Pleurotus lindquistii is a Lentinus

Article *in* Mycotaxon -Ithaca Ny- · October 2000

CITATIONS
7

READS
57

2 authors:

Bernardo E Lechner
National Scientific and Technical Research Council
50 PUBLICATIONS **325** CITATIONS
SEE PROFILE

Edgardo Albertó
National University of General San Martín- CONICET
104 PUBLICATIONS **831** CITATIONS
SEE PROFILE

MYCOTAXON

Volume LXXVI, pp. 97-104 October-December 2000

PLEUROTUS LINDQUISTII IS A LENTINUS

BERNARDO E. LECHNER[1] & EDGARDO ALBERTÓ[2]

[1] PRHIDEB-CONICET, Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires (1428) Buenos Aires, Argentina and Instituto Fitotécnico de Santa Catalina, UNLP, Facultad de Ciencias Agrarias y Forestales, Llavallol, Buenos Aires, Argentina. E-mail <blechner@bg.fcen.uba.ar>

[2] Instituto Tecnológico de Chascomús IIB-INTECH (UNSAM-CONICET), Camino de Circ., Km 6, C.C. 164, (7130) Chascomús, Buenos Aires, Argentina. E-mail <edgardoalberto@hotmail.com>

Abstract: Using a strain determined by Singer 37 years ago as *Pleurotus lindquistii*, fruitbodies were obtained using traditional methods for edible mushroom culture. The new basidiomata allowed us to redescribe the species and to transfer it to *Lentinus*. Mating studies between monosporic cultures revealed a tetrapolar mating system. Descriptions of cultural characters and Nobles' code are given.

Keywords: *Pleurotus*, *Lentinus lindquistii*, *Lentinus*, culture study.

INTRODUCTION

To this time the knowledge of the genus *Pleurotus* in Argentina is scanty: only a few species have been recorded (Singer & Digilio 1955; Singer 1960, 1969; Raithelhuber 1974, 1977, 1991). In the fungus culture collection of our Biological Science Department we found a strain labeled *Pleurotus lindquistii* Singer. Singer (1960) described this species as growing on trunks of *Salix humboldtiana* in the marginal rain forest of Río de la Plata (Buenos Aires). The dikaryon strain was isolated by J. E. Wright two years later from specimens determined by R. Singer, collected in Pereyra Park, a large planted forest near La Plata city. This uncommon species was never collected again. Nevertheless we were able to obtain basidiomata from the dikaryon strain isolated in 1962. In the present work we redescribe and illustrate *Pleurotus lindquistii* Singer, transfer it to *Lentinus*, and report on its sexuality and cultural characters according to Nobles' methodology (Nobles, 1965).

MATERIALS AND METHODS

Basidiome production: To obtain basidiomata traditional methods for fruiting species of *Pleurotus* were used (Zadrazil, 1974; Stamets, 1993). A mixture of sawdust (70 %), wheat meal (10 %), oatmeal (4 %) and $CaCO_3$ (1 %) was introduced in 40 x 25 cm polypropylene bags and autoclaved at 120 °C for 2 hours. After cooling they were inoculated with strain BAFC 2102, and incubated in the dark at 25°C. After 15 days, bags were kept at 18-20 °C with 9 h light/ 15 h darkness photoperiod to induce basidiome formation.

Macro- and Micromorphology: Specimens were macroscopically described. The description of this species combines cultures and herbarium specimens. Colour names are in accordance with Munsell color Co. (1954) and Rayner (1970). Citation of author names of taxa are according to Kirk & Ansell (1992). Herbarium abbreviations follow Holmgren *et al.* (1990). Specimens are deposited in the BAFC Mycological Herbarium. Microscopic examination of tissues mounted in 5% KOH and 1 % aqueous phloxine was undertaken.

Pairing studies: Monosporic cultures were obtained from water dilutions of fresh spore prints on sterile aluminum paper; spores were suspended in 10 ml of sterile-distilled water containing 0.01 ml of Tween 80 to avoid agglutination. This solution was diluted to 1/10, 1/100 and 1/1000. Petri dishes containing Nobles'medium (Nobles, 1948) were inoculated with 1 ml of each of these dilutions and incubated in the dark at 25°C. Colonies were reisolated in tubes, discarding all those having clamps. Haplonts were confronted in pairs in Petri dishes using 7-mm diam blocks as inoculum. Plates were incubated in the dark at 25°C, and after a week hyphae were observed under the microscope both in the contact zone and in the lateral area (Burnett, 1968). A positive result was reckoned (+) by the presence of clamps, and a negative one (-) by their absence.

Culture characters: Cultures were inoculated in 90 mm Petri dishes using Nobles' (1948) medium and incubated in the dark at 25°C. During six weeks, aspect, colour, growth rate, odour and microscopic structures of both the aerial and the submerged mycelium were observed weekly according to Nobles (1965).

Production of oxidases and phenoloxidases was evaluated by growing the strain on tannic and gallic media (Nobles, 1965). Tyrosine, p-cresol and guaiacol spots tests (Boidin, 1954), and the aniline test (Albertó & Wright, 1997) reactions were measured by the intensity of the colour halo produced. All the information thus obtained was codified in a "species code" according to Nobles (1965).

Material studied: ARGENTINA, Buenos Aires, Punta Lara, leg. Lindquist & Singer, 21-IV-60, BAFC (Holotype); Parque Pereyra, leg. R. Singer, 20-VI-62 (BAFC 34.673); San Isidro, Arroyo Sarandí, leg. J. C. Gamerro, 5-X-63 (BAFC) on trunk of *Salix*. Basidiomata obtained in culture: Llavallol, leg. E. Albertó & B. Lechner,12 IX-96 (BAFC 34.599); 29-IX-96 (BAFC 34.598); 2-II-96 (BAFC 34.597).

RESULTS

***Lentinus lindquistii* (Sing.) Lechner & Albertó comb. nov.**
Basionym: *Pleurotus lindquistii* Singer, Bol. Soc. Arg. Bot. 8(3-4): 216. 1960.

Pileus 30-75 mm diam. (Fig. 1A), convex- cyathiform to slightly infundibuliform, white to cream, dry covered with squamules; squamules elongate, appressed or recurved, sepia to ochraceous brown (2.5YR 3/4, dark redish brown) fibrillose at the pileus margin and denser towards the centre; flesh thin, white to cream. Lamellae pale whitish (10YR 8/6; 8/8 yellow; Rayner 1-17d, paleoluteous) but pure white at the edges, fimbriate, subcrenulate, with lateral veins and anastomoses towards the stipe in young specimens, occasionally bifurcate, attenuate, subdecurrent, crowded, narrow. Stipe 10-40 x 5-11 mm, cylindric, large, tough, white to cream, yellowish, subcentral to eccentric, squamulose, densely covered with very small dark fibrils at the base (cream coloured in many specimens), that becoming larger, scattered and cream to yellowish towards the pileus, and with a pallid or whitish narrow evanescent cortinoid veil in the lower part in young specimens (Fig. 1B), absent in mature specimens, solid, in clusters. Odor strong, agreeable to slightly farinaceous, non-raphanoid. Spore print cream to whitish.

Basidiospores 6-7.5(-8) X 3.5-4 µm, Q= 2, oblong to oblong-cylindric, smooth, thin-

walled, hyaline, inamyloid (Fig. 2C). Basidia 22-28 X 4.5-6 µm, 4-spored, clavate (Fig. 2D). Pleurocystidia absent or similar to basidioles. Cheilocystidia 12-35 X 3-6 µm, scattered, filiform, cylindric to clavate, hyaline. Hyphal pegs present (Fig. 2B).

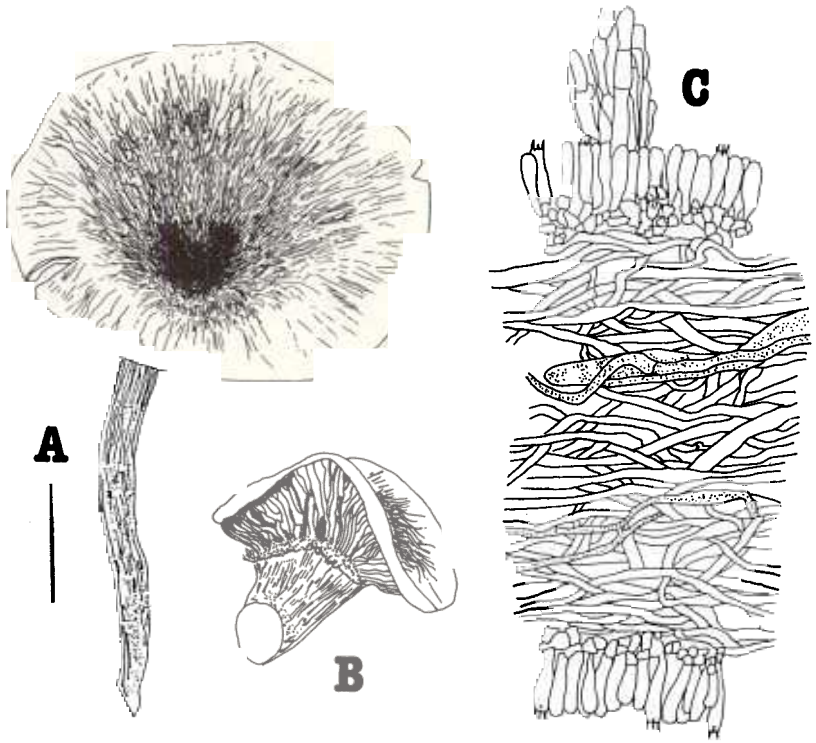

Fig. 1. *Lentinus lindquistii*. A, Basidiocarp; B, Young basidiocarp; C, Hymenophoral trama. Scale bar: Figs 1A = 1 cm, 1B = 0.5 cm, 1C = 25 µm.

Pileipellis a cutis, 20-30 µm thick; hyphae (Fig. 2A) radiating, clamped, usually thick-walled, non-gelatinized generative hyphae with brown citoplasmatic pigment. Hyphae of pileus (Fig. 2H) squamules clamped, filamentous, 2.5-7 µm diam.; skeletal hyphae (Fig. 2G) very scattered and scarce. Hymenophoral trama subregular, hiphae clamped, parallel to subparallel, non-gelatinous (Fig. 1C). Subhymenium poorly developed, 10 µm wide. Stipe tissue dimitic; generative hyphae, 3-4 µm diam.; skeletal hyphae 3-14 µm diam., 250-320 µm long, non-inflated, only tapered at the apex (Figs. 2F). Hyphae of stipe fibrils 2.5-7 µm diam., clamped, filamentous, with a brown pigment encrusting the walls.

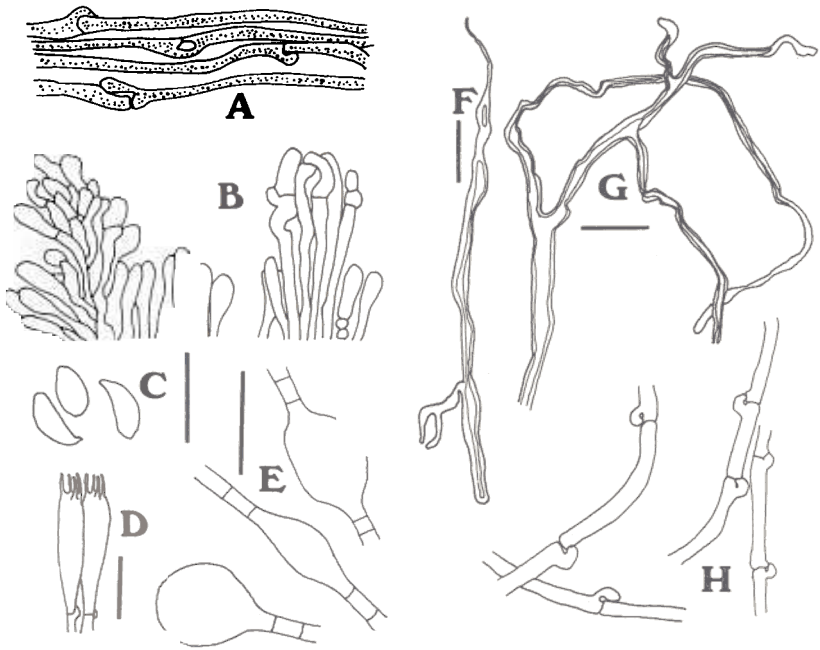

Fig. 2. Microscopical features of *Lentinus lindquistii*. A, Pileipellis; B, Hyphal pegs; C, Spores ; D, Basidia; E, Chlamydospores; F and G, Skeletal cells; H, Generative hyphae. Scale bar: Figs 2A = 30 µm; 2B, 2G = 20 µm; 2C, 2D, 2E, 2H = 10 µm; 2F = 40 µm.

Mating system

Eight subcultures were obtained. Pairing of these in all possible combinations revealed a tetrapolar mating system. Mating types were assigned as follows: isolates 3, 8= A1B1; 4, 5= A1B2; 2= A2B1 and 1, 6 and 7= A2B2 (Fig. 3).

	1	2	3	4	5	6	7	8
1								
2	-							
3	+	-						
4	-	+	-					
5	-	+	-	-				
6	-	-	+	-	-			
7	-	-	+	-	-	-		
8	+	-	-	+	+	+	-	

Fig. 3. Shelf-cross grid for *Lentinus lindquistii*. +, compatible pairings; -, incompatible pairings.

Culture characters

Macroscopic Characters: Mycelial mat covering Petri plates in 2-3 weeks, ocasionally with brown areas, whitish, loose near the inoculum, outward more appressed, cottony at the margin with abundant aerial mycelium; mycelial strands absent. Colony margin regular, entire . Reverse unstained. Odour mild, *sui generis*. No basidiocarps were produced during this period, since a light stimulus is required.

Microscopic characters: Hyphae hyaline (except brown in dark areas), clamped, 2-5 µm diam. Terminal and intercalary chlamydospores abundant, hyaline, 7-10 X 9-13 µm, increasing in number with age of culture. Microdoplets absent.

Oxidase reactions: Tannic acid strongly positive (++++); gallic acid strongly positive (+++++); p-cresol positive (+) without growth, tyrosine negative (-) with loose growth, aniline test (++) with loose growth.

Nobles species code: 2.3.7.34.36.(37).38.42.53.54.60.

DISCUSSION

Lentinus lindquistii basidiomata are characterized by their relatively small size, presence of sepia-coloured fibrils on the cream-coloured pileus surface, fleshy basidiocarp, stipe tissue dimitic and presence of hyphal pegs on the lamellae.

Primordium development is characterized by a small spherical dark brown pileus and a relatively long stem densely covered with brown fibrils. Later, the pileus expands and as a consequence, the fibrils become more distant at the pileus margin and appressed and dense at the centre. Fibril colours are very variable, from dark brown to cream, depending on light regimes.

In young specimens, lamellae are distinguished by having pore-like anastomoses at the base of the stem (Fig. 4A); lamellae separate towards the pileus margin so they finally end as independent structures (Fig. 4B). The formation of reticulum did not occur in all specimens studied.

Skeletal hyphae are mainly present in the stipe trama as very long cells (Fig. 2B). Skeletal hyphae of pileus context are very scant and can only be observed after a detailed search.

Taxonomically, *Lentinus lindquistii* is close to *L. tigrinus* but differs from the latter by decurrent lamellae, sinuous clavate, often constricted or nodulose cheilocystidia and longer and narrower spores.

The generic delimitation of *Pleurotus*, *Panus* and *Lentinus* has been and still is controversial. Stankovičová (1973) made a comprehensive study of some of pleurotoid species of Agaricales showing the variaton existing among *Polyporus*, *Phyllotopsis*, *Pleurotus*, *Panus* and *Lentinus*, among other. She concluded that the hyphal system is not to be considered as a character of generic importance, but appeared to be fairly constant within genera such as *Pleurotus*, *Panus* and *Lentinus*, although both *Pleurotus* and *Lentinus* included both dimitic and monomitic hyphal construction.

Corner (1981), characterized *Lentinus* as follows: dimitic with skeleto-binding cells; hyphal pegs in most species; narrowly ellipsoid to subcylindric, more or less aguttate basidiospores; no pleurocystidia; *Panus* was diagnosed as: dimitic with long intercalary tapering skeletals cells; no hyphal pegs; broadly ellipsoid, guttate to subcylindric and aguttate basidiospores; pleurocystidia common, as metuloids or gloeocystidia. *Pleurotus* was defined as: monomitic or dimitic with terminal tapered skeletal hyphae; no hyphal pegs; basidiospores various, guttate or not, pleurocystidia ocasional. Corner (1981) pointed out that *Lentinus* could be clearly separated from *Pleurotus* but that the distinction between *Panus* and *Pleurotus* was obscure.

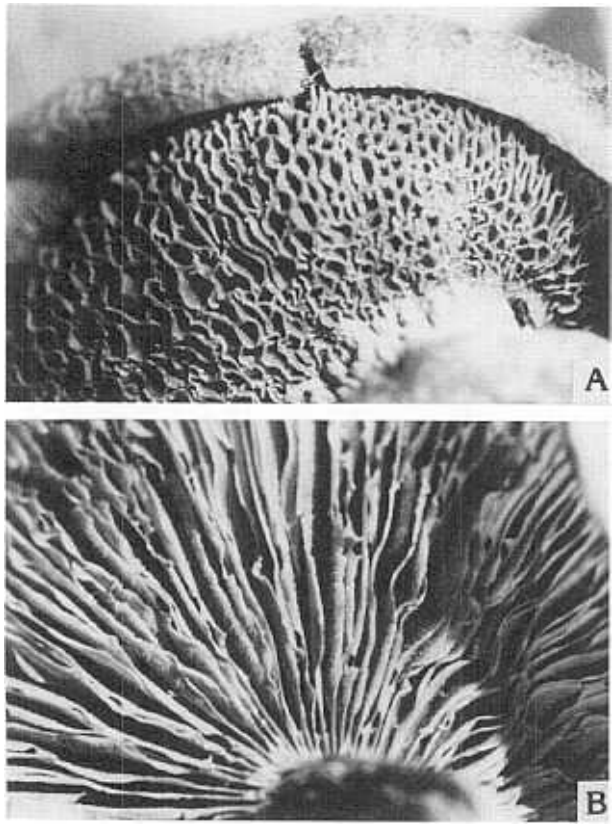

Fig. 4. *Lentinus lindquistii*. A, Anastomosed lamellae appearing as pores; B, Aspect of lamellae of mature specimens.

Pegler (1983) incorporated *Panus* within *Lentinus* and distributed its taxa at sectional level. He defined subg. *Lentinus* as having a context with skeleto-ligative hypae (i.e. thick-walled, intercalarly or terminal, branching laterally with tapering branches), hyphal pegs usually present, metuloids and gloeocystidia absent; and subg. *Panus* as having skeletal hyphae (i.e. thick-walled, typically unbranched; if branching is present, then not distinctly tapering), hyphal pegs absent; cystidia sometimes present.

Watling and Gregory (1989) accepted the genus *Lentinus* as outlined by Pegler (1983).

Singer (1975) placed *Pleurotus lindquistii* in sect. *Lepiotarii* (Fr.) Pilát of *Pleurotus*, which included species with a "lamellar trama at first consisting of thin-walled hyphae, eventually sclerified a dimitic at least in type specimens, veil present and a distinct stipe".

When mature basidiomata of *Lentinus lindquistii* have a soft coriaceus context which dries hard and rigid, subcentral to eccentric stipe, poorly developed subhymenium, irregular hymenophoral trama, hyphal pegs, dimitic hyphal system with tapered skeletal hyphae and, production of chlamydospores and absence of nematotoxic microdoplets in agar cultures. This latter character as suggested Miller (1984) and finally proposed Petersen (1993) can be used to

segregate *Pleurotus* of other genera.

Following Pegler's (1983) concept, the above features support the transfer of this species to *Lentinus* Fr. subg. *Lentinus* (Fr.) Pegler (1983), section *Tigrini* Pegler (1983).

A culture study according to Nobles' methodology together with enzyme spot tests allowed the detection of laccases and phenoloxidases, warranting that the mycelia produce a white rot.

AKNOWEDGEMENTS

We wish to thank Drs. R. Petersen (UT, USA), who suggested us that *Pleurotus lindquistii* could be a *Lentinus*, Dr. E. Horak (Swisserland) and J. E. Wright (UBA, Argentina) who kindly read the typescript and made valuable suggestions.

This work was funded by the Argentine Nat'l Research Council (CONICET) and the Agencia de Promoción Científica. Publication N° 109 of the PRHIDEB.

LITERATURE

ALBERTÓ E. & J. E. WRIGHT 1997. Aniline agar: a simple medium useful in characterizing white rot higher fungi in culture. *Mycotaxon* 62: 375-388.

BOIDIN, J. 1954. Essai biotaxonomique sur les Hydnés resupinés et les Corticiés. *Rev. Mycol. Mem. hors.* Ser. 6. 388 pp.

BURNETT, J. H. 1968. *Fundamentals of mycology*. Edward Arnold. Ltd. London. 546 pp.

CORNER, E. J. H., 1981. The Agaric genera *Lentinus*, *Panus*, and *Pleurotus* with particular reference to Malaysian species. *Nova Hedwigia* 69: 1-169.

HOLMGREN, P. K., N. H. HOLMGREN & L. C. BARNETT 1990. *Index Herbariorum*. New York Botanical Garden, USA, 693 pp.

KIRK P. M. & A. E. ANSELL 1992. Authors of fungal names. *Index of Fungi*, Suppl. 1- 95.

MILLER, O. K. Jr., 1984. New concepts in our understanding of *Pleurotus*, *Hohenbuehelia* and their allies. *Korean J. Mycol.* 12(4): 189.

MUNSELL, Color Co., Inc. 1954. *Determination of soil color*. U. S. Dept. Agriculture Handbook. Baltimore. 16 pp., 7 pp.

NOBLES, M. K. 1948. Studies in forest pathology VI. Identification of cultures of wood-rotting fungi. *Can. J. Res.* 26: 281-431.

NOBLES, M. K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. *Can. J. Bot.* 43: 1097-1139.

PEGLER, D. N. 1983. *The genus Lentinus, a world monograph*. Kew Bull. Addit. Ser. X. 281 pp.

PETERSEN, R. H. 1993. Cultural characters and asexual reproduction as aids in separating genera of pleurotoid basidiomyces. *Inoculm* 44(2): 53.

RAITHELHUBER, J. 1974. *Hongos Argentinos I.* Comp. Imp. Arg., Buenos Aires. 157 pp.

RAITHELHUBER, J. 1977. *Hongos Argentinos II.* Comp. Imp. Arg., Buenos Aires. 140 pp.

RAITHELHUBER, J. 1991. *Flora Mycológica Argentina*; Hongos III. Mycosur, Stuttgart, Germany. 500 pp.

RAYNER, R.W. 1970. A mycological colour chart. Commonwealth Agricultural Bureaux. 9 sheets,34 pp.

SINGER, R. & P. L. DIGILIO 1951. Prodromo de la Flora Agaricina Argentina. *Lilloa* 25: 6-461.

SINGER, R. 1960. Dos especies interesantes de Agaricales en Punta Lara. *Bol. Soc. Arg. Bot.* 8(3-4): 216-218.

SINGER, R. 1969. Mycoflora Australis. *Nova Hedwigia* 29: 1-405.

SINGER, R. 1975. *The Agaricales in modern taxonomy*. 3th ed. Cramer, Vaduz. 912 pp.

STAMETS, P. S. 1993. *Growing Gourmet and Medicinal Mushrooms*, Ten Speed Press, Berkeley, USA. 554 pp.

STANKOVIČOVÁ, L. 1973. Hyphal structure in some pleurotoid species of Agaricales. *Nova Hedwigia* 24: 61-120.

WATLING, R. & N. M. GREGORY 1989. *Crepidotaceae, Pleurotaceae* and other pleurotoid agarics, in D. M. Henderson, P. D. Orton & R. Watling (Edit.), *British Fungus Flora, Agarics and Boleti*, 6. Edinburgh. 157 pp.

ZADRAZIL, F. 1974. The ecology and industrial production of *Pleurotus ostreatus, Pleurotus florida, Pleurotus cornucopiae* and *Pleurotus eryngii*. *Mushroom Sci.* 9: 621-652.