

ABSTRACT

This thesis focuses on the implementation of modern methods and approaches for species delimitation in the genus *Aspergillus*, an economically important fungal genus and model organism. So far, taxonomic studies in *Aspergillus* regularly included multiple DNA loci (typically four), and the phylogenetic analysis itself mostly consisted of calculating a phylogenetic tree based on individual loci and the concatenated dataset, or less commonly on genealogical concordance principles. Additionally, the datasets usually contained only a limited number of strains per species. The inclusion of more sophisticated phylogenetic species delimitation methods (mostly based on Multispecies coalescent model) in *Aspergillus* taxonomy adds a whole new layer to the analysis that ensures much higher objectivity of taxonomic decisions. Each of the eight presented papers contains a taxonomic treatment of a particular part of the genus with phylogenetic analyses based on datasets containing DNA sequences from three to six loci or whole genome data (series *Nigri*). The available molecular data are analyzed by a gradually refined set of phylogenetic species delimitation methods reflecting progress made between years 2017 and 2022. The individual papers also examine some specific characteristics that suitably complement the species concept for the given groups, e.g., osmotolerance (sect. *Restricti*, ser. *Versicolores*), mycotoxin production (sect. *Nidulantes*) or interspecific hybridization (ser. *Viridinutantes*). In total, 28 new *Aspergillus* species are described in these papers and 24 are reduced to synonymy. Overall, the included studies serve as a model for taxonomic studies in other fungi by demonstrating the use of combination of species delimitation methods and their inclusion in polyphasic approach. The implementation of these methods has provided a more objective way of deciding about the species boundaries and should bring more stability to the taxonomy of the genus in the long term. It has been shown that although new species of *Aspergillus* are described every year and there is undeniably still unknown diversity within the genus, there are also some parts that suffer from taxonomic inflation and the number of species in these parts should be revised and reduced.