

## Some species of *Perenniporia* Murrill (Poriales, Basidiomycotina) from Southern Brazil

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**Abstract** - (Some species of *Perenniporia* Murrill (Poriales, Basidiomycotina) from Southern Brazil). *Perenniporia contraria*, *P. martius*, *P. medulla-panis*, *P. ohiensis*, *P. piperis*, *P. stipitata* and *P. tephropora* are described in this paper. A key to these species is presented. Five species studied in culture are included, through the respective species code. *P. tephropora* is a new record from Southern Brazil. A check-list of names *Perenniporia* species known throughout the world is given.

**Resumo** - (Algumas espécies de *Perenniporia* Murrill (Poriales, Basidiomycotina) do sul do Brasil). *Perenniporia contraria*, *P. martius*, *P. medulla-panis*, *P. ohiensis*, *P. piperis*, *P. stipitata* e *P. tephropora* coletadas no sul do Brasil são descritas. O trabalho inclui os códigos numéricos de cinco destas espécies que foram estudadas em cultura e uma chave dicotômica para a determinação das espécies citadas. *P. tephropora* é uma nova citação para o sul do Brasil. Inclui-se uma lista de espécies de *Perenniporia* conhecidas no mundo.

Key words - *Perenniporia*, taxonomy, Southern Brazil

### Introduction

The genus *Perenniporia* Murrill was described in 1942. The type species, *Polyporus medulla-panis* Jacq.: Fr., was selected by Cooke in 1953 (Ryvarden 1991).

*Perenniporia* is a large cosmopolitan genus with the following characteristics: basidiomata perennial, resupinate to pileate, smooth pileus, ochraceous to blackish with age, hard and woody, a di- to trimitic hyphal system, dextrinoid skeletal hyphae in variable degrees, and thick walled, ellipsoid to distinctly truncate spore-shape, with a variable dextrinoid reaction (Ryvarden & Gilbertson 1994).

The number of species considered in the genus is approximately 20 (Hawksworth et al. 1995). However, in a bibliographic survey we found 56 names available, shown in Table 1. Also, the CBS Database (Centraalbureau voor Schimmelcultures) provides a further nine names: *P. adnata* Corner, *P. albocinnamonea* Corner, *P. decurrata* Corner, *P. ferruginea* Corner, *P. maackiae* (Bond. & Ljub.) Parm., *P. penangia* Corner, *P. subaurantia* (Rodway & Cleland) Buch. & Ryv. and *P. unita* (Pers.) Murr. (= *P. medulla-panis* (Jacq.: Fr.) Donk).

There are 13 records of *Perenniporia* from Brazil: *P. contraria* (Berk. & Curt.) Ryv. (Ryvarden 1988b), *P. detrita* (Berk.) Ryv. (Ryvarden 1984), *P.*

*glaucopora* (Lloyd) Ryv. (Jesus 1996), *P. inflexibilis* (Berk.) Ryv. (Ryvarden 1984), *P. martius* (Berk.) Ryv. (Ryvarden 1984), *P. medulla-panis* (Jacq.: Fr.) Donk (Ryvarden 1984, Rajchenberg & Meijer 1990, Loguercio-Leite & Gerber 1997), *P. neofulva* (Lloyd) Ryv. (Ryvarden 1990, Gugliotta & Capelari 1995), *P. ochroleuca* (Berk.) Ryv. (Ryvarden 1984), *P. ohiensis* (Berk.) Ryv. (Loguercio-Leite & Wright 1991), *P. piperis* (Rick) Rajch. (Rajchenberg 1987, Silveira & Guerrero 1991, Loguercio-Leite & Wright 1991), *P. sinuosa* Ryv. (Ryvarden 1987), *P. stipitata* Ryv. (Ryvarden 1987, Loguercio-Leite & Wright 1991) and *P. tephropora* (Mont.) Ryv. (Wright 1976).

The present paper provides descriptions and an identification key for some species of *Perenniporia* from Southern Brazil.

### Materials and methods

Collections from Southern Brazil were made, examined and deposited at FLOR and the specimens were compared with material of BAFC (Holmgren et al. 1990). Basidiomata were analysed macro- and microscopically. Measurements and drawings were made from freehand sections mounted in 1% phloxine solution plus 5% KOH solution and Melzer's reagent. The fungi colour definition were according to Munsell (1975). Dicarotic cultures (identified by 'cc' followed by a number) were made of basidioma's tissues and studied by Nobles method (Nobles 1965), which consists of a 6-week study on malt extract agar, at 25°C and in darkness. The results were expressed through a code species (Nobles 1965). Tests on garlic acid agar (GAA) and on tannic acid agar (TAA) were carried out in a similar way according to Nobles (1965) and the evaluation of reaction intensity was based on Bettucci & Guerrero (1971). Drop tests, which reveal the presence of enzymatic activity strains, were performed according to Käärik (1965), Harkin & Obst (1973), Taylor (1974) and Stalpers (1978) when cultures were seven days old.

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## Results

### Key to species

1. Basidiomata pileate ..... 2
1. Basidiomata resupinate to effused-reflexed ..... 6
2. Pileus with a reddish and brownish to black distinct crust; vegetative hyphae strongly dextrinoid ..... 3
2. Pileus without crust; vegetative hyphae non-dextrinoid to dextrinoid in variable degree ..... 4
3. Pilear crust reddish to almost black; context white, up to 3 mm thick; pores 5-7 per mm; spores broadly ellipsoid to subglobose, more or less truncate,  $4-5 \times 3-3.5 \mu\text{m}$  ..... 1. *P. contraria*
3. Pilear crust brownish to black; context yellowish brown to dark grayish brown, in young specimens cream, up to 3.5 cm thick; pores 4 per mm; spores pipshaped to weakly truncate with a distinct tapering end,  $6.5-9 \times 3.5-4.5 \mu\text{m}$  ..... 2. *P. martius*
4. Basidiomata perennial, ungluate; pores 5-6 per mm; vegetative hyphae weakly dextrinoid in mass; spores ellipsoid to ovoid, truncate, thick-walled, dextrinoid,  $9.5-12 \times 6-7.5 \mu\text{m}$  ..... 4. *P. ohioensis*
4. Basidiomata annual to biannual, scutellate, semicircular to flabeliform; pores 7-12 per mm; vegetative hyphae non-dextrinoid to strongly dextrinoid; spores shorter than  $7 \mu\text{m}$  ..... 5
5. Basidiomata dimidiate; vegetative hyphae non-dextrinoid; spores broadly ellipsoid to subglobose, slightly thickened walls, non-dextrinoid to weakly dextrinoid in some specimens,  $3.5-5 \times 2.5-3.5 \mu\text{m}$  ..... 5. *P. piperis*
5. Basidiomata laterally stipitate; vegetative hyphae strongly dextrinoid; spores subglobose, truncate, thick-walled, dextrinoid,  $4-6 (-7) \times 3-4.5 \mu\text{m}$  ..... 6. *P. stipitata*
6. Basidiomata resupinate, cream to bright yellow; skeletal hyphae hyaline in KOH, dextrinoid; spores broadly ellipsoid to ovoid, usually truncate,  $5-6 \times 4-5 (-5.5) \mu\text{m}$ , variable dextrinoid ..... 3. *P. medulla-panis*
6. Basidiomata resupinate to effused-reflexed, with orbiculate pilei; pileus, if present, with grayish to black crust; pore surface gray to olivaceous brown; skeletal hyphae olivaceous brown in KOH, weakly dextrinoid; spores ellipsoid, truncate,  $5-6.5 \times (3-) 4-4.5 \mu\text{m}$ , dextrinoid ..... 7. *P. tephropora*

*Perenniporia contraria* (Berk. & Curt.) Ryv.,  
Norw. J. Bot. 19: 233. 1972.

Figure 1.

≡ *Fomes contrarius* Berk. & Curt., *Grevillea*  
15:21. 1886.

Basidiomata perennial, pileate, semicircular, light in weight when dry. Pileus surface glabrous, shallowly concentrically sulcate, radially cracked, covered by a dark reddish brown (3/2, 3/3, 2.5/2 5YR) and dark brown (3/2 7.5YR, 3/3 10YR) to black (2.5/1 5YR) crust; margin pale yellow (8/4 2.5Y), acute. Pore surface pale yellow (8/4 2.5Y) and yellow (8/6, 7/6 2.5Y) to brownish yellow (6/6 10YR). Pores round, 5-7 per mm, with thin to rather thick, entire and slightly farinose dissepiments. Tubes 3-5 mm deep, indistinctly stratified, pale yellow (8/4 2.5Y). Context 1-3 mm thick, white (8/2 2.5Y), pilear cortex as a black (2.5/1 5YR) line above, up to 0.5 mm thick.

Hyphal system dimitic; generative hyphae clamped, thin-walled, hyaline, 2-2.5  $\mu\text{m}$  diam.;

skeletal hyphae thick-walled to almost solid, hyaline, 3-3.5  $\mu\text{m}$  diam, swell in KOH up to 10  $\mu\text{m}$  diam., strongly dextrinoid. Sterile elements absent. Basidia not found. Basidiospores broadly ellipsoid to subglobose, more or less truncate, thick-walled, hyaline to pale yellow in KOH, smooth,  $4-5 \times 3-3.5 \mu\text{m}$ , variable dextrinoid.

Material examined - BRAZIL: SANTA CATARINA: Ilha de Santa Catarina, Morro da Lagoa da Conceição, A. Gerber et al. 762, 26/7/1995 (FLOR). CUBA: J. Wright 946 (BAFC).

*Perenniporia martius* (Berk.) Ryv., Norw. J. Bot.  
19:143. 1972.

Figure 2.

≡ *Polyporus martius* Berk., Hook. J. Bot. 8: 198.  
1956.

Basidiomata perennial, pileate, broadly attached, ungluate, up to 9.5 cm thick, consistency very hard and heavy when dry. Pileus surface glabrous,

Table 1. Check-list on *Perenniporia* in the world: available names, literature references for description and geographical distribution (# = first record for southern Brazil; \* = first record for Santa Catarina state, ■ = first record for Paraná state, \* = no description found)

Names	Description	Distribution
<i>P. ahmadii</i> Ryv.	Ryvarden 1983a	Pakistan
<i>P. albida</i> Wright & Rajch.	Rajchenberg & Wright 1982	Argentina, French Antilles, Guiana
<i>P. amyloextrinoides</i> Gilbn. & Ryv.	Gilbertson & Ryvarden 1987	U.S.A.
<i>P. amylohypha</i> Ryv. & Gilbn.	Lowe 1966, Ryvarden & Gilbertson 1984	U.S.A.
<i>P. clelandii</i> (Lloyd) Ryv.	Cunningham 1965	Australia
<i>P. compacta</i> (Overh.) Ryv. & Gilbn.	Gilbertson & Ryvarden 1987	U.S.A.
* <i>P. contraria</i> (Berk. & Curt.) Ryv.	Ryvarden & Johansen 1980	Africa, Brazil (RS, SC), Cuba
<i>P. dendrohyphidia</i> Ryv.	Ryvarden 1988a	Africa
<i>P. detrita</i> (Berk.) Ryv. (= <i>P. mesoleuca</i> )	Ryvarden & Johansen 1980	Brazil (?), China, Sarawak, South Africa, Tahiti
<i>P. ellipsospora</i> Ryv. & Gibn.	Gilbertson & Ryvarden 1987	U.S.A.
<i>P. ellisiana</i> (And.) Gilgn. & Ryv.	Gilbertson & Ryvarden 1987	Canada, U.S.A.
<i>P. fergusii</i> Gibn. & Ryv.	Gilbertson & Ryvarden 1987	U.S.A.
<i>P. formosana</i> T. T. Chang	Chang 1994	Taiwan
<i>P. fraxinea</i> (Fr.) Ryv.	Ryvarden & Gilbertson 1994	Europe
<i>P. fraxinophila</i> (Pk.) Ryv.	Gilbertson & Ryvarden 1987	U.S.A.
<i>P. fulviseda</i> (Bres.) Dhanda	Keller 1986, Ryvarden & Gilbertson 1994	Italy
<i>P. glaucopora</i> (Lloyd) Ryv.	Ryvarden & Johansen 1980	Africa, Brazil (RO)
<i>P. gomezii</i> Wright & Rajch.	Rajchenberg & Wright 1982	Argentina
<i>P. inflexibilis</i> (Berk.) Ryv. (= <i>P. glaucopora</i> , <i>P. minutula</i> )	Ryvarden & Johansen 1980	Africa, Brazil (?)
<i>P. isabellina</i> (Pat.) Ryv.	Ryvarden 1983b	Venezuela
<i>P. japonica</i> (Yasuda) Hattori & Ryv. (= <i>P. fulviseda</i> )	Ryvarden & Gilbertson 1994	Europe, India, Japan
* <i>P. latissima</i> (Bres.) Ryv.	Ryvarden 1988b	Japan, Java
<i>P. malvena</i> (Lloyd) Ryv.	Ryvarden 1989	Samoa
■ <i>P. martius</i> (Berk.) Ryv.	Teixeira 1948, Wright & Deschamps 1975, Ryvarden & Johansen 1980	Africa, Argentina, Brazil (AM, RS, PR), Costa Rica
<i>P. medulla-panis</i> (Jacq.: Fr.) Donk	Ryvarden & Johansen 1980, Gilbertson & Ryvarden 1987	Cosmopolitan; Brazil (PR, SC, SP)
<i>P. mesoleuca</i> (Petch.) Ryv.	Ryvarden & Johansen 1980	Africa
<i>P. micropora</i> Ryv.	Ryvarden 1987	Peru
<i>P. minutissima</i> (Yasuda) Hattori & Ryv.	Hattori & Ryvarden 1994	Japan
<i>P. minutula</i> (Henn.) Ryv.	Ryvarden & Johansen 1980	Africa
<i>P. mundula</i> (Wakef.) Ryv.	Ryvarden & Johansen 1980	Africa
<i>P. narymica</i> (Pil.) Pouz. (= <i>P. amylohypha</i> )	Gilbertson & Ryvarden 1987, Ryvarden & Gilbertson 1994	Central Siberia, Europe, U.S.A.
<i>P. neofulva</i> (Lloyd) Ryv.	Ryvarden 1990	Brazil (RS, SP)
<i>P. ochroleuca</i> (Berk.) Ryv.	Ryvarden & Johansen 1980, Ryvarden & Gilbertson 1994	Cosmopolitan; Brazil (SP)
<i>P. ohiensis</i> (Berk.) Ryv.	Gilbertson & Ryvarden 1987	Argentina, Brazil (SC), Costa Rica, Uruguay, USA
<i>P. oviforma</i> Cunn. ex Buch. & Ryv.	Buchanan & Ryvarden 1988	New Zealand
<i>P. phoiophila</i> Gilbn. & M. Blackwell	Gilbertson & Ryvarden 1987	U.S.A.
<i>P. piperis</i> (Rick) Rachj. (= <i>P. albida</i> )	Rachjenberg & Wright 1982	Brazil (RS, SC)
<i>P. podocarpus</i> Buch. & Hood	Buchanan & Hood 1992	New Zealand
<i>P. robinophila</i> (Murr.) Ryv.	Ryvarden 1983a, Gilbertson & Ryvarden 1987	India, Pakistan, USA
<i>P. roseoisabellina</i> (Pat. & Gail) Ryv.	Ryvarden 1983b	Venezuela
<i>P. rosmarini</i> David & Malecon	Ryvarden & Gilbertson 1994	Morocco, USA

(cont.)

Names	Description	Distribution
<i>P. semistipitata</i> (Lloyd) Gilbn. & Ryv.	Gilbertson & Ryvarden 1987	Singapore, USA
<i>P. sinuosa</i> Ryv.	Ryvarden 1987	Brazil (AM)
<i>P. stipitata</i> Ryv.	Ryvarden 1987	Brazil (RO, SC), Colombia, Panama, Trinidad
<i>P. straminea</i> (Bres.) Ryv.	Ryvarden 1988b	Philippine Island
<i>P. straminella</i> (Bres.) Ryv.	Ryvarden 1988b	Java
<i>P. subacida</i> (Pk.) Donk	Ryvarden & Johansen 1980, Gilbertson & Ryvarden 1987	Africa, Asia, Costa Rica, Europe, U.S.A.
<i>P. subcretacea</i> (Lloyd) Ryv.	Ryvarden 1990	Australia, Tasmania
<i>P. tepeitensis</i> (Murr.) Ryv.	Ryvarden 1985, Gilbertson & Ryvarden 1987	Costa Rica, Mexico, U.S.A.
<i>P. tenuis</i> var. <i>pulchella</i> (Schw.) Lowe	Gilbertson & Ryvarden 1987	Canada, China, Europe, Japan, U.S.A.
<i>P. tenuis</i> var. <i>tenuis</i> (Schw.) Ryv.	Gilbertson & Ryvarden 1987	Europe, U.S.A.
* <i>P. tephropora</i> (Mont.) Ryv.	Wright, 1976; Ryvarden & Johansen 1980, Kotlaba et al. 1984	Africa, America, Asia, Australia, Brazil (PE, SC), Cuba
<i>P. truncata</i> (Lloyd) Ryv.	Ryvarden 1992	Africa, Philippine Island
<i>P. truncatospora</i> (Lloyd) Ryv.	Ryvarden et al. 1986	Japan
<i>P. variegata</i> Ryv. & Gilbn.	Ryvarden & Gilbertson 1984, Gilbertson & Ryvarden 1987	U.S.A.
<i>P. voeltzkowii</i> (Henn.) Ryv.	Ryvarden & Johansen 1980	Africa

concentrically sulcate, covered by a distinct crust, dark brown (3/3 10YR) and very dark grayish brown (3/2 10YR) to very dark gray (3/1 10YR); in young specimens, pileus surface, zonate concentrically with yellow (7/6 10YR) and dark yellowish brown (4/4 10YR) to dark brown (3/3 10YR) bands; margin obtuse. Pore surface cream (7/4 10YR) to light yellowish brown (6/4 10YR). Pores round, 4 per mm, with thick and entire dissepiments. Tubes up to 6 cm deep, indistinctly stratified, each layer up to 8 mm long; the younger layers cream (8/3 10YR) and the older layers light yellowish brown (6/4 10YR) to yellowish brown (5/4 10YR). Context 1.4-3.5 cm thick, in young specimens cream (8/3 10YR), in old specimens dark yellowish brown (4/4 10YR) and brown (4/3 10YR) to very dark grayish brown (3/2 10YR), pilear cortex has a black (2/1 10YR) line above, up to 2 mm thick.

Hyphal system trimitic, generative hyphae clamped, thin-walled to solid, hyaline, 1.5-2.5 µm diam.; skeletal hyphae thick-walled, hyaline to yellowish in KOH, 2.5-7 µm diam., strongly dextrinoid; binding hyphae rare, thick-walled, 2-3.5 µm diam, dextrinoid. Cystidia not observed. Basidia not found. Basidiospores pipshaped to weakly truncate with a distinct tapering end, thick-walled, hyaline, smooth, 6.5-9 µm, variable dextrinoid.

Material examined - BRAZIL: PARANÁ: Capanema, Distrito de São Luiz, Fazenda São Luiz, L. Basso 986, 4/3/1997 (FLOR). ARGENTINA: MISIONES: Garupé, A. Gomez et al. s.n., 28/7/1964 (BAFC 23685); BUENOS AIRES: Punta Lara, Reserva MAA, J. Deschamps s.n., 14/7/1976 (BAFC 34532).

Culture studied: cc 986 (= FLOR 11485)

Enzymatic tests: GAA: +++; TAA: +; laccase: ++(α-naphtol), -(guaiacol), +(syringaldazine); cytochromo oxidase: -(tmdp); peroxidase: ++(pyrogallol); tyrosinase: -(p-cresol).

Species code: 2. 3. 8. 34. 36. 38. 43. 50. 54.

*Perenniporia medulla-panis* (Jacq.: Fr.) Donk, Persoonia 5:76. 1967.

Figure 3.

≡ *Polyporus medulla-panis* Jacq.: Fr., Syst. Mycol. 1:380. 1821.

Basidiomata annual to perennial, resupinate. Pore surface white (8/2 10YR), cream (8/3, 8/4 10YR) to light yellowish brown (6/4 10YR). Pores circular, (4-) 5-6 per mm, with thick dissepiments. Tubes distinctly stratified, each layer up to 1 mm long, yellow (7/6 10YR). Context very thin up to 0.5 mm thick, concolours with tubes.

Hyphal system trimitic, generative hyphae clamped, thin-walled, hyaline, 2-3  $\mu\text{m}$  diam.; skeletal hyphae thick-walled, hyaline 1.5-2.5  $\mu\text{m}$  diam.; binding hyphae thick-walled, hyaline, highly branched, 1.5-2  $\mu\text{m}$  diam. The vegetative hyphae are variable dextrinoid. Cystidioles present in the hymenium, fusoid, thin-walled, hyaline, with a basal clamp, 12.5-21 x 4-6.5  $\mu\text{m}$ . Basidia clavate, 4-sterigmate, 14-24 x 7-10  $\mu\text{m}$ , with a basal clamp. Basidiospores broadly ellipsoid to ovoid, usually truncate, thick-walled, hyaline, smooth, 5-6 x 4.5 (-5.5)  $\mu\text{m}$ , variable dextrinoid.

Material examined - BRAZIL, SANTA CATARINA: Ilha de Santa Catarina, Costeira do Ribeirão, Sítio do Jambo, A. Gerber 641, 21/5/1995 (FLOR); idem, Costeira do Ribeirão, Sítio do Jambo, A. Gerber 1006A, 30/3/1997 (FLOR); idem, Lagoa do Peri, A. Gerber et al. 773, 23/7/1995 (FLOR). ARGENTINA: BUENOS AIRES: Magdalena, Estancia El Destino, M. Rajchenberg & D. Job s.n., 28/8/1984 (BAFC 30234).

Culture studied: cc 641 (= FLOR 11192)

Enzymatic tests: GAA: ++++; TAA: +++; laccase: +( $\alpha$ -naphthol), -(guaiacol), +(syringaldazine); cytochromo oxidase: -(tmpda); peroxidase: +(pyrogallol); tyrosinase: +(p-cresol).

Species code: 2. 3. 8. 34. 36. 38. 42. 51. 54.

*Perenniporia ohiensis* (Berk.) Ryv., Norw. J. Bot. 19: 143. 1972.

Figure 4.

≡ *Trametes ohiensis* Berk., Grevillea 1:66. 1872.

Basidiomata perennial, sessile, solitary; ungulate, small. Pileus surface glabrous, azonate to faintly zonate, sulcate; cream (8/4 2.5YR) and dark reddish brown (3/3 5YR) spreading from the base; margin rounded. Pore surface pale yellow (7/4 2.5Y). Pores circular, 5-6 per mm, with thick and entire dissepiments. Tubes unistratified, 3 mm deep. Context up to 1 mm thick. Tubes and context concolours with pore surface.

Hyphal system dimitic, generative hyphae clamped, thin-walled, hyaline, 1.8-2.5  $\mu\text{m}$  diam.; skeletal hyphae slightly thickened to subsolid walls, rarely branched, 2.5-4  $\mu\text{m}$  diam., weakly dextrinoid, dominating in the context; in the dissepiments the skeletal hyphae are branched, 2.2-2.5  $\mu\text{m}$ , appearing as binding hyphae. Cystidioles present in the hymenium, fusoid, thin-walled, 27.7 x 7.2  $\mu\text{m}$ , with

a basal clamp. Basidioles clavate, 18.7-19.8 x 5.8-9.4  $\mu\text{m}$ . Basidiospores ellipsoid to ovoid, truncate, thick-walled, hyaline, smooth, 9.4-12.6 x 6.1-7.2  $\mu\text{m}$ , dextrinoid.

Material examined - BRAZIL: SANTA CATARINA: Ilha de Santa Catarina, Rio Tavares, C. Loguercio-Leite & J. Furlani 48B, 6/1/1988 (FLOR). ARGENTINA: SALTA: Monte 2 km SO Rio del Valle, D. Gomez & L. Zubieta s.n., 21/4/1956 (BAFC30532). ESTADOS UNIDOS: MINNESOTA: Ithaca, Clearwater Co., Nat. Park Ithaca Lake, L. Ryvardeen 14311, 16/9/1977 (BAFC27804).

*Perenniporia piperis* (Rick.) Rajchen., Nord. J. Bot. 7:555. 1987

Figure 5.

≡ *Fomes piperis* Rick, Iheringia Bot. 7:202. 1960.

Basidiomata annual or biannual, pileate, dimidiate, solitary, confluent or imbricate, in the last case with a large base in common; soft corky. Pileus surface glabrous, concentrically sulcate, pale yellow (7/4 2.5Y) to yellow (8/6 2.5Y), sometimes with brownish yellow (6/8 10YR) bands; margin thin, regular, definite, 2-3 mm thick. Pore surface cream (8/4 10YR), pale yellow (8/4 2.5Y) to yellow (8/6 10YR). Pores isodiametric, 7-9 per mm. Tubes 1-2 mm deep, concolours with pore surface. Context up to 3 mm thick, concolours with tubes.

Hyphal system dimitic, generative hyphae clamped, thin-walled, hyaline, 1.8-2.6  $\mu\text{m}$  diam., slightly branched; skeletal hyphae thick-walled to subsolid, hyaline to yellowish, 3.6-6.1  $\mu\text{m}$  diam. in the context, in the trama, branched skeletal hyphae of 1.1-3.2  $\mu\text{m}$  diam. are observed. None of the vegetative hyphae react with Melzer's solution. Sterile elements absent. Basidia clavate, 4-sterigmate, 10.8-12.6 x 4-4.3  $\mu\text{m}$ , with a basal clamp. Basidiospores broadly ellipsoid to subglobose, faintly truncate, slightly thickened walls, 3.5-5 x 2.5-3.5  $\mu\text{m}$ , in some specimens weakly dextrinoid.

Material examined - BRAZIL: SANTA CATARINA: Ilha de Santa Catarina, Morro da Lagoa da Conceição, J. Furlani s.n., 10/5/1986 (FLOR 10323); idem, Morro da Lagoa da Conceição, C. Loguercio-Leite & J. Furlani 241, 26/7/1988 (FLOR); idem, Morro da Lagoa da Conceição, C. Loguercio-Leite & J. Furlani 404, 31/1/1989 (FLOR); idem, Lagoa do Peri, M.A. Neves et al. 532, 18/8/1994 (FLOR);

idem, Morro da Lagoa da Conceição, M.A. Neves et al. 543, 22/9/1994 (FLOR); idem, Morro da Lagoa da Conceição, A. Gerber et al. 597, 16/3/1995 (FLOR); idem, Morro da Lagoa da Conceição, A. Gerber et al. 604, 16/3/1995 (FLOR); idem, Morro da Lagoa da Conceição, A. Gerber et al. 647, 30/5/1995 (FLOR); idem, Morro da Lagoa da Conceição, A. Gerber et al. 662, 30/5/1995 (FLOR); idem, Morro da Lagoa da Conceição, A. Gerber et al. 856, 21/3/1996 (FLOR); idem, Morro da Lagoa da Conceição, A. Gerber et al. 928, 31/5/1996 (FLOR); idem, Saco Grande, UCAD, A. Gerber et al. 1062, 12/7/1997 (FLOR). ARGENTINA: MISIONES: P.N. Iguazú, M. Rajchenberg s.n., 9/3/1980 (BAFC 27471).

Cultures studied: cc 532 (= FLOR 11061), cc 597 (= FLOR 11079)

Enzymatic tests: GAA: +++; TAA: +; laccase: ++( $\alpha$ -naphthol), -(guaiacol), ++(syringaldazine); cytochromo oxidase: +(tmpda); eroxidase: ++(pyrogallol); tyrosinase: -( $p$ -cresol).

Species code: 2. 3. 8. 32. 36. 38. 42 (43). 52. 54.

*Perenniporia stipitata* Ryv., Mycotaxon 28: 535. 1987.

Figure 6.

Basidiomata annual, pileate, laterally stipitate; pileus spathulate, flabeliform to semicircular, solitary or imbricate, with numerous pilei from common stipe. Pileus surface glabrous, shallowly sulcate, cream (8/3, 8/4, 7/4 10YR), yellow (8/6 2.5Y, 7/6; 7/8 10YR), reddish yellow (7/8 5YR) to brownish yellow (6/6 10YR), with yellow (7/8 10YR), brownish yellow (6/8 10YR), yellowish red (4/6, 5/6 5YR), brown (5/2 7.5YR), yellowish brown (5/8 10YR) to light gray (7/2 10YR) concentric bands; margin very thin, straight or lobular. Pore surface white (8/1, 8/2 10YR), cream (8/3, 8/4 10YR) to yellow (8/8 10YR). Stipe up to 2.5 cm long, glabrous, concolours with pore surface. Pores small, circular, (6-)7-10(-12) per mm. Tubes uni- or bi-stratified up to 0.7 mm deep, concolours with pore surface. Context up to 0.3 mm thick, concolours with tubes.

Hyphal system dimitic, generative hyphae clamped, thin-walled, hyaline, 1.5-3  $\mu$ m diam.; skeletal hyphae thick-walled to almost solid, straight, unbranched, 2.5-7.2  $\mu$ m diam., strongly dextrinoid; in the context skeletal hyphae thick-walled, branched, 2.5-4  $\mu$ m diam. Sterile elements absent. Basidia clavate, 4 esterigmate, 7.5-14.4 x 3-4.5  $\mu$ m, with a basal

clamp. Basidiospores subglobose, truncate, thick-walled, hyaline, smooth, 4-6(-7)  $\mu$ m, variable dextrinoid.

Material examined - BRAZIL: SANTA CATARINA: Ilha de Santa Catarina, Morro da Lagoa da Conceição, J. Furlani s.n., 10/5/1986 (FLOR 10320); idem, Morro da Lagoa da Conceição, 5/2/1988, C. Loguercio-Leite & J. Furlani 119 (FLOR); idem, Morro da Lagoa da Conceição, 5/2/1988, C. Loguercio-Leite & J. Furlani 121 (FLOR); idem, Morro da Lagoa da Conceição, 5/2/1988, C. Loguercio-Leite & J. Furlani 122 (FLOR); idem, Morro da Lagoa da Conceição, 24/2/1988, C. Loguercio-Leite & J. Furlani 135A. (FLOR); idem, Morro da Lagoa da Conceição, 26/7/1988, C. Loguercio-Leite & J. Furlani 212 (FLOR); idem, Morro da Lagoa da Conceição, 4/7/1988, C. Loguercio-Leite & J. Furlani 285 (FLOR); idem, Morro da Lagoa da Conceição, 23/2/1994, A. Gerber et al. 369 (FLOR); idem, Morro da Lagoa da Conceição, 23/2/1994, A. Gerber et al. 371 (FLOR); idem, Morro da Lagoa da Conceição, 23/2/1994, A. Gerber et al. 380 (FLOR); idem, Morro da Lagoa da Conceição, 29/3/1994, A. Gerber et al. 411 (FLOR); idem, Morro da Lagoa da Conceição, 29/3/1994, A. Gerber et al. 413 (FLOR); idem, Morro da Lagoa da Conceição, 29/3/1994, A. Gerber et al. 415 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 428 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 429 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 437 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 494 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 496 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 499 (FLOR); idem, Morro da Lagoa da Conceição, 28/4/1994, A. Gerber et al. 500 (FLOR); idem, Morro da Lagoa da Conceição, 26/7/1995, A. Gerber et al. 753 (FLOR); idem, Morro da Lagoa da Conceição, 25/4/1996, A. Gerber & M. A. Neves 902 (FLOR).

Culture studied: cc 499 (= FLOR 11015)

Enzymatic tests: GAA: +; TAA: +.

Species code: 2. 3. 8. 34. 36. 38. 47. 50. 54.

*Perenniporia tephropora* (Mont.) Ryv., Norw. J. Bot. 19:233. 1972.

Figure 7.

≡ *Polyporus tephroporus* Mont., Ann. Sci. Nat. Ser 3 vol. 4: 358. 1845.

Basidiomata perennial, resupinate to effused-reflexed, with orbiculate pilei, consistency hard, woody. Pileus surface glabrous, sulcate and cracked, very dark gray (3/1 5Y) to black (2/0 2.5Y); margin thick and round. Pore surface brown (5/3, 4/3 10YR), grayish brown (5/2 2.5Y), dark grayish brown (4/2 2.5Y), light gray (7/2 2.5Y), light yellowish gray (6/4 10YR) to light brownish gray (6/2 2.5Y). Pores round to angular, (3-)-4-5 per mm, with thin to fairly thick, entire dissepiments. Tubes distinctly stratified, each layer 2-3 mm long, grayish brown (5/2 2.5 Y). Context up to 2 mm thick, dark grayish brown (4/2 2.5Y) to very dark grayish brown (3/2 2.5Y).

Hyphal system trimitic; generative hyphae clamped, thin-walled, hyaline, 2-2.5  $\mu\text{m}$  diam.; skeletal hyphae thick-walled, olivaceous brown in KOH, 3.5-7  $\mu\text{m}$  diam.; binding hyphae thick-walled, hyaline, 1.5-3  $\mu\text{m}$  diam. The vegetative hyphae are faintly dextrinoid. Sterile elements absent. Basidia not found. Basidiospores ellipsoid, truncate, thick-walled, hyaline, 5-6.5 x (3-) 4-4.5  $\mu\text{m}$ , dextrinoid.

Material examined - BRAZIL: SANTA CATARINA: Ilha de Santa Catarina, Costeira do Ribeirão, Sítio do Jambo, 11/4/1993, A. Gerber & R. Silva 199 (FLOR); idem, Costeira do Ribeirão, Sítio do Jambo, 11/4/1993, A. Gerber & R. Silva 202 (FLOR);

idem, Costeira do Ribeirão, Sítio do Jambo, 11/4/1993, A. Gerber & R. Silva 203 (FLOR); idem, Costeira do Ribeirão, Sítio do Jambo, 11/4/1993, A. Gerber & R. Silva 204 (FLOR); idem, Costeira do Ribeirão, Sítio do Jambo, 30/3/1997, A. Gerber 1004 (FLOR); idem, Costeira do Ribeirão, Sítio do Jambo, 30/3/1997, A. Gerber 1006B (FLOR). ARGENTINA: MISIONES: P.N. Iguazú, 29/9/1980 J. Wright s.n. (BAFC 27385).

Cultures studied: cc 203 (= FLOR 11030)

Enzymatic tests: GAA: ++++; TAA: ++++; laccase: +( $\alpha$ -naphthol), -(guaiacol), ++(syringaldazine); cytochromo oxidase: -(tmpda); peroxidase: +(pyrogallol); tyrosinase: -(p-cresol).

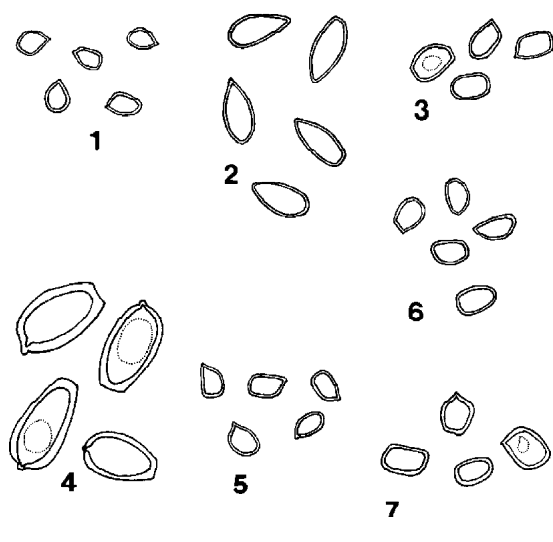
Species code: 2. 3. 8. 34. 36. 38. 42. 50. 54

## Discussion

The species described in this paper present differential macro and/or micromorphological characteristics sufficient for the clear identification of any given species. We will present distinctions between them at morphological and cultural pathways.

Rajchenberg & Wright (1982) in their description of *P. albida* (= *P. piperis*), compared this species with *P. contraria* and accepted that these species have an identical hyphal system and spores. However, *P. contraria* presents vegetative hyphae which are strongly dextrinoid, while in *P. piperis* the vegetative hyphae are indextrinoid. Actually, both species have spores similar in size and shape. Despite the fact that these species have quite similar microscopical characteristics, macroscopically they can be misunderstood, since *P. contraria* presents a reddish to black pilear crust which is very characteristic, not occurring in *P. piperis*.

Besides *P. contraria*, another species found in Southern Brazil that presents pilear crust is *P. martius*, whose crust is brownish to black and whose basidiomata are very hard and heavy when dry, unlike *P. contraria* which has a softer, lighter basidiomata. *P. martius* distinguishes itself from the others by its pip shape with distinct tapering end spores. Ryvarden & Johansen (1980) mention the occurrence of cystidia in some specimens of this species, but we were unable to find any. Afterwards, Ryvarden (1988b) stated that the specimens with cystidia are *P. latissima* (Bres.) Ryv. and "should not be merged with *P. martius*".



Figures 1-7. Basidiospores. 1. *Perenniporia contraria*; 2. *P. martius*; 3. *P. medulla-panis*; 4. *P. ohiensis*; 5. *P. piperis*; 6. *P. stipitata*; 7. *P. tephropora*. Bar = 5 $\mu\text{m}$ .

Two resupinate species were found, *P. medulla-panis* and *P. tephropora*. The latter also can be effused-reflexed and the first is always resupinate. These species are easily separated by the colour of their basidiomata. Wright (1976), based mainly on the dark (grayish to brownish) colour of basidiomata of *P. tephropora*, created the genus *Loweoporus* (*Polyporus tephroporus* Mont. as type species), since *P. medulla-panis* (type species of *Perenniporia*) has a light-coloured basidiomata. Ryvarden (1991) believes that it is difficult to decide whether *Polyporus tephroporus* should be accepted as *Perenniporia* or as *Loweoporus*. This is still a controversial matter.

*P. stipitata* is unique in the genus by the occurrence of the lateral stipe and the fanshaped pileus (Ryvarden 1987).

*P. ohiensis*, according to Gilbertson & Ryvarden (1987), has a very distinctive morphology with its small basidiomata, large truncate dextrinoid spores and weakly dextrinoid hyphae. This species is distinguished from others considered in this survey by small basidiomata and large spores.

On the other hand, analysing our cultural studies, it can be observed that the species codes presented in this paper are similar. However, there are characteristics that are not expressed by the codes to differentiate the species in culture. There are also differences between cultures of the same species when studies made by several authors are compared, as may be observed in the following.

*P. martius* and *P. stipitata* are the only species that present skeletal hyphae with dextrinoid reactions in culture. *P. martius* also has dextrinoid reaction in the binding hyphae. Wright & Deschamps (1975) studied another culture of *P. martius*, not observing dextrinoid reaction in the binding hyphae which were covered by crystals.

*P. stipitata* grows more slowly, not reaching the dish diameter within six weeks, and is the only that forms basidioles and basidia with spores. *P. stipitata* had not been studied in culture previously (Ryvarden 1987).

The only species in this paper that did not produce chlamydo spores was *P. piperis*. Susin (1989) who also studied this species in culture, did not mention chlamydo spores, besides observing a plectenchyma and the formation of a brown exudate which was not observed in the cultures studied in this work.

*P. medulla-panis* and *P. tephropora* shared more characteristics, differing from each other by the

occurrence of crystals in the former. Comparing results of other authors, differences not observed in this survey were noted. The culture of *P. tephropora* studied by Wright (1976) produced crystals, presented skeletal hyphae with dextrinoid reaction, and formed poroid zones. The culture of *P. medulla-panis* studied by Wright & Deschamps (1975) modified the agar media color and formed basidioma. Wright & Deschamps (*op. cit.*), Stalpers (1978) and Flott & Gilbertson (1991) did not describe the presence of chlamydo spores in cultures of *P. medulla-panis*.

Observing the enzymatic tests (drop tests), few differences are noted between the four species (*P. martius*, *P. medulla-panis*, *P. piperis* and *P. tephropora*) in which they were performed. The tests to detect laccase ( $\alpha$ -naphthol and syringaldazine) were positive for all species, while the test with guaiacol was negative, which determines that species are in fact white rot. Taylor (1974) performed guaiacol tests on several species in cultures of different ages. In his work, it was apparent that positive reactions to guaiacol were observed only for cultures that were 10 days old or more. All the species had a positive reaction to peroxidase. Only *P. piperis* had a positive reaction to cytochromo oxidase, and tirosinase tests was positive for *P. medulla-panis* and *P. tephropora*.

Previously, seven species of *Perenniporia* had been recorded in three states of Southern Brazil (Paraná, Santa Catarina and Rio Grande do Sul). However, *P. contraria* is the first record in Santa Catarina State and *P. martius* is a new record for Paraná State. In this survey, *P. neofulva* was not found. In addition, *P. tephropora* is a new record for southern Brazil. Thus, the number of known species for this region has now been increased to eight.

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