Dissertation Title	A Morphological and Molecular Reappraisal of Sooty Moulds
Author	Putarak Chomnunti
Degree	Doctor of Philosophy (Biosciences)
Advisor	Assoc. Prof. Dr. Kevin D. Hyde
Co-Advisor	Asst. Prof. Dr. Ekachai Chukeatirote

ABSTRACT

Sooty moulds are fungi growing on the surface of plants and produce dark mycelium that cover leaves and other structures, but do not generally infect the host. Plant pathologists regard these fungi as threats because their growth can block the amount of light absorbed by the leaves, reducing photosynthesis, and causing the products to be of lower quality. Furthermore, the taxonomy of these fungi has been confused. The lack of documentation on the morphological characters of existing species is the main reason for difficulties in identification. Sequence data in GenBank is also inadequate. In this study, I am investigating morphology and phylogeny of the sooty moulds on living leaves in northern Thailand. Specimens with dark mycelium on living leaves were collected in field work, and found to include sexual and asexual states of the fungi, sometimes in the same leaf. In present study I revisit sooty moulds collected in Thailand and assigned to the families *Capnodiaceae*, *Chaetothyriaceae*, *Trichomeriaceae* and other families known from the literature. For the latter I borrow and studied material kept in various herbaria and fungaria.

Selected genera in the *Capnodiaceae* are morphologically noted. Type specimens of the ascomycetous genera *Aithaloderma, Anopeltis, Callebaea, Capnodaria, Echinothecium, Phragmocapnias* and *Scorias* were re–examined, described and illustrated. *Leptoxyphium* is an asexual *Capnodiaceae*, together with *Polychaeton.* In fact, *Polychaeton* is a legitimate and earlier name for *Capnodium*, but in order to maintain nomenclatural stability I have proposed here that the name of the sexual stage should be considered for the approved lists of fungal names currently in preparation. Notes are provided on the ascomycetous genus *Scoriadopsis*. However, I was unable to locate and study the type of this monotypic genus during the time frame of this study, because in the original publication of the species, there is not mention of where the specimen is stored. The ascomycetous genera *Aithaloderma, Ceramoclasteropsis, Hyaloscolecostroma* and *Trichomerium* are excluded from *Capnodiaceae* on the basis of having ascostromata and trans-septate hyaline ascospores and should be accommodated in *Chaetothyriales*. Furthermore, *Callebaea* is excluded as the ascomata are thyriothecia and the genus is placed in *Micropeltidaceae*. *Echinothecium* is placed as synonym of *Sphaerellothecium* and thus transferred to *Mycosphaerellaceae*. The type specimen of *Capnophaeum* is lost and this should be considered as a doubtful genus. The coelomycetous *Microxiphium* is polyphyletic, while the status of *Fumiglobus*, *Polychaetella* and *Tripospermum* is unclear. Fourteen new collections of sooty moulds made in Thailand were isolated and sequenced. The nuclear large and small rDNA was partially sequenced and compared in a phylogeny used to build a more complete understanding of the relationships of genera in *Capnodiaceae.* Four new species (*Capnodium coartatum, Leptoxyphoum cacuminum, Phargmocapnias asiaticus* and *P. siamensis*) are described and illustrated, while *Phragmocapnias* and *Scorias* are epitypified with fresh collections.

Several taxa of epiphyllous ascomycota belonging to *Chaetothyriaceae* (*Chaetothyriales*, Eurotiomycetes) were collected in northern Thailand. This family is poorly understood both in current morphological and phylogenetic studies. Chaetothyriaceae is a family characterized by ascomata which form beneath mycelia

pellicle lying on the leaf surface, and which is attached to the upper part of ascomata, ascomata sub-globose to globose with or without setae. Asci bitunicate, clavate or pyriform, short pedicellate and ascospores are clavate, muriform hyaline, with or without mucilaginous sheath. This study deals with three new species, i.e. *Ceramothyrium thailandicum*, *Chaetothyrium brischofiacola* and *Phaeosaccardinula ficus* which are fully described and illustrated. A DNA sequence analyses of LSU and ITS rDNA genes shows that the new species cluster in the *Chaetothyriaceae*. In addition this research adds six sequences for *Chaetothyriaceae* to GenBank providing additional data for the family.

Trichomerium is a genus of foliar epiphytes with the appearance of sooty moulds, in the literature assigned to the *Capnodiales*. Species have ascostromata with setae and develop on a loosely interwoven mycelial mass of dark brown hyphae, while asci have a bitunicate appearance, containing hyaline ascospores. In this study, I made 16 collections of the genus from Thailand. All were isolated, and the LSU and ITS rDNA gene regions sequenced. Phylogenetic analysis indicated that the *Trichomerium* species form a monophyletic clade within *Chaetothyriales* and warrant the introduction of a new family *Trichomeriaceae* within this order. Bootstrap support for the *Chaetothyriales* is 100% and clearly separates *Trichomeriaceae* from *Capnodiales* which otherwise are morphologically very similar. A detailed account of *Trichomerium* is provided and I describe and illustrate three new species based on morphological and molecular data. It would be better if *T. foliicola* could be adopted as the generic type of *Trichomerium* because the holotypeit has been impossible to obtain the holotype specimen of *T. coffeicola* and also no molecular data exists in worldwide databases for this species or genus.

Keywords: *Capnodiaceae*/Classification/*Chaetothyriaceae*/Molecular/Sooty moulds