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Daedalea americana sp. nov. (Polyporales, Basidiomycota) evidenced by morphological characters and phylogenetic analysis

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Abstract

A new polypore, *Daedalea americana*, collected from North and Central America, is described and illustrated based on morphological characters and molecular evidence. It is characterized by annual and pileate basidiocarps, grayish brown with brown to cinnamon brown band and concentrically zonate pileal surface when fresh, cream to clay-pink pore surface, circular to angular pores (4–5 per mm) and ellipsoid basidiospores measured as 4.0–5.1 × 2.1–3.0 µm. Phylogenetic analysis based on the internal transcribed spacer (ITS) regions and nuclear large subunit (nLSU) ribosomal RNA gene regions support *D. americana* as a distinctive species belonging to *Daedalea*.

Key words: brown-rot fungi, Fomitopsidaceae, phylogeny, polypore, taxonomy

Introduction

Daedalea Pers., typified by *D. quercina* (L.) Pers., was established by Persoon (1801). Previously it was a collective genus for all species with a daedaleoid to labyrinthine hymenophore and numerous species with similar hymenophores have been described in or transferred to this genus (Fries 1821). As more microscopic, chemical characters and molecular data became available, many *Daedalea* species have been transferred to other genera (Singer 1944; Donk 1966; Ryvarden 1984; Binder *et al.* 2005; Binder *et al.* 2013). Currently, *Daedalea* is restricted to species that produce a brown rot and have pileate, mostly perennial basidiocarps; smooth to velutinate, often concentrically sulcate pileus; irregular, labyrinthine/daedaleoid to lamellate or poroid hymenophores; brownish context; a trimitic hyphal system with clamped generative hyphae; catahymenium formed by skeletal hyphae in the hymenia; and hyaline, thin-walled, smooth, oblong-ellipsoid to cylindrical basidiospores (Ryvarden and Johansen 1980; Gilbertson and Ryvarden 1986; Núñez and Ryvarden 2001; Lindner *et al.* 2011; Li and Cui 2013; Ryvarden and Melo 2014).

Recently, several studies on the taxonomy of *Daedalea* were carried out. Rajchenberg (1986) transferred *Trametes aethalodes* Mount. to *Daedalea* based on morphological and cultural characters, and proposed that *Daedalea* is characterized by pileate fruiting bodies, a trimitic hyphal system, presence of irregular thick-walled generative hyphae, skeletal hyphae and tramal cystidia that protrude into the hymenia. Lindner *et al.* (2011) described a new species, *D. neotropica* D.L. Lindner, Ryvarden & T.J. Baroni, from Maya Mountains of Belize and provided a synopsis of *Daedalea sensu stricto* including *D. dickinsii* Yasuda, *D. neotropica*, *D. pseudodochmia* (Corner) T. Hatt., and *D. quercina* based on morphological characters and molecular evidence of ITS sequences. Subsequently, another new species, *D. ryvardenica* Drechsler-Santos & Robledo, was described from Brazil based on morphological characters; and a taxonomic discussion of the morphological characters of *Daedalea*, the hyphal system and the shape of the basidiospores, was presented by Drechsler-Santos *et al.* (2012). In China, two new species of *Daedalea*, *D. circularis* B.K. Cui & Hai J. Li and *D. radiata* B.K. Cui & Hai J. Li, were discovered and described from southern China according to phylogenetic analysis of ITS rDNA sequences and morphological characters (Li and Cui 2013).

During a series of studies on brown rot fungi (Wang *et al.* 2004; Wei & Dai 2006; Cui & Dai 2013; Li *et al.* 2013; He *et al.* 2014; Shen *et al.*2014, Song *et al.* 2014), a new species of *Daedalea* from North and Central America, is discovered based on morphological characters and phylogenetic analysis of ITS and nLSU rDNA sequences, and its illustrated description is provided.

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Our results provide further confirmation that *Daedalea* is clustered with other brown-rot fungal genera, such as *Antrodia* P. Karst. and *Piptoporus* P. Karst. in the *Antrodia* clade (Binder *et al.* 2005; Li and Cui 2013), though a better phylogenetic research of this group is needed based on more samples and more conserved gene markers.

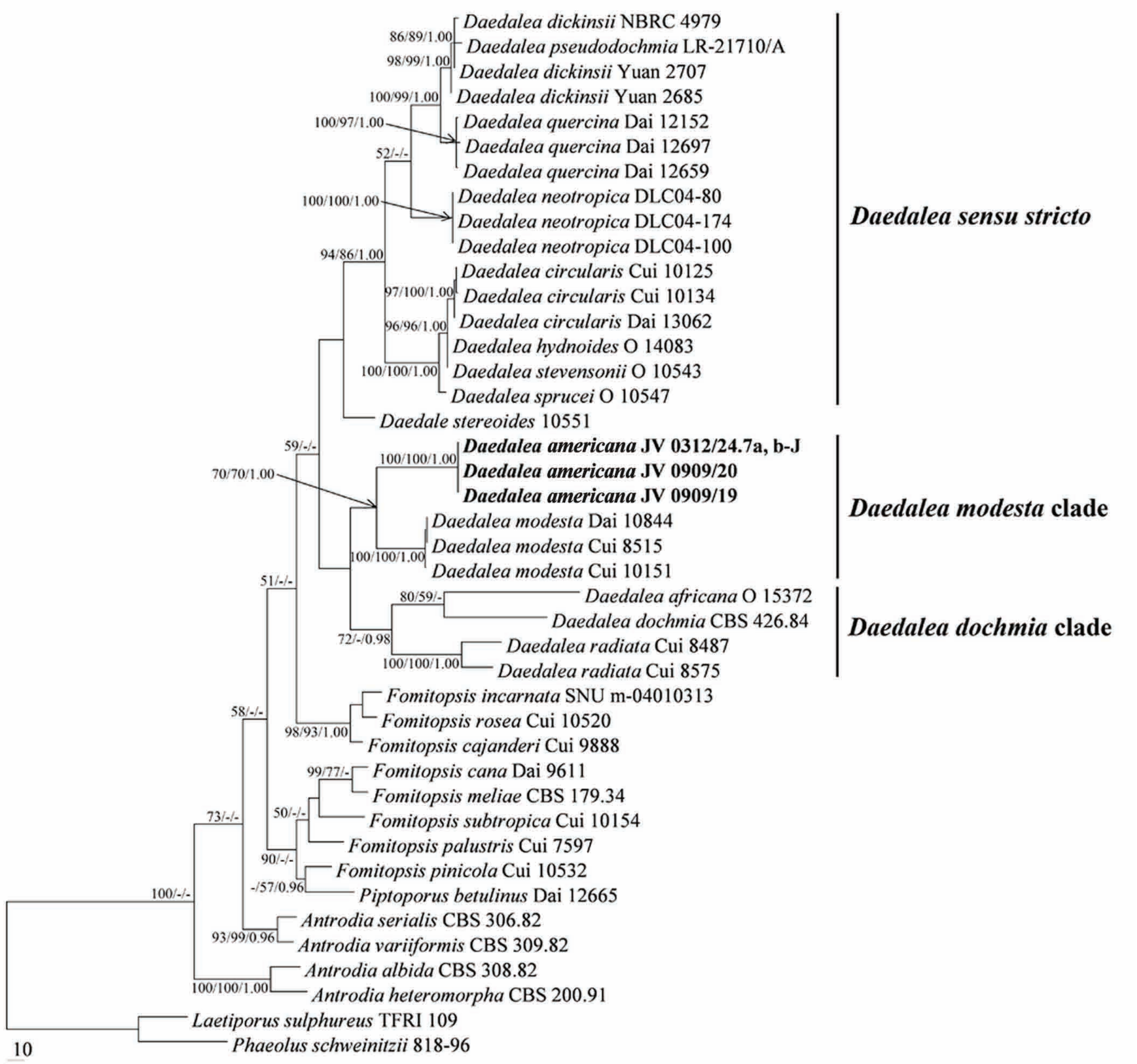

FIGURE 3. Maximum parsimony strict consensus tree illustrating the phylogeny of *Daedalea americana* and related species based on combined ITS+nLSU sequence data. Branches are labeled with parsimony bootstrap proportions high than 50%, maximum likelihood bootstrap higher than 70% and Bayesian posterior probabilities more than 0.95.

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References

Binder, M., Hibbett, D.S., Larsson, K-H., Larsson, E., Langer, E. & Langer, G. (2005) The phylogenetic distribution of resupinate forms across the major clades of mushroom-forming fungi (Homobasidiomycetes). *Systematics and Biodiversity* 3: 113–157. http://dx.doi.org/10.1017/S1477200005001623

Binder, M., Justo, A., Riley, R., Salamov, A., López-Giráldez, F., Sjökvist, E., Copeland, A., Foster, B., Sun, H., Larsson, E., Larsson, K.H., Townsend, J., Grigoriev, I.V. & Hibbett, D.S. (2013) Phylogenetic and phylogenomic overview of the Polyporales. *Mycologia* 105: 1350–1373. http://dx.doi.org/10.3852/13-003

Carranza-Morse, J. & Gilbertson, R.L. (1986) Taxonomy of the *Fomitopsis rosea* complex (Aphyllophorales, Polyporaceae). *Mycotaxon* 25: 469–486.

Cui, B.K. & Dai, Y.C. (2013) Molecular phylogeny and morphology reveal a new species of *Amyloporia* (Basidiomycota) from China. *Antonie van Leeuwenhoek* 104: 817–827. http://dx.doi.org/10.1007/s10482-013-9994-1

Donk, M.A. (1966) Notes on European polypores. I. *Persoonia* 4: 337–343.

Drechsler-Santos, E.R., Cavalcanti, M.A.Q., Loguercio-Leite, C. & Robledo, G.L. (2012) On Neotropical *Daedalea* species: *Daedalea ryvardenica* sp. nov. *Kurtziana* 37: 65–72.

Felsenstein, J. (1985) Confidence intervals on phylogenetics: an approach using bootstrap. *Evolution* 39: 783–791. http://dx.doi.org/10.2307/2408678

Fries, E.M. (1821) *Systema Mycologicum. Vol. 1*. Officina Berlingiana, Lund.

Gilbertson, R.L. & Ryvarden, L. (1986) *North American Polypores 1. Abortiporus – Lindtneria*. Fungiflora, Oslo, pp. 1–433.

Hall, T.A. (1999) Bioedit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *Nucleic Acids Symposium Series* 41: 95–98.

Han, M.L. & Cui, B.K. (2015) Morphological characters and molecular data reveal a new species of *Fomitopsis* (Polyporales) from southern China. *Mycoscience* 56: 168–176. http://dx.doi.org/10.1016/j.myc.2014.05.004

Han, M.L., Song, J. & Cui, B.K. (2014) Morphology and molecular phylogeny for two new species of *Fomitopsis* (Basidiomycota) from South China. *Mycological Progress* 13: 905–914. http://dx.doi.org/10.1007/s11557-014-0976-0

Hattori, T. (2005) Type studies of the polypores described by E.J.H. Corner from Asia and West Pacific Areas. VII. Species described in *Trametes* (1). *Mycoscience* 46: 303–312. http://dx.doi.org/10.1007/s10267-005-0250-z

He, S.H., Vlasák, J. & Dai, Y.C. (2014) *Hispidaedalea* gen. nov. and *Griseoporia taiwanense* sp. nov. (Gloeophyllales, Basidiomycota) based on morphological and molecular characters. *Mycological Progress* 13: 833–839. http://dx.doi.org/10.1007/s11557-014-0966-2

Hillis, D.M. & Bull, J.J. (1993) An empirical test of bootstrapping as a method for assessing confidence in phylogenetic analysis. *Systematics and Biodiversity* 42: 182–192. http://dx.doi.org/10.1093/sysbio/42.2.182

Kim, K.M., Lee, J.S. & Jung, H.S. (2007) *Fomitopsis incarnatus* sp. nov. based on generic evaluation of *Fomitopsis* and *Rhodofomes*. *Mycologia* 99: 833–841. http://dx.doi.org/10.3852/mycologia.99.6.833

Kim, K.M., Yoon, Y.G. & Jung, H.S. (2005) Evaluation of the monophyly of *Fomitopsis* using parsimony and MCMC methods. *Mycologia* 97: 812–822. http://dx.doi.org/10.3852/mycologia.97.4.812

Li, H.J. & Cui, B.K. (2013) Two new *Daedalea* species (Polyporales, Basidiomycota) from South China. *Mycoscience* 54: 62–68. http://dx.doi.org/10.1016/j.myc.2012.07.005

Li, H.J., Han, M.L. & Cui, B.K. (2013) Two new *Fomitopsis* species from southern China based on morphological and molecular characters. *Mycological Progress* 12: 709–718. http://dx.doi.org/10.1007/s11557-012-0882-2

Li, H.J., Cui, B.K. & Dai, Y.C. (2014) Taxonomy and multi-gene phylogeny of *Datronia* (Polyporales, Basidiomycota). *Persoonia* 32: 170–182. http://dx.doi.org/10.3767/003158514X681828

Lindner, D.L., Ryvarden, L. & Baroni, T.J. (2011) A new species of *Daedalea* (Basidiomycota) and a synopsis of core species in *Daedalea sensu stricto*. *North American Fungi* 6: 1–12. http://dx.doi.org/10.2509/naf2011.006.004

Núñez, M. & Ryvarden, L. (2001) East Asian polypores 2. *Synopsis Fungorum* 14: 262–265.

Nylander, J.A.A. (2004) *MrModeltest v2. Program distributed by the author*. Evolutionary Biology Centre, Uppsala University.

Persoon, C.H. (1801) *Synopsis Methodica Fungorum*. Gottingae.

Petersen, J.H. (1996) Farvekort. *The Danish Mycological Society's color-chart*. Foreningen til Svampekundskabens Fremme, Greve, pp. 1–6.

Posada, D. & Crandall, K.A. (1998) Modeltest: testing the model of DNA substitution. *Bioinformatics* 14: 817–818. http://dx.doi.org/10.1093/bioinformatics/14.9.817

Rajchenberg, M. (1986) On *Trametes aethalodes* and other species of *Daedalea* (Polyporaceae). *Canadian Journal of Botany* 64: 2130–2135.

Ronquist, F. & Huelsenbeck, J.P. (2003) MrBayes 3: bayesian phylogenetic inference under mixed models. *Bioinformatics* 19: 1572–1574. http://dx.doi.org/10.1093/bioinformatics/btg180

Ryvarden, L. (1984) Type studies in the Polyporaceae 16. Species described by J.M. Berkeley, either alone or with other mycologists from 1856 to 1886. *Mycotaxon* 20: 329–363.

Ryvarden, L. & Johansen, I. (1980) *A preliminary polypore flora of East Africa*. Fungiflora, Oslo, 636 pp.

Ryvarden, L. & Melo, I. (2014) Poroid fungi of Europe. *Synopsis Fungorum* 31: 1–455.

Shen, L.L., Cui, B.K. & Dai, Y.C. (2014) A new species of *Postia* (Polyporales, Basidiomycota) from China based on morphological and molecular evidence. *Phytotaxa* 162: 147–156. http://dx.doi.org/10.11646/phytotaxa.162.3.3

Singer, R. (1944) Notes on taxonomy and nomenclature of the polypores. *Mycologia* 36: 65–69.

Song, J., Chen, Y.Y., Cui, B.K., Liu, H.G. & Wang, Y.Z. (2014) Morphological and molecular evidence for two new species of *Laetiporus* (Basidiomycota, Polyporales) from southwestern China. *Mycologia* 106: 1039–1050. http://dx.doi.org/10.3852/13-402

Stamatakis, A. (2006) RAxML-VI-HPC: maximum likelihood-based phylogenetic analyses with thousands of taxa and mixed models. *Bioinformatics* 22: 2688–2690. http://dx.doi.org/10.1093/bioinformatics/btl446

Swofford, D.L. (2002) *PAUP*: phylogenetic analysis using parsimony (*and other methods). Version 4.0b10*. Sinauer Associates, Massachusetts.

Thompson, J.D., Gibson, T.J., Plewniak, F., Jeanmougin, F. & Higgins, D.G. (1997) The Clustal_X windows interface: fexible strategies for multiple sequence alignment aided by quality analysis tools. *Nucleic Acids Research* 25: 4876–4882. http://dx.doi.org/10.1093/nar/25.24.4876

Wagner, T. & Fischer, M. (2001) Natural groups and a revised system for the European poroid Hymenochaetales (Basidiomycota) supported by nLSU rDNA sequence data. *Mycological Research* 105: 773–782. http://dx.doi.org/10.1017/S0953756201004257

Wang, Z., Binder, M., Dai, Y.C. & Hibbett, D.S. (2004) Phylogenetic relationships of *Sparassis* inferred from nuclear and mitochondrial ribosomal DNA and RNA polymerase sequences. *Mycologia* 96: 1015–1029. http://dx.doi.org/10.2307/3762086

Wei, Y.L. & Dai, Y.C. (2006) Three new species of *Postia* (Aphyllophorales, Basidiomycota) from China. *Fungal Diversity* 23: 391–402.

White, T.J., Bruns, T., Lee, S. & Taylor, J. (1990) Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. *In:* Innis, M.A., Gelfand, D.H., Sninsky, J.J. & White, T.J. (Eds.) *PCR Protocols: a guide to methods and applications*. Academic Press, San Diego, pp. 315–322.

Zhao, C.L., Cui, B.K., Song, J. & Dai, Y.C. (2015) Fragiliporiaceae, a new family of Polyporales (Basidiomycota). *Fungal Diversity* 70: 115–126. http://dx.doi.org/10.1007/s13225-014-0299-0