The genus *Phanerochaete* (Corticiaceae, Basidiomycotina) sensu lato in Uruguay

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Eight species of *Phanerochaete* are reported from Uruguay for the first time. including a new species, *P. vesiculosa*. *Phanerochaete vesiculosa* is characterized by thin-walled, clavate to cylindrical vesicles embedded in the subiculum. A key to the known species of *Phanerochaete* from Uruguay is provided.

Key words: *Phanerochaete vesiculosa,* taxonomy, Corticiaceae

Phanerochaete P. Karst. is a widespread group of saprophytic, wood decay fungi. Burdsall (1985) included 46 species in his monograph, and today Phanerochaete is one of the largest genus within the Corticiaceae *sensu lato* with more than 90 described species worldwide (Hjortstam, 2000; Parmasto, 1997). Historically a member of the Corticiaceae Herter (Burdsall, 1985), recent phylogenetic studies place Phanerochaete in the "polyporoid clade" (Hibbett & Donoghue, 2001; Moncalvo & al., 2002).

Phanerochaete is a group of morphologically diverse species with resupinate basidiomes and smooth, tuberculate or aculeate hymenophores (Burdsall, 1985; Hjortstam, 2000). Microscopically, it is characterized by a monomitic hyphal system of primarily simple septate generative hyphae, clavate basidia, and thin-walled, non-amyloid, and acyanophilous basidiospores. Cystidia are present in many species. Recent molecular phylogenetic studies indicate that the genus is polyphyletic as well (de Koker & al., 2003; Greslebin & al., 2004). In the future it may be necessary to divide Phanerochaete into smaller, natural groups; but for now, it is convenient to maintain this genus for the many corticioid species with the features described above.

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Only four species of *Phanerochaete* were recorded from Uruguay previously. These are *Phanerochaete filamentosa* (Berk. & M. A. Curtis) Burds. (= *Rhizochaete filamentosa* (Berk. & M. A. Curtis) Greslebin, Nakasone & Rajchenberg), *P. xerophila* Burds., *P. avellanea* (Bres.) J. Erikss. & Hjortst., and *P. australis* Jülich (Gazzano 1988, 1994, 2000, 2002). In this work, eight additional species of *Phanerochaete* are reported for the first time from Uruguay, including a new species, *Phanerochaete vesiculosa*. A key to the known species of *Phanerochaete* in Uruguay is provided.

Materials and Methods

All specimens are deposited at the herbarium of the Facultad de Ciencias, Universidad de la Republica, Montevideo, Uruguay (MVHC). Additional specimens are deposited at BPI and MVM. For microscopic study, thin free-hand sections of the basidiomes were mounted in 5% (w/v) aqueous potassium hydroxide and 1% (w/v) aqueous phloxine, Melzer's reagent, or cotton blue in lactic acid (Kirk & al., 2001). Melzer's reagent tests for amyloid and dextrinoid reactions whereas cotton blue for cyanophily.

Key to the known species of *Phanerochaete* in Uruguay

1. Cystidia absent 2
1*. Cystidia present 4
2. Basal hyphae mainly thick-walled, basidiospores 7–9.5 × 3.5–4.5 µm . . . . . *P. corymbata*
2*. Basal hyphae mainly thin-walled 3
3. Basidiospores broadly ellipsoid, 6.5–9 × 3.5–4.5 µm . . . . . *P. xerophila*
3*. Basidiospores narrowly ellipsoid, 5–7.5 × 2.5–3.5 µm . . . . . *P. avellanea*
4. Brown subicular hyphae present, basidiospores 5.5–7 × 2.5–3.5 µm . . . . . *P. singularis*
4*. Brown subicular hyphae absent 5
5. Hymenophore raduloid to hydnoid 6
5*. Hymenophore smooth to tuberculate 7
6. Cystidia fusoid, basidiospores 5–6 × 3–3.5 µm . . . . *P. omnivora*
6*. Cystidia cylindrical-clavate, basidiospores 4.5–6 × 2–25.3) µm . . . . . *P. aculeata*
7. Vesicles present in subiculum, cystidia clavate to fusiform, 40–70 × 5.5–8 µm, and basidiospores (6.5–)7–9 × 4–5 µm . . . . . *P. vesiculosa*
7*. Not with this combination of characters 8

8. Cystidia strongly encrusted 9
8*. Cystidia smooth or lightly encrusted 10
9. Basidiocarp and cords turning purple or red in KOH . . . . . *P. filamentosa*
9*. Basidiocarp not changing color in KOH . . . . . *P. sordida*
10. Cystidia subulate, 25–50 × 8–12µm . . . . . *P. australis*
10*. Cystidia nearly cylindrical, >50 µm long 11
11. Hymenophore smooth to warted, cystidia thin-walled and smooth, basidiospores 5.5–7 × 2.5–3 µm . . . . . *P. magnoliae*
11*. Hymenophore smooth, cystidia thin-walled at apex, becoming thick-walled toward base, smooth, lightly to heavily encrusted, basidiospores 4.5–7 × 2.5–3.5 µm . . . . . *P. sordida*

Taxonomy

Phanerochaete aculeata Hallenberg, Iran. J. Pl. Path. 14: 62. 1978.

Specimens examined. – URUGUAY Dpto. Canelones, Rincón del Gigante, on fallen branch of *Malus sylvestris* Mill. (Rosaceae), 26 Oct. 2002, leg. S. Martinez s.n. (MVHC 5073). Dpto. Lavalleja, Minas, Establecimiento "Santa Clara," on bark of *Eucalyptus* sp. (Myrtaceae), 3 Dec. 2002, leg. S. Martínez s.n. (MVHC5112). Dpto. Paysandú, Establecimiento "San Pedro," on fallen trunk of *Eucalyptus globulus* Labill., no date, leg. S. Simeto, S. Lupo & S. Martínez (MVHC 5011). Dpto. Río Negro, Tres Bocas, Establecimiento "La Nona," on wood of *Eucalyptus* sp., 24 Oct. 2001, leg. S. Martínez s.n. (MVHC 5132), 14 Oct. 2002, leg. S. Martínez s.n. (MVHC 5090, 5091).

Remarks: This is the most common species of *Phanerochaete* on *Eucalyptus* in Uruguay. *Phanerochaete aculeata* is characterized by an odontoid hymenophore and narrowly ellipsoid basidiospores.

Phanerochaete corymbata (G. Cunn.) Burds., Mycol. Mem. 10: 65. 1985.

= *Corticium corymbatum* G. Cunn., Trans. Roy. Soc. New Zealand 82: 324. 1954.

Specimens examined. – URUGUAY: Dpto. Montevideo, Montevideo City, Parque Rodó, an fallen branch of *Tipuana tipu* (Benth.) Kuntze (Fabaceae), Jun. 2000, leg. S. Martinez s.n. (MVHC 5016, 5027).

Remarks: Both specimens cited were collected on branches felled by a storm. The relatively large basidiospores and thick-walled subicular hyphae are important features that distinguish *Phanerochaete* corymbata from *P. tuberculata* (P. Karst.) Parmasto.

Phanerochaete maguoliae (Berk. & M. A. Curtis) Burds., Mycol. Mem. 10: 95. 1985.

= *Radulum magnoliae* Berk. & M. A. Curtis in Hooker, Kew Bull. Misc. Inf. 1: 236. 1849.

Specimens examined. – URUGUAY: Dpto. Florida, Cerro Colorado, on bark of *Eucalyptus globulus*, Dec. 2000, leg. S. Lupo & L. Bettucci (MVHC5075). Dpto. Paysandú, Pandule, Establecimiento "El Cerro," on fallen branch of *Eucalyptus bicostata* Maiden, Blakely & Simmonds, leg. G. Pérez & S. Martínez (MVHC5096).

Remarks: The specimens studied have nearly smooth hymenia, but other characters are typical for the species. This species is only known on *Eucalyptus* in Uruguay.

Phanerochaete omnivora (Shear) Burds. & Nakasone, Mycotaxon 7: 17. 1978.

= *Hydnum omnivorum* Shear, J. Agric. Res. 30: 476. 1925.

Specimens examined. – URUGUAY: Dpto. Florida, Florida City, Parque Robaina, on fallen branch of unknown angiosperm, 26 Feb. 1995, leg. S. Martínez s.n. (MVHC 5022, MVM). Dpto. Lavalleja, Minas, Paraje Higueritas, on wood of angiosperm, May 2003, leg. G. Pérez (MVHC 5147). Dpto. Río Negro, Tres Bocas, Establecimiento "La Nona," on *Eucalyptus* sp., wood on soil, 14 Oct. 2002, leg. S. Martínez s.n. (MVHC 5092).

Remarks: The yellow hydnaceous basidiome and fusoid cystidia are important features that distinguish *P. omnivora*, although specimen MVHC 5022 lacks cystidia. Specimens on *Eucalyptus* have especially bright yellow basidiomes. This is the first report of *P. omnivora* outside of the United States.

Phanerochaete singularis (G. Cunn.) Burds., Mycol. Mem. 10: 121. 1985.

= *Corticium singulare* G. Cunn., Trans. Roy. Soc. New Zealand 82: 325. 1954.

Specimens examined. – URUGUAY: Dpto. Florida, Florida City, Parque Robaina, on fallen branch of unknown angiosperm, 26 Feb. 1995, leg. S. Martínez s.n. (MVHC 1074). Dpto. Colonia, Carmelo, Paraje Martín Chico, on fallen branch of angiosperm, 11 Jul. 2003, leg. R. Alonso, S. Simeto & S. Martínez (MVHC 5219).

Remarks: Characterized by brown-colored subicular hyphae with rare single or double clamp connections and long cystidia, *P. singularis* was recently placed in the new genus *Australicium*

(Hjortstam & Ryvarden, 2002). *Phanerochaete singularis* is also reported from Brazil and Venezuela (Hjortstam & Ryvarden, 2002).

Phanerochaete sordida (P. Karst.) J. Erikss. & Ryvarden, Corticiaceae North Europe 5: 1023. 1978.

= *Corticium sordidum* P. Karst., Med. Soc. Fauna Fl. Fenn. 9: 65. 1882.

Specimens examined. – URUGUAY. Dpto. Florida, Florida City, Parque Rabaina, on wood of unknown angiosperm, 23 Oct. 1994, leg. S. Martínez s.n. (MVHC 5131). Dpto. Río Negro, Establecimiento "Las Acacias", on fallen trunk of *E. globulus*, 5–6 Apr. 1999, leg. R. Alonso & S. Tiscornia (MVHC 5043).

Remarks: *Phanerochaete sordida* is a well recognized species-complex with smooth or lightly to heavily encrusted cystidia (Burdsall, 1985; Eriksson & al., 1978; de Koker & al., 2000). This cosmopolitan taxon is distributed worldwide.

Phanerochaete vesiculosa S. Martinez & Nakasone, **sp. nov.,** – Figs. 1–2.

Basidiomata effusa, subceracea vel crustacea, usque ad 200 µm crassum; hymenophora laevia, rimosa. Systema hypharum monomiticum, hyphae efibulatis cum rare singulis fibulis. – Cystidia clavata vel late fusiformia, 40–70 × 5.5–8 µm. Vesiculae clavata vel fere cylindrica. 35–10 × 8–13 µm, tenuitunicatis, hyalinis. – Basidia clavata, 32–40 × 5.5–8 µm, 4–sterigmatibus. Basidiosporae late ellipsoideae, laevibus, tenuitunicatae, hyalinis, (6.5–)7–9 × 4–5 µm.

Holotype. – URUGUAY Dpto. Florida, Florida City, Parque Robaina, on fallen branch of unknown angiosperm, 9 Jun. 1996, leg. S. Martínez 242 (MVHC 5060; isotype, BPI).

Etymology. – vesiculosa (Latin, adj.), referring to the embedded vesicles.

Basidiomata resupinate, widely effuse, up to 9 × 2.5 cm, adnate, up to 200 µm thick, subceraceous to crustaceous. – Hymenial surface light yellow to light orange, smooth, extensively cracked to expose white, fibrillose context, unchanged in KOH; margin appressed, abrupt, smooth with a narrow, white fibrillose edge or gradually thinning out, smooth to rimose. – Hyphal system monomitic, generative hyphae simple septate with rare single clamp connections. –Subiculum up to 80 µm thick, an open, loose tissue with a thin (up to 35 µm thick) basal layer of somewhat agglutinated hyphae running parallel to substrate, then hyphae

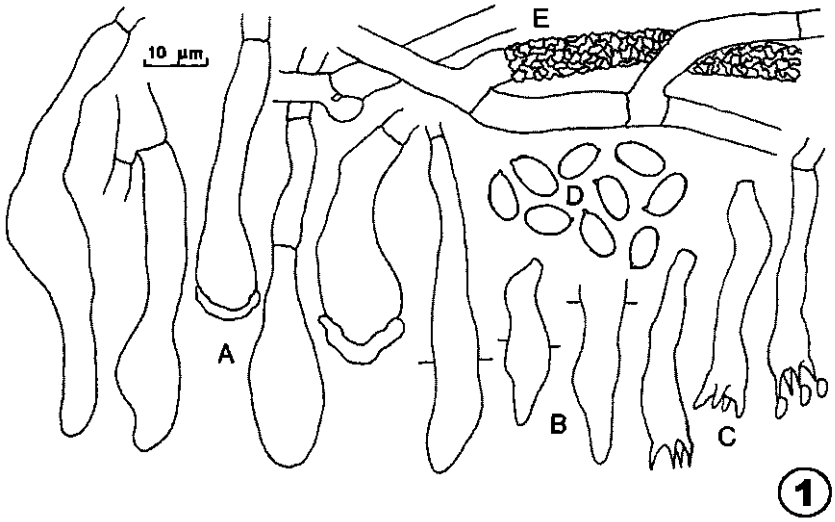

Fig. 1. Microscopic elements of *Phanerochaete vesiculosa* (from the holotype). – A Embedded vesicles. – B Hymenial cystidia. – C Basidia. – D Basidiospores. – E Subicular hyphae.

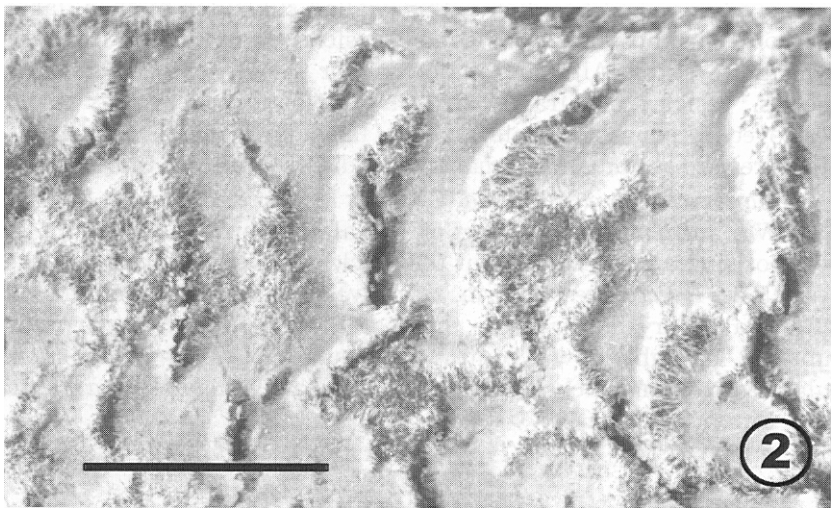

Fig. 2. Phanerochaete vesiculosa (from the holotype). Close-up of dried basidiome (scale bar 1 mm).

becoming upright, moderately branched, heavily encrusted with hyaline crystals; subicular hyphae 3–7 µm diam, simple septate with occasional single clamps, sparsely to moderately branched, walls thin, hyaline, smooth or heavily encrusted with hyaline crystals,

some crystals dissolving in KOH. – Subhymenium up to 40 µm thick, a dense, partially agglutinated compact tissue of short-celled, frequently branched hyphae; subhymenial hyphae 3–4.5 µm diam, simple septate, walls hyaline, thin, smooth or encrusted with hyaline crystals. – Vesicles clavate to more or less cylindrical, 35–70 × 8–13 µm, tapering to 3–4.5 µm diam at base, simple septate at base, walls thin, hyaline, smooth or with a thin, brown, mucilaginous apical cap, staining deeply in phloxine, fragile, occurring singly or in clusters, embedded in upper subiculum, rare or locally abundant. – Hymenium a dense palisade of partially agglutinated basidia and rare cystidia. – Cystidia scattered, clavate to wide fusiform, 30–70 × 5.5–8 µm, simple septate at base, protruding up to 25 µm beyond hymenium, walls thin, hyaline, occasionally encrusted with small, yellowish granules dissolving in KOH. – Basidia rare, readily collapsed, clavate, 32–40 × 5.5–8 µm, tapering to 2.5–3 µm diam at base, simple-septate at base, walls thin, hyaline, smooth, 4-sterigmate. – Basidiospores ellipsoid to broadly ellipsoid, with small guttulae, (6.5–)7–9 × 4–5 µm, walls thin, hyaline, smooth, not reacting in Melzer's reagent or cotton blue.

Remarks. *Phanerochaete vesiculosa* is characterized by an extensively cracked basidiome, thin-walled subicular hyphae, large ellipsoid basidiospores, embedded vesicles, and wide, fusiform hymenial cystidia. Although important for the identification of this species, vesicles are fragile and inconspicuous. They are easily destroyed in squash mounts and are irregularly distributed. Basidiospores are abundant but mature basidia are difficult to find.

Phanerochaete martelliana (Bres.) J. Erikss. & Ryvarden, *P. laxa* S.H. Wu, and *P. auranta* (Bourdot & Galzin) Burds. have basidiospores of similar dimensions but they lack vesicles. Furthermore, the cystidia in *P. laxa* are fusiform, thick-walled and heavily encrusted with hyaline crystals whereas those of *P. martelliana* are narrowly subulate. Its light brown, continuous basidiome, thick-walled subicular hyphae, and lack of hymenial cystidia distinguish *P. auranta* from *P. vesiculosa*.

Phanerochaete xerophila Burds., Mycol. Mem. 10: 141. 1985.

Specimen examined. – URUGUAY Dpto. Paysandú, Arroyo Araujo, Route 26, Km 40,400, on fallen branch of *Scutia buxifolia* Reissrk (Rhamnaceae). 9 Jun. 1996, leg. S. Simeto, S. Lupo & S. Martínez (MVHC 5018).

Remarks: Basidia in the specimen cited are smaller (23–31 × 5.5–7 µm) than described by Burdsall (1985). The report of *Phanerochaete xerophila* from Uruguay by Gazzano (1994) was erroneous,

as the specimen (MVHC 9241) is *Porostereum fuscomarginatum* (Burt) Hjortstam.

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References

Burdsall, H. H., Jr. (1985). A contribution to the taxonomy of the genus *Phanerochaete* (Corticiaceae, Aphyllophorales). – Mycol. Mem. 10. J. Cramer, Braunschweig.

de Koker, T. H., K. K. Nakasone, J. Haarhoff, H. H. Burdsall, Jr., & B. J. H. Janse (2003). Phylogenetic relationships of the genus *Phanerochaete* inferred from the internal transcribed spacer region. – Mycol. Res. 107: 1032–1040.

Eriksson, J., K. Hjortstam, & L. Ryvarden (1978). The Corticiaceae of North Europe. *Mycoaciella – Phanerochaete*. Vol. 5: 889–1047, – Oslo, Fungiflora

Gazzano, S (1988). Notas sobre Basidiomycetes xilófilos del Uruguay. III. Nuevos registros de Corticiaceae s.l. y Polyporaceae s.l. (Aphyllophorales). – Comun. Bot. Mus. Hist. Nat. Montev 5 (87): 1–3.

Gazzano, S (1994). Notas sobre Basidiomycetes xilófilos del Uruguay. VI. Nuevos registros. – Comun. Bot. Mus. Hist. Nat. Montev. 5 (102): 1–9.

Gazzano, S (2000). Notas sobre Basidiamycetes xilófilos del Uruguay IX. Nuevos registros de hongos corticioides y poroides (Aphyllophorales). – Comun. Bot. Mus. Hist. Nat. Montev. 6 (115): 1–7.

Gazzano, S 12002). Notas sobre Basidiomycetes xilófilos del Uruguay. XI. Nuevos registros en hongos corticioides (Aphyllophorales: Coniophoraceae, Corticiaceae, Hericiaceae e Hymenochaetaceae). – Comun. Bot. Mus. Hist. Nat. Montev. 6 (124): 1–8.

Greslebin, A. G., K. K. Nakasone, & M. Rajchenberg (2004). *Rhizochaete*, a new genus of phanerochaetoid fungi. – Mycologia 96 (2): 260–271.

Hibbett, D. S. & M. J. Donoghue (2001). Analysis of character correlations among wood decay mechanisms, mating systems, and substrate ranges in Homobasidiomycetes. – Syst. Biol. 50 (2): 215–242.

Hjortstam, K. & L. Ryvarden (2002). *Australicium* (Basidiomycotina, Aphyllophorales) a new genus for *Corticium singulare* G. Cunn. – Synopsis Fungorum 15: 18–21.

Kirk, P. M., P. F. Cannon, J. C. David, & J. A. Stalpers (2001). Ainsworth & Bisby's Dictionary of the Fungi. – Oxon, United Kingdom, CAB International.

Moncalvo, J.-M., R. Vilgalys, & al. (2002). One hundred and seventeen clades of euagarics. – Mol. Phylogenet. Evol. 23: 357–400.

Parmasto, E. (1997). Cortbase–a nomenclatural taxabase of corticioid fungi (Hymenomycetes). – Mycotaxon 61: 467–471.

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