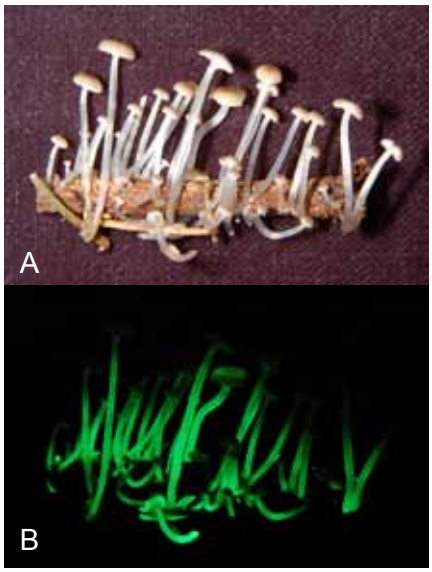
Top 10 new species for 2011 includes two mushrooms

Each year the International Institute for Species Exploration (IISE), based in Tempe (AZ, USA) announces a list of the Top 10 New Species for the preceding calendar year. The selections are made by an international panel of 14 specialists drawn from nine countries who consider nominations made through the IISE's website. Amongst the ten species selected for 2011 (http://species.asu.edu/Top10) are a bacterium, cockroach, cricket, fish, leech, spider, mammal, monitor lizard, and two mushrooms: *Mycena luxaeterna* and *Psathyrella aquatiica*.

Mycena luxaeterna, dubbed the Eternal light mushroom, was described on the basis of two collections from São Paulo state in Brazil by Desjardin *et al.* (2010). It occurs on sticks in the primary Atlantic forest which is renowned for endemics of all kinds of organisms. The luminescence is yellowish green and most intense near the base, but the mycelium is also fluorescent in culture. It is one of four new luminescent *Mycena* species described in the same paper, of which another is from Brazil, and the two others are from Malaysia and Puerto Rico.

Psathyrella aquatica, referred to as the



Mycena luxaeterna. A. In daylight. B. Luminescent in the dark. Photo: © Cassius V Stevani.

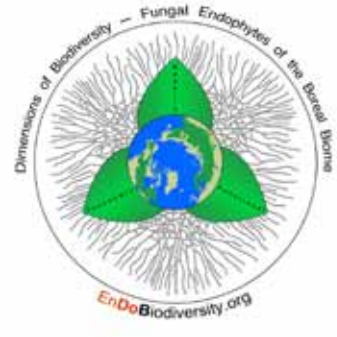
Psathyrella aquatica. Basidiomes underwater, showing the flowing water against the stipe and aquatic vegetation in the vicinity. Photo: © Robert Coffan.

iospores are released as wedge-shaped rafts into gas pockets below the caps. Molecular phylogenetic analyses clearly placed the species in *Psathyrella s. str.*

Desjardin DE, Perry BA, Lodge DJ, Stevani CV, Nagasawa E (2010) Luminescent *Mycena*: new and noteworthy species. *Mycologia* **102**: 459–477.

Frank JL, Coffan RA, Southworth D (2010) Aquatic gilled mushrooms: *Psathyrella* fruiting in the Rogue River in southern Oregon. *Mycologia* **102**: 93–107.

A multidimensional study of endophytic fungal diversity



As major sources of ecological and evolutionary innovations, symbioses drive genome evolution, ecological diversification, and speciation – and thus shape all dimensions of the diversity of life. For the photosynthetic organisms that underlie primary productivity in all of earth's terrestrial biomes, no symbionts are more important, abundant, or diverse than fungi. Through a large-scale collaborative project supported by the National Science Foundation's new Dimensions of Biodiversity (DoB) programme, an interdisciplinary team of mycologists (A. Elizabeth Arnold, Ignazio Carbone, François Lutzoni, and Georgiana May) will undertake the first-ever integrative study of the taxonomic, functional and genetic diversity of the most diverse and widespread fungal symbionts of plants – endophytic fungi.

Found within healthy tissues of all plants (and in lichens as 'endolichenic' fungi), endophytes inhabit wild-, crop- and forage species without causing noticeable symptoms of disease. In many cases endophytes produce diverse and important secondary metabolites and shape the responses of their hosts to abiotic and biotic stressors. Although species-rich in all biomes, endophytes peak in phylogenetic diversity in boreal forests, the largest biome on earth and an imperiled ecosystem of immense global importance.

Under the leadership of Arnold, the PI team will develop a novel biodiversity-informatics pipeline to discover, evaluate, and describe the taxonomic, functional, and genetic diversity of endophytes at multiple spatial and phylogenetic scales around the

The EndoBiodiversity Project PIs. (Clockwise from upper left) A. Elizabeth Arnold (project leader), Ignazio Carbone, Georgiana May, and François Lutzoni

circumboreal belt. Over the course of this five-year study, culture-based and culture-free surveys on three continents will unveil the biodiversity, spatial heterogeneity, environmental sensitivity, and host associations of endophytes associated with 20 iconic species of boreal plants and lichens at local, regional, and intercontinental scales. New analytical tools using reciprocally illuminating phylogenetic- and population-genetics approaches, paired with collaborations with specialists in key genera, will orchestrate rapid circumscription and naming of new fungal species, efficiently capturing and describing taxonomic diversity while framing hypotheses regarding the evolution of ecological modes in the *Ascomycota*. The resulting framework will optimize selection and development of new model systems for fungal biology, which will be used to empirically assess the functional diversity of endophytes through *in vitro* and *in vivo* assays of mutualistic, pathogenic, and saprotrophic modes. The relative and absolute contributions of diverse mechanisms to shaping that functional diversity will be examined, including mobile genetic elements, endohyphal microbial symbionts, and genome evolution. More information about the project can be found at www.EnDoBiodiversity.org, which will serve as a public portal for sharing the team's new bioinformatics tools, data sets, and outreach efforts.

International collaborations with mycologists will complement local outreach activities at four universities (University of Arizona; North Carolina State University; Duke University; and University of Minnesota, Twin Cities), with the goal of promoting diversity in mycology for high school students, science teachers, undergraduate and graduate students, and postdoctoral scholars. Development and deposition of permanent fungal culture collections will complement the biodiversity informatics portal, which will be devoted to sharing ecological, taxonomic, and molecular data sets as well as a suite of electronic resources for integrative analyses of fungal diversity. Taxonomists will be integrated into the project by the PIs' hosting of visiting international researchers and students, a major international workshop at CBS (in collaboration with Pedro Crous), and joint symposia designed to reach a diverse audience of fungal taxonomists, evolutionary biologists, and ecologists in national and international venues. The first of these symposia will be held at the annual meetings of the Mycological Society of America in August 2011 (Mechanisms of fungal-plant interactions: perspectives from the interface of ecology, evolutionary biology, and genomics, led by Arnold and Lutzoni).

From the first observations of endophytes over a century ago to the invigoration of fungal diversity studies in the early 1990s (e.g. Hawksworth 1991), endophytes have captured the imagination and curiosity of mycologists, ecologists, and evolutionary biologists. By integrating the modern tools of molecular and computational biology with quantitative field surveys in fungal ecology, experimental manipulations shaped by the disciplines of plant pathology and microbiology, and the rich history and organismal knowledge of fungal taxonomy, this project will provide a first fully integrative and largely open-source glimpse into the biology of endophytic symbionts – and thus will contribute to our larger understanding of the diversity of fungi, their evolutionary trends, and their ecological importance at a global scale.

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Hawksworth DL (1991) The fungal dimension of biodiversity: magnitude, significance, and conservation. *Mycological Research* **95**: 641–655.

IMC9 (2010) Keynote and Plenary Papers published

The March issue of *Fungal Biology Reviews* (25 (1): 1–77, 2011) was a special issue devoted to the Keynote and Plenary Papers from IMC9, a more general overview and photographs of which were provided in the last issue of *IMA Fungus* (**1**(2): (8)–(11), 2010). Taken together, this special issue of *Fungal Biology Reviews* provides an exceptional overview of cutting-edge mycology. The wide ranging and stimulating Keynote Paper by IMA President John Taylor, "The poetry of mycological accomplishment and challenge" (pp. 3–13) is followed by texts of the six Plenary Papers: "The dynamic fungal cell" (Gero Steinberg and Martin Schuster, pp. 14–37), Progress in molecular and morphological taxon discovery in *Fungi* and options for formal classification of environmental sequences" (David Hibbett and colleagues, pp. 38-47), "Microbial pathogens in the fungal kingdom (Joseph Heitman, pp. 48-60), "The biology of blast: understanding how *Magnaporthe oryzae* invades rice plants" (Rita Galhano and Nicholas Talbot, pp. 61–67), "Nutritional exchanges in the arbuscular mycorrhizal symbiosis: implications for sustainable agriculture" (Alastair Fitter and colleagues, pp. 68–72) and "The fungal treasure chest: spore orgins?" (Nancy Keller, pp. 73–77). Most are lucidly written and well-illustrated, and Steinberg & Schuster's article is accompanied by links to a staggering 76 movie clips – something of an innovation in science publishing that has already been remarked upon by other publishers (though this is a case where the online full-colour version scores over the hard-copy half-tones of starting frames). Nick Read and Geoff Robson, guest editors for the special issue, are to be congratulated on bringing out such

a stimulating issue capturing the vibrance of mycological research today.

Outline of *Ascomycota*

The *Outline of Ascomycota – 2009,* painstakingly prepared by H. Thorsten Lumbsch and Sabine M. Huhndorf, is now also available in hard-copy for those wishing to have one to hand as *Myconet* volume 14. This has been issued as *Fieldiana*, *Life and Earth Sciences* no. 1 (2010). The *Outline* includes all accepted genera of teleomorph-typified genera of *Ascomycota,* arranged by suprageneric ranks up to phylum, and is based on changes proposed in the literature and commented on in the series of *Notes* that accompanies the *Outline*. The *Outline* is intended as a general-purpose classification, suitable for use as a framework for teaching and in other analyses. The number of hierarchical taxa above the rank of order accepted swells as phylogenetic relationships are clarified, and now comprises three subphyla, 16 classes, and 11 subclasses. At some point in the not too distant future, particularly with the prospect of the abandonment of the dual nomenclatural system, it will also become imperative that at least anamorph-typified names accepted for holomorphs are also embraced, but plans as to how that can be achieved have yet to be formulated.

Only generic synonyms proposed since 2007 are included in this version. However, the compilers state that an attempt to include all synonymous generic names will be made in future revisions – and that hard-copy versions will now be produced every other year. This issue of *Fieldiana* also includes 363 *Notes* based primarily on recent literature, taking the total number of notes published since the series was initiated in *Systema Ascomycetum* in 1986 to 5113. New notes continue to be compiled and posted on the *Myconet* home page (http://www.fieldmuseum.org/myconet/). All mycologists working on these fungi are urged to contribute notes or forward copies of pertinent publications to the compilers in order to make this service as comprehensive and topical as possible.