identify lichenicolous fungi. This goal supports studies on fungal biodiversity so needed currently. Having in my hands the first volume of the *Flora of Lichenicolous Fungi*, I can assure readers that this aim is fully achieved. In addition, the outstanding quality of the monograph makes it not only the perfect tool for taking species determination to a whole new level, but it also exposes the hidden beauty of this fungal group to the general public. The printed version of the *Flora of Lichenicolous Fungi* was published by the National Museum of Natural History, Luxembourg, but the electronic version is also available for free on the official webpage (https://www.mnhn.lu/science/flora-of-lichenicolous-fungi/?lang=en) making this volume widely available to all interested amateurs, students and researchers around the world.