A Mycological Florilegium of Systematic Literature: 2005–2008

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This anthology focuses on the systematics literature and papers combining phylogenetics and taxonomy, published in the last three years. This selection of papers focusing on the North American mushroom species is, as always personal, not exhaustive, and intended to give you a taste of what is going on in the systematic-mycological world. Check out the journals mentioned to see what else is happening!

Take note here that mycology is not just for pros: in the *Cleistocybe* and *Pleuteus aurantipes* articles, the *Tubaria* treatment, and the *Russula* paper, amateur mycologists played a big role in the collecting, monitoring and documenting of the (new) taxa.

A New Family

Pfister, D. H., C. Slater, and K. Hansen, 2008. *Chorioactidaceae*: a new family in the *Pezizales* (*Ascomycota*) with four genera. *Mycological Research* 112: 513–27.

Six unusual, and rare species in four genera are united in one new family in the Ascomyetes, the *Chorioactidaceae,* named for *Chorioactis,* the Devil's cigar. All four genera share the dark outside of the fruitbody and a pale hymenium, and microscopic characters relating to ascus shape and spore reactions. All have remarkable morphologies: *Desmazierella* has small disks set with stiff dark hairs, not only on the exterior, but also on the hymenium itself, and it grows on pine needles that are still attached to branches which have fallen on the ground; the Devil's cigar starts out as a brown cigar which spreads open as an earthstar; *Neournula* has urn or goblet shaped fruitbodies; and *Wolfina* has violet tinges in its flesh but lacks the exciting looks of the others. Molecular data settled the dispute where to place those oddballs that formerly were accommodated in the *Sarcoscyphaceae* or in the *Sarcosomataceae* and have now found their own family.

New Genera

Ammirati, J. F., A. D. Parker, and P. B. Matheny, 2007. *Cleistocybe*, a new genus of *Agaricales*. *Mycoscience* 48: 282–89.

Halling, R. E., T. J. Baroni, and M. Binder, 2007. A new genus of *Boletaceae* from eastern North America. *Mycologia* 99: 310–16.

Perry, B. A. and D. H. Pfister, 2008. *Chaetothiersia vernalis*, a new genus and species of *Pyronemataceae* (*Ascomycota, Pezizales*) from California. *Fungal Diversity* 28: 65–72.

There are three new North American genera to list here: *Bothia,* a bolete genus named after the New York-based bolete expert Ernst Both; the northwestern *Cleistocybe;* and the ascomycete *Chaetothiersia*.

Bothia is the new name for a well-known species x. *castanellus* in which x stands for the seven different genus names where it was thought to belong in the past. It is closely related to the *Xerocomus (Boletus) chrysenteron* group, grows exclusively with oaks, and can be found from Minnesota east to Massachusetts and Connecticut and south to South Carolina. It has the typical boletinoid hymenophore with compound pores, so prominent in *Boletinellus merulioides* (another of those vagrant species).

Cleistocybe looks like a *Clitocybe,* but it has a veil (!), and is closely related to the sturdy, veiled *Catathelasma.* Its two species, *C. vernalis* and *C. gomphidioides,* can be distinguished on account of fruiting time (*C. vernalis* in spring, *C. gomphidioides* in late summer to fall) and the pileipellis (not gelatinous in *C. vernalis,* gelatinous in *C. gomphidioides*). The first species is so far only known from Washington, but *C. gomphidioides* is widespread and has been collected in Colorado, Idaho, and Washington.

The third genus, *Chaetothiersia*, is named after Harry Thiers, who collected this fungus in the Californian Sierra Nevadas, and who was so instrumental in promoting field mycology and in expanding our knowledge of California mushroom species. This pale-grey cup fungus has brown stiff hairs on the outside and smooth spores. It grows on decaying wood high in the mountains of eastern California during the springtime before the start of the summer heat.

Pluteus

Minnis, A. M., W. J. Sundberg, A. S. Methven, S. D. Sipes, and D. L. Nickrent, 2006. Annulate *Pluteus* species, a study of the genus *Chamaeota* in the United States. *Mycotaxon* 96: 31–40.

Minnis, A. M., W. J. Sundberg, and S. F. Nelsen, 2006. *Pluteus aurantipes* sp. nov. from Wisconsin, United States. *Mycologia* 98: 659–61.

One of the genera on my wish list of must-see-ums was *Chamaeota,* the ringed *Pluteus*. That wish can be scrapped, as this genus has lost its rationale now that its species fall in the middle of *Pluteus* proper. Still I would dearly like to see a ringed *Pluteus,* and also the nice orange stiped *P. aurantipes,* with strikingly yellow gills, newly described from the Midwest.

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Agaricaceae

Kerrigan, R. W., P. Callac, J. Guinberteau, M. P. Challen, and L. A. Parra, ("2005") 2006. *Agaricus* section *Xanthodermatei*: a phylogenetic reconstruction with commentary on taxa. *Mycologia* 97: 1292–1315.

Kerrigan, R. W., ("2007") 2008. Lectotypification of *Agaricus brunnescens*. *Mycologia* 99: 906–15.

Vellinga, E. C. and R. M. Davis, 2007. Lepiotaceous fungi in California, U.S.A.—1. *Leucoagaricus amanitoides*. *Mycotaxon* 98: 197–204.

Vellinga, E. C., 2007 Lepiotaceous fungi in California, U.S.A.—2. *Lepiota rhodophylla*. *Mycotaxon* 98: 205–11.

Vellinga, E. C., 2007. Lepiotaceous fungi in California, U.S.A.—3. Pink and lilac species in *Leucoagaricus* sect. *Piloselli*. *Mycotaxon* 98: 213–24.

Vellinga, E. C., 2007. Lepiotaceous fungi in California, U.S.A.—4. Type studies of *Lepiota fumosifolia* and *L. petasiformis*. *Mycotaxon* 98: 225–32.

Vellinga, E. C., 2007. Lepiotaceous fungi in California, U.S.A.—5. *Lepiota oculata* and its look-alikes. *Mycotaxon* 102: 267–80.

Vellinga, E. C. and W. J. Sundberg, 2008. Lepiotaceous fungi in California, U.S.A.—6. *Lepiota castanescens*. *Mycotaxon* 103: 97–108.

Agaricus is one of those genera which is easy to recognize, but in which species recognition is in a totally different ballpark. The attempt by Kerrigan and co-authors to shine light on one section has to be applauded. The yellow-staining phenol-odored section *Xanthodermatei* is tackled, with a molecular-phylogenetic approach, covering European and American species. Species in the *A. xanthodermus* group are not only morphologically close, but their ITS sequences do not differ greatly. *Agaricus moelleri* is the name now in use for the species that had been variously known as *A. meleagris, A. praeclaresquamosus* and *A. placomyces. Agaricus placomyces* in the original sense as described by Peck occurs in the eastern part of the U.S.A., north of Florida. *Agaricus moelleri* appears to be restricted to Europe. Furthermore, there are two, still undescribed species in California, which were called A. *praeclaresquamosus* in the past. One surprise to me is that *A. xanthodermus* and *A. californicus* are not really closely related, though we have a hard time distinguishing them in the field.

Sometimes taxonomists play more the role of detectives than of systematists in unraveling the complicated histories and human stories behind the names of their fungi. The story of *Agaricus brunnescens* is fascinating reading, starting with late-19th-century letter writers and early mushroom growers, then jumps to the present age of good microscopes, DNA sequences, and computers. At stake is the name for the cultivated button mushroom, commonly known as *A. bisporus.* But is this really the oldest name for this species? Kerrigan in the role of mushroom sleuth convincingly shows that the type collection of *A. brunnescens,* by some considered the correct name for *A. bisporus,* is a mixture of two different species, one of them indeed what we nowadays call *A. bisporus.* The last word on the name has not been spoken yet, as now, a proposal to conserve the widely used name *A. bisporus* against older ones is in the pipeline.

A series of six papers on Californian *Cystolepiota, Lepiota,* and *Leucoagaricus* species appeared in *Mycotaxon,* in which new species are described and old ones revisited, all in an ongoing effort to document the western parasol mushrooms. One finding of interest is that *L. fumosifolia* is identical to *L. cystidiosa*—one of those powdery Cystolepiotas. This species is easy to recognize under the microscope because of its yellow-exuding cystidia all over the gills. A key to the *Cystolepiota* species helps to identify these small species.

Red Mushrooms

Bridge, P. D., B. M. Spooner, R. E. Beever, and D.-C. Park, 2008. Taxonomy of the fungus commonly known as *Stropharia aurantiaca* with new combinations in *Leratiomyces*. *Mycotaxon* 103: 109–21.

Matheny, P. B., E. C. Vellinga, N. L. Bougher, O. Ceska, P.-A. Moreau, M. A. Neves, and J.F. Ammirati, 2007. Taxonomy of displaced species of *Tubaria*. *Mycologia* 99: 569–85.

Reasons for name changes in mushrooms are many; often the original concept has been forgotten and a new interpretation of the name has taken over. This is the case for what we have been calling *Stropharia aurantiaca* (or *Hypholoma* or *Naematoloma aurantiacum*). Originally it was described as a red variety of the slender *Str. squamosa*, a species that grows in forests and beech woods, and has nothing to do with the wood chip invader now bearing the name "aurantiaca." Microscopically the two are also quite different. Now Bridge et al. have adopted an old name of an Australian species as the rightful name for "aurantiaca," which should be called *Psilocybe ceres.* The authors did not leave it at that but, armed with data based on the Large SubUnit (LSU), they also decided that the genus *Stropharia* also has to be split up. The genus *Leratiomyces,* described for secotioid species from New Caledonia, now accommodates the species *Ps. ceres, Stropharia squamosa, S. hornemannii, S. percevallii, S. magnivelaris,* and some *Weraroa* species (*W. erythrocephala* and *W. cucullata*). However, there are no morphological data to support this division of *Stropharia*, and the molecular evidence presented shows that *Stropharia* and *Leratiomyces* are sister taxa, together forming a monophyletic group. I would like to see more supporting data, from other genes in particular and with a wider taxon sampling to support the proposed changes.

Tubaria is not a genus that basks in attention from mushroom people. Its members are mostly just brown, non-descript fruitbodies that cover wood chip mulches in vast flocks. The paper by

Matheny and six others treat the species that are either red or have a distinct ring. The western species *Naucoria vinicolor* and *Pholiota punicea* now find their home in *Tubaria* and are presented to the wider public with nice pictures. The second one grows almost exclusively at the base of madrone trees from California up north to Vancouver Island. *Tubaria vinicolor* is not as picky and can be found in urban areas (my own front yard for example). It is also unequivocally shown that the northern, ringed species *T. confragosa* is a real *Tubaria*, but there might be a European and a North American species hiding here.

Little Brown Mushrooms

Bandala, V. M. and L. Montoya, 2008. Type studies in the genus *Crepidotus*. *Mycotaxon* 103: 235–54.

Gulden, G., Ø. Stensrud, K. Shalchian-Tabrizi, and H. Kauserud, 2005. *Galerina* Earle: A polyphyletic genus in the consortium of dark-spored agarics. *Mycologia* 97: 823–37.

Guzmán, G. L. Salstad, and E. Gandara, 2006. A new bluing species of *Psilocybe,* section *Stuntzii,* from New Mexico, U.S.A. *Mycotaxon* 99: 223–26.

Moreau, P.-A., U. Peintner, and M. Gardes, 2006. Phylogeny of the ectomycorrhizal mushroom genus *Alnicola* (*Basidiomycota, Cortinariaceae*) based on rDNA sequences with special emphasisis on host specificity and morphological characters. *Molecular Phyogenetics and Evolution* 38: 602–18.

Moreau, P.-A., 2005. A nomenclatural revision of the genus *Alnicola* (*Cortinariaceae*). *Fungal Diversity* 20: 121–55.

While little brown mushrooms in general are avoided, the genus *Crepidotus* is positively shunned. Its little fruitbodies, often occurring in masses on downed logs and wood, are not rich in characters and beauty. However, they play their own important role in nature as wood decayers and their names should be known. The Mexican couple Bandala & Montoya have been studying type collections of the American species of this genus, and in the present paper they consign several species names to the waste-paper basket reserved for the synonyms of better known taxa. A few examples: *Crepidotus applanatus* has now *C. cuneiformis, C. cystidiosus,* and *C. truncatus* as synonyms, and *C. grummosopilosus* is identical to *C. calolepis,* a sad fate for such a rhythmic and melodious name!

The title of the article on *Galerina* says it all: here is another genus that does not appear to be a homogeneous entity and whose parts have affinities to various, different dark-spored agarics. The good news is that the new groups roughly correspond to the formerly recognized subgenera or sections. The group of *G. calyptrata* is a sister group to the genus *Gymnopilus,* but the rest of *Galerina* is closer to genera like *Phaeocollybia* and *Panaeolus.* Interestingly, the groupings here shown concur well with Kühner's concept of the *Strophariaceae* as given in his comprehensive overview of the agarics (1980). No new genus names are yet proposed for the three main groups of the old *Galerina.*

A new bluing *Psilocybe* species is described from New Mexico. It looks like *Ps. stuntzii* from the Pacific Northwest, but is more robust and the shape of the cheilocystidia is a bit different as well. The authors named it *Ps. mescaleroensis* after Mescalero, the name of the mountains where the mushroom was found and the name of the local native tribe. It might have a use in the rituals of this group of people.

The little brown alder and willow associates in the genus *Alnicola* (perhaps better known under the name *Naucoria*) are the subject of a thorough phylogenetic and nomenclatural study by Moreau, a French mycologist. Just like *Galerina, Alnicola* cannot be maintained in its present form. Three different groups, corresponding to the traditional sections, can be recognized, and morphology and molecules are nicely congruent. The core of *Alnicola* has narrow pointed cystidia and a cutis made up of inflated cells; the species with cylindrical and capitate cystidia are either, separate and more related to *Hebeloma,* or they group with *Hymenogaster.* Only European species were included in the analysis, and it would be interesting to extend the sampling to other temperate areas.

Russulaceae

Buyck, B., D. Mitchell, and J. Parrent, 2006. *Russula parvovirescens* sp. nov., a common but ignored species in the eastern United States. *Mycologia* 98: 612–15.

Nuytinck, J., S. L. Miller, and A. Verbeken, 2006. A taxonomical treatment of the North and Central American species in *Lactarius* sect. *Deliciosi*. *Mycotaxon* 96: 261–308.

Despite the fact that Russulas are ubiquitous forest dwellers and important ectomycorrhizal species, people tend to forego them and go with the adage "better kicked than picked." The death of Raymond Fatto, who loved his Russulas and whose keys for the eastern American species can be found on the Russulales News Web site, left a void in the study of this group, but fortunately Bart Buyck and others have jumped in. The new species *R. parvovirescens* looks like a small *R. virescens* but has a very different cap cuticle made up of upright chains of almost globose cells. It is common and has been found in deciduous or mixed broadleaf forests from Maine to Texas.

Section *Deliciosi* of *Lactarius* in North America is the subject of an excellent treatment by the Belgian *Lactarius* group and Wyoming-based Steve Miller. *Lactarius indigo* is the most striking member of this group with its blue latex; all other species have yellow, orange or reddish (to brown) latex. Fruitbodies of many species turn green with age and weather. A worldwide phylogenetic approach was taken but all species are also morphologically characterized and their microscopic characters beautifully illustrated. At present 13 North American species are recognized, but more are to be expected. A troublesome group is what is called *L.*

deliciosus; on this side of the Atlantic Ocean it differs from the real *L. deliciosus,* described from Europe, and from the also European *L. deterrimus* associated with *Picea*, and it might well harbor several species. Here is a task for all of us to collect, photograph, and make notes on specimens of this group! One small species, *L. aurantiosordidus,* from northern California is described as new. A synoptic key, not a dichotomous one, is given to aid in recognition of the species. The worldwide context for this study is given in a purely phylogenetic paper (Nuytinck et al., 2008).

Other Groups

Mata, J. L., K. W., Hughes, and R. H. Petersen, ("2006") 2007. An investigation of *Omphalotaceae* (Fungi: Euagarics) with emphasis on the genus *Gymnopus*. *Sydowia* 58: 191–289.

Parmasto, E. and R. L. Gilbertson, 2006. The genus *Hymenochaete* (*Basidiomycota*, Hymenomycetes) in the Hawaiian Islands. *Mycotaxon* 94: 189–214.

Wilson, A. W. and D. E. Desjardin, 2005. Phylogenetic relationships in the gymnopoid and marasmioid fungi (Basidiomycetes, euagarics clade). *Mycologia* 97: 667–79.

The work on *Gymnopus* and allies in the *Omphalotaceae* is one of those research projects to fill in our gaps of knowledge. A huge article on all aspects of this group spans mating studies, morphology, and relationships based on analyses of the ITS region. Special care was taken to include the type species of all genera involved. In the process, one new species from Tennessee and North Carolina is described: *G. junquilleus,* a yellow species in the *G. dryophilus* group (*Collybia dryophila*), close to the European species *G. subalpinus*.

The last word on the systematics of this group has not been said yet—another paper on this group, by Wilson and Desjardin shows different groupings and results. Sampling of the huge diversity of these fungi in the tropics seems to be one prerequisite for resolving the problems, and secondly, a multi-gene approach is definitely needed.

Thanks to the enthusiasm and hospitality of Don Hemmes in Hilo on the Big Island, Hawai'i is rapidly becoming one of the best mycologically known states of the U.S.A. Excellent floristic treatments of difficult genera like *Coprinus* and *Agaricus* have been published, and now it is the turn of the wood inhabiting *Hymenochaete*. This is one of those genera we often see but probably walk by most of the time: brown shelved *Stereum*-like fruitbodies without pores on the underside. However, just like every other group you delve into, this one has fascinating microscopic characters. Big thick-walled cystidia (setae) take a prominent place among the basidia. The Hawai'ian islands harbor 18 species; a few are endemic, but most are shared with Australasia. The spores of these must be good at staying viable during the long flight. Because the spores are small and inconspicuous the authors used a video camera to capture them and Global Lab Image software to analyze and measure them.

Catinella

Greif, M. D., C. F. C. Gibas, A. Tsuneda, and R. S. Currah, 2007. Ascoma development and phylogeny of an apothecioid dothideomycete, *Catinella olivacea*. *American Journal of Botany* 94: 1890–99.

If this anthology were restricted to one paper, this one would be my choice—it is a beautiful example of a thorough approach to unraveling taxonomy, and with surprising results. The subject is the greenish cup fungus, *Catinella olivacea,* which grows in hollow logs. Data from the development of the fruitbodies, the morphology of the mature fruitbodies and a phylogenetic comparison of this species with a wide range of other Ascomycetes, clearly show that this species does not actively shoots off its spores; instead, the spores end up in a slimy mass easily dispersed by insects and mites, and that it is best placed in the Dothideomycetes, and not in the Leotiomycetes (Jelly Babies and their relatives), as always was assumed. Dothideomycetes have a totally different way of producing asci than the Leotiomycetes, and most members form rather inconspicuous fruitbodies. A recent overview of this group was published by Schoch et al. (2007).

References

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Nuytinck, J., A. Verbeken, and S. L. Miller, ("2007") 2008. Worldwide phylogeny of *Lactarius* section *Deliciosi* inferred from ITS and glyceraldehyde-3-phosphate dehydrogenase gene sequences. *Mycologia* 99: 820–32.

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