

NEW AND RARE BOLETES FROM CHILE

Por E. HORAK¹

RESUMEN

Se describen e ilustran 3 nuevas especies de Boletales de los bosques de *Nothofagus* chilenos: *Gastroboletus valdivianus*, *Boletus loyita*, y *B. putidus*. Se conocen ahora 5 boletáceas que forman micorrizas ectotróficas con especies sudamericanas de *Nothofagus*.

So far not more than about a dozen of native *Boletaceae* have been observed in the forests of South America. This is a very low number considering the rich ecological sites which range from evergreen tropical rain forests in the North and Northeast of the Continent to deciduous temperate or subantarctic forests in Patagonia and Tierra del Fuego.

The following list reviews all known records up to date (Phillipi 1893; Espinosa 1923; Singer 1964, 1967, 1969, 1970; Mujica & Oehrens 1967):

- A. Boletes associated with native *Alnus*, *Nothofagus*, *Quercus*, various *Leguminosae*, *Sapindaceae*, etc.

Gastroboletaceae: * *Gastroboletus valdivianus*.

Boletaceae: *Gyrodon monticola*, *G. rompelii*, *G. proximus*, *G. exiguus*. *Phaeogyroporus braunii*, *Ph. beniensis*, *Ph. tropicus*. *Xerocomus brasiliensis*. * *Boletus loyo*, * *B. loyita*, * *B. chilensis*, * *B. putidus*. *Strobilomycetaceae*: *Porphyrellus festivus*, *P. venezuelae*, *Boletellus ananas*.

- B. Boletes associated with exotic introduced *Pinus*, *Picea*, *Abies*, *Larix*, *Salix*, *Populus*, etc.

Boletaceae: *Xerocomus chrysenteron*, *X. hypoxanthus*. *Boletus edulis*, *B. versicolor* (aff.), *Suillus granulatus*, *S. piperatus*, *S. aeruginascens*, *S. luteus*, *S. subaureus*. *Leccinum griseum*, *L. aurantiacum*.

¹ Institute for Special Botany, ETH, Zürich, Switzerland.

According to this enumeration 5 *Boletales* (secc *) occur under *Nothofagus* in South America. Analysing the collecting localities one is surprised to see that all records are known only from the "selva valdiviana" (Wintero-Nothofagetea s.l.; Oberdorfer 1960). This association is restricted to the most favoured sites North, East South of Valdivia (see map in Oberdorfer 1960), Chile. Spreading from the Pacific coast that type of forest enters also the longitudinal Valley and reaches its upper limits at about 1.000 m a.s.l. on the East-side of the coastal Cordilleras.

The "selva valdiviana" is dominated by *Nothofagus obliqua*, *N. dombeyi*, *N. procera* and *N. alpina*. These trees are considered to be the mycorrhizal partners of the before mentioned boletes. However, the possibility is not excluded that some of the numerous Chilean *Myrtaceae* also have mycorrhiza with agarics and boletes. More detailed field work is needed to get additional information on this biological and economically important aspect (Singer & Moser 1965).

It has to be emphasized that no native bolete was ever found outside the limits of the "selva valdiviana" and it remains an open question whether the vast *Nothofagus* forests in Patagonia and Tierra del Fuego do have boletes among their mycorrhizal fungi or not. If yes, than these taxa do fructificate rather sporadically under the rougher climatic conditions and thus up to now escaped the attention of collectors.

The Chilean species of *Boletales* do have insignificant taxonomic relationships with species described from *Nothofagus* forests in New Zealand (McNabb 1968). No published records are available on boletes occurring in other regions where *Nothofagus* is still be found (Tasmania, SE-Australia, New Caledonia, Papua New Guinea).

If not otherwise stated the magnifications of the figures are as follows: carpophores (natural size), spores (2000 x), basidia and cystidia (1000 x) cuticle (500 x).

Type material of the new species is kept in the author's herbarium, Zürich, Switzerland (ZT).

ACKNOWLEDGEMENTS

The writer is indebted to the authorities of the Universidad Austral, Valdivia, Chile, who sponsored collecting trips to several localities in South Chile (autumn 1975) and to Prof. Dr. E. Oehrens, of the same university who kindly gave us advice and full support both in the field and the laboratory during our stay in Valdivia.

KEY TO CHILEAN BOLETALES (native spp.)

1. Carpophores gastroboletoid (tubes radiating irregularly, pores labyrinthiform), — 40 mm, yellowish; gleba (tubes) yellow, pores deep red; stipe fusoid, yellow; spores 11,5-15/5-5,5 μ elliptical, \pm symmetrical
1. *Gastroboletus valdivianus*

- 1°. Carpophores boletoid (tubes vertical, pores round or polygonal), spores fusoid 2
 2. Pileus red, purple; stipe pruinose, not reticulate 3
 2°. Pileus yellow-brown to fuscous; stipe pruinose or reticulate; robust; pores polygonal 4
 3. Pileus —200 mm (or larger); pores reddish brown, very small, round; stipe —150/—70 mm, robust; spores 11-14/4,5-5 μ 2. *Boletus loyi*
 3°. Pileus —60 mm; pores yellow, polygonal; stipe —100/10-20 mm, fusoid; spores 10-11/3,5-4 μ 3. *Boletus loyita*
 4. Pileus dark brown or fuscous, —110 mm; stipe glabrous or pruinose-floccose; spores 8-10,5/3-4 μ ; cystidia fusoid 4. *Boletus putidus*
 4°. Pileus dark brown to yellow-brown, —200 mm; stipe reticulate; spores 8-11/3,5-4 μ ; cystidia clavate 5. *Boletus chilensis*

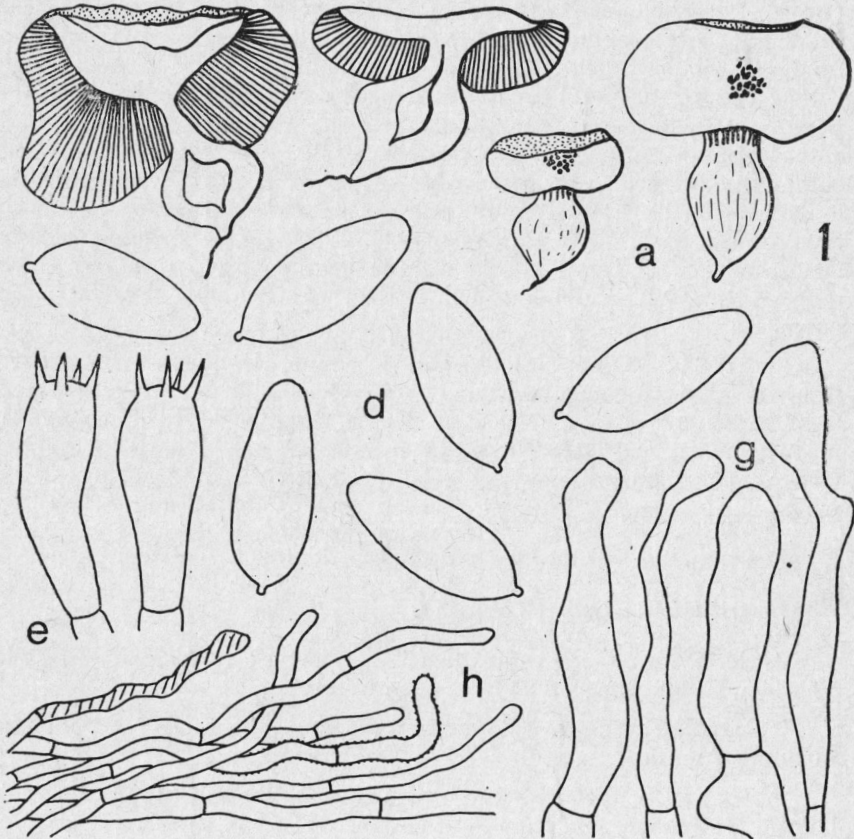


Fig. 1. — *Gastroboletus valdivianus* Hk. sp. n. (type): a) Carpophores; d) Spores; e) Basidia; g) Cheilocystidia; h) Cuticle.

1. **Gastroboletus valdivianus** Horak sp. n. (Fig. 1: a, d, e, g, h) *Epithet*: valdivianus (lat.) - belonging to the province of Valdivia (Chile).

Pileo 15-40 mm lato, peridio ochraceo-argillaceo, sicco, parte apicali reducto; gleba tubulosa, ex luteo olivacea, poris rubris, subcyanescens; stipite 15-30/7-15 mm, fusoideo, ad apicem rubro costatoque, basim versus luteo, glabro. Sporis 11,5/5-5,5 μ , ellipticis, luteis, levibus. Ad terram in silvis nothofagineis. Chile. Typus (SGO).

Gastrocarp 15-40 mm diam., convex to plano-convex. Peridium reduced (even in young carpophores not completely covering the tubes), pale yellowish or ochraceous, ageing pale beige; dry, glabrous to tomentose, felty, not cracking, at margin any veil remnants absent. Gleba (tubes) exposed, peridial membrane absent, tubulose, disoriented, radiating at various angles from the peridium, easily peeling off peridium, broadly adnate to stipe-columella or subemarginate, \approx 15 mm wide; yellow turning olive-yellow; pores irregular to labyrinthiform, \approx 2 mm wide, yellow becoming deep red when old, turning pale blue where cut or bruised. Stipe 15-30/7-15 mm, fusoid, tapering into base and columella; red near apex, otherwise yellow; dry, apically with distinct longitudinal ribs from the subdecurrent tubes, glabrous or tomentose towards the base, often with distinct, tail-like yellow rhizoids, hollow, single in groups. Context pale olive-yellow in stipe, wine red above gleba, soft. Taste and odour not distinctive. Chemical reactions unknown.

Spores 11,5-15/5-5,5 μ , ellipsoid, \pm symmetrical, yellowish, smooth, thin-walled, germ pore absent, inamyloid. Basidia 28-35/9-11 μ 4-spored. Cystidia 30-60/4-8 μ , cylindrical or clavate, thin-walled, hyaline (KOH), inconspicuous, scattered. Cuticle a cutis of repent, cylindrical hyphae (4-6 μ diam.), membranes not gelatinized, with yellow (KOH), plasmonic and encrusting pigment. Clamp connections absent.

Habitat: On soil under *Nothofagus (dombeyi, obliqua)*.

Distribution: Chile (Valdivia).

Material examined: Holotype (SGO), isotype (ZT,75/265): "Chile, Valdivia, Cuesta Sta. Elvira; leg. Horak, 9.IV.1975".

This collection represents the first record of the genus *Gastroboletus* in South America.

According to the monograph of Thiers & Trappe (1969) secotioid boletes are known only from North America (8 spp.), Asia (1 sp.; type of genus: *G. boedijnii* Lohwag) and Africa (1 sp.). Based on superficial field observations it is likely that *G. valdivianus* forms ectotrophic mycorrhiza with *Nothofagus obliqua* and *N. dombeyi* as well.

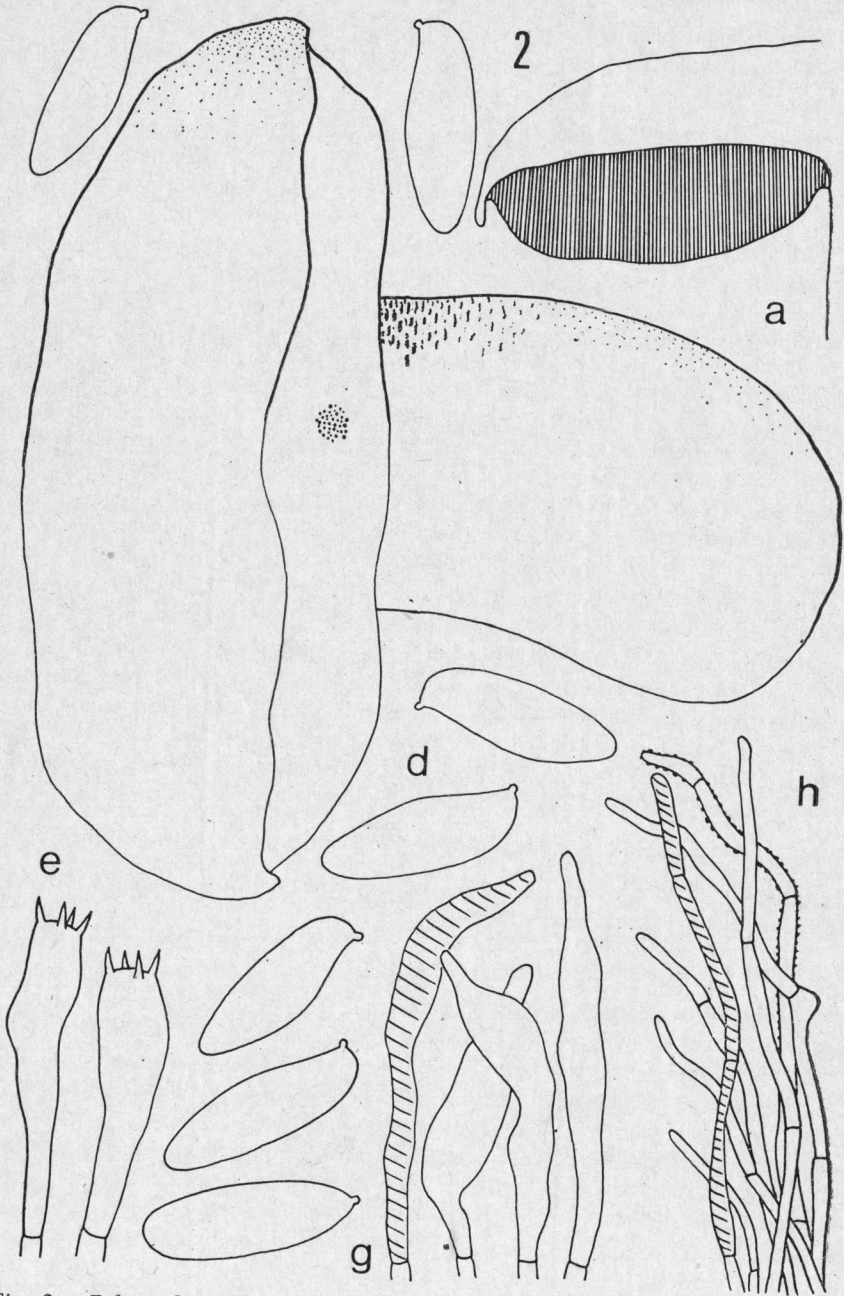


Fig. 2. — *Boletus loyo* Phil. ex Speg. (ZT, 75/259): a) Carpophores (1:3); d) Spores; e) Basidia; g) Cheilocystidia; h) Cuticle.

2. *Boletus loyo* Phil. ex Speg. 1912: An. Mus. Nac. B. Aires 23: 9. (Syn: *Boletus loyus* Espinosa 1915: Bol. Mus. Nac, Chile 8:5). (Fig. 2: a, d, e, g, h).

Pileus (70) 100-200 (-350) mm diam., hemispherical when young, convex to pulvinate, very massive, disc flat in aged carpophores; wine red, purple, vinaceous red, yellowish in the cracks and towards the sterile, projecting margin; dry, subviscid when moist velutinous, cuticle in old specimens cracked into irregular polygons (areolate), margin with conspicuous, membranaceous, overlapping pseudoveil. Tubes 8-15 mm long, emarginate-depressed around stipe, deep yellow becoming olive-yellow or olive-brown, pores concolorous or redbrown, polygonal, up to 1 mm diam.; not or indistinctly bluing when bruised. Stipe 80-150 (-200)/40-70(-100) mm, robust, clavate to ventricose, not attenuated at base; at apex and when young yellow, turning wine red or purple; dry, minutely floccose or pruinose, at times velutinous, any reticulation absent, solid, single; veil absent. Context deep yellow, purple beneath cuticle and towards base of stipe, slightly bluing only. Taste like fresh walnut, odour similar. Chemical reactions: KOH -on context: orange; on pileus: negative. NH₃, FeSO₄: negative.

Spore print olive-brown. Spores 11-14(15)/4.5-5 μ , fusiform, with distinct suprahilar depression, yellowish, smooth, thinwalled.

Basidia 26-40/7-10 μ , 4-spored. Cystidia 30-55/5-11 μ , fusoid, hyaline or with brown (KOH), plasmatic pigment, thinwalled or occasionally with membranes up to 1.5 μ diam., in dense clusters on margin of pores. Cuticle a cutis of interwoven, cylindrical hyphae (3-7 μ diam.), with yellow-brown (KOH), plasmatic and encrusting pigment, membranes not strongly gelatinized. Clamp connections absent.

Habitat: On soil under *Nothofagus (obliqua, procera, dombeyi)*.

Distribution: So far only known from the region between Valdivia and Concepcion (selva valdiviana).

Illustrations: Singer (1964).

Material examined: ZT,75/256: "CHILE, Valdivia, Cuesta Sta. Elvira; leg. Horak, 8.IV.1975". - ZT,75/259: "Chile, Valdivia, Cuesta Sta. Elvira; leg. Horak, 8.IV.1975." - (Holotype in LIL, not studied.).

From year to year *S. loyo* is offered for sale on the markets in Valdivia, La Unión and other cities in Southern Chile. Nevertheless only few mycologists have collected and studied this magnificent bolete which resembles *Boletus regius* Fr. or *B. bicolor* Peck, both from the Northern Hemisphere.

Boletus loyo, the choicest of Chiles edible fungi, can reach enormous size and weight. In April 1975 very large carpophores (up to 35 cm diam.!) were observed in *Nothofagus procera* forests near Chivéria, Cordillera Pelada (prov. Valdivia).

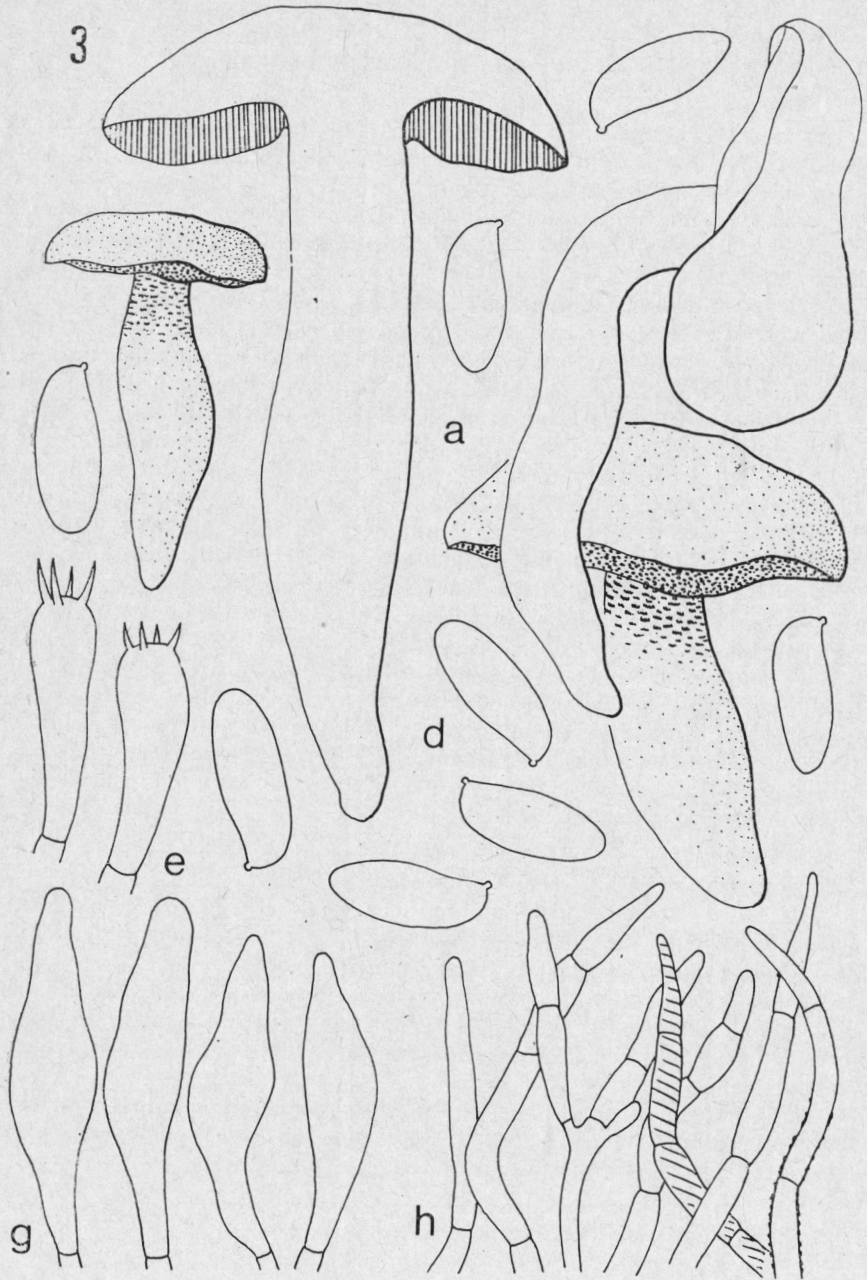


Fig. 3. — *Boletus loyita* Hk. sp. n. (type): a) Carpophores; d) Spores; e) Basidia; g) Cheilocystidia; h) Cuticle.

3 *Boletus loyita* Horak sp. n. (Fig. 3: a, d, e, g, h)

Epithet: local name, fungus considered to be the "wife" of *Boletus loyo*.

Pileo —60 mm lato, ex hemispherico pulvinato, vinaceo-purpureo, brunnescente, sicco, velutino. *Tubis* luteis, vix cyanescentibus. *Stipite* —100/—20 mm, subfusoido vel cylindraco, luteo ad apicem, vinaceo-purpureo basim versus, haud reticulato. *Caro* lutea valde cyanescente, ad basim purpurea. *Sporis* 20-11/3,5-4 μ , fusiformibus. *Ad terram* in silvis nothofagineis. Chile. *Typus* (SGO).

Pileus 25-60 mm diam., hemispherical, conical becoming slightly depressed at centre; deep wine red or purple when young, later fading to brownish wine red; dry, velutinous or minutely fibrillose, cuticle not cracking, margin not appendiculate. *Tubes* —8 mm long, depressed or emarginate-subdecurrent around stipe, ventricose; deep yellow when young, turning golden yellowish in aged carpophores, without red tints, pores concolorous, polygonal (—2 mm diam.), slightly bluing when bruised. *Stipe* 40-100/10-20 mm, subfusoid or cylindrical, usually deep wine red to purple; dry, minutely pruinose all over, any reticulation absent, solid, single. *Context* yellow in pileus and upper parts of the stipe, bluing immediately after cutting; red-purple in base of stipe. *Taste* and *odour* no distinctive. *Chemical reactions*: KOH —on pileus: yellow; on context: negative. *Spores* 10-11/3,5-4(4,5) μ fusoid, smooth, yellowish brownish. *Basidia* 25-32/8-10 μ , 4-spored, *Cystidia* 35-50/9-12 μ , fusoid, hyaline, thinwalled, rather scattered on pore edges. *Cuticle* a trichoderm or palisade of cylindrical hyphae (3-8 μ diam.), terminal cells conically tapering, membranes not gelatinized, with reddish brown (KOH) plasmatic and encrusting pigment. *Clamp connections* absent.

Habitat: On soil under *Nothofagus* (*dombeyi*, *obliqua*).

Distribution: Chile (selva valdiviana).

Material examined: Holotype (SGO), isotype (ZT,75/245): CHILE, Valdivia, Cuesta Sta. Elvira; leg. Horak & Oehrens, 9.IV.1975."

According to Singer (1969) *Boletus versicolor* Fr. does occur in Chile. Superficially *Boletus loyita* looks very much like that fungus but is not conspecific at all. Its spores are larger, the apex of stipe is reticulated and the base of the stipe is covered with a conspicuous yellow tomentum.

The Chilean *B. loyita* has rather close taxonomic relationships with *Boletus fraternus* Peck (1897). However, the two species are well separated by the different size of the spores.

4. *Boletus putidus* Horak sp. n. (Fig. 4: r, s, t, u, v)

Epithet: putidus (lat.) - simple, boring.

Pileo —110 mm lato, ex hemispherico appianato, brunneo vel fusco, minute velutino, sicco. *Tubis* e luteo olivaceobrunneis, poris con-

coloribus instructis, vix cyanescentibus. Stipite —100/—40 mm, clavato vel fusoides, luteo ad apicem, rubrobrunneo ad basim versus, reticulatione deest. Sporis 8-10,5/3-4 μ , fusoides. Ad terram in silvis nothofagineis.. Chile, Typus (SGO).

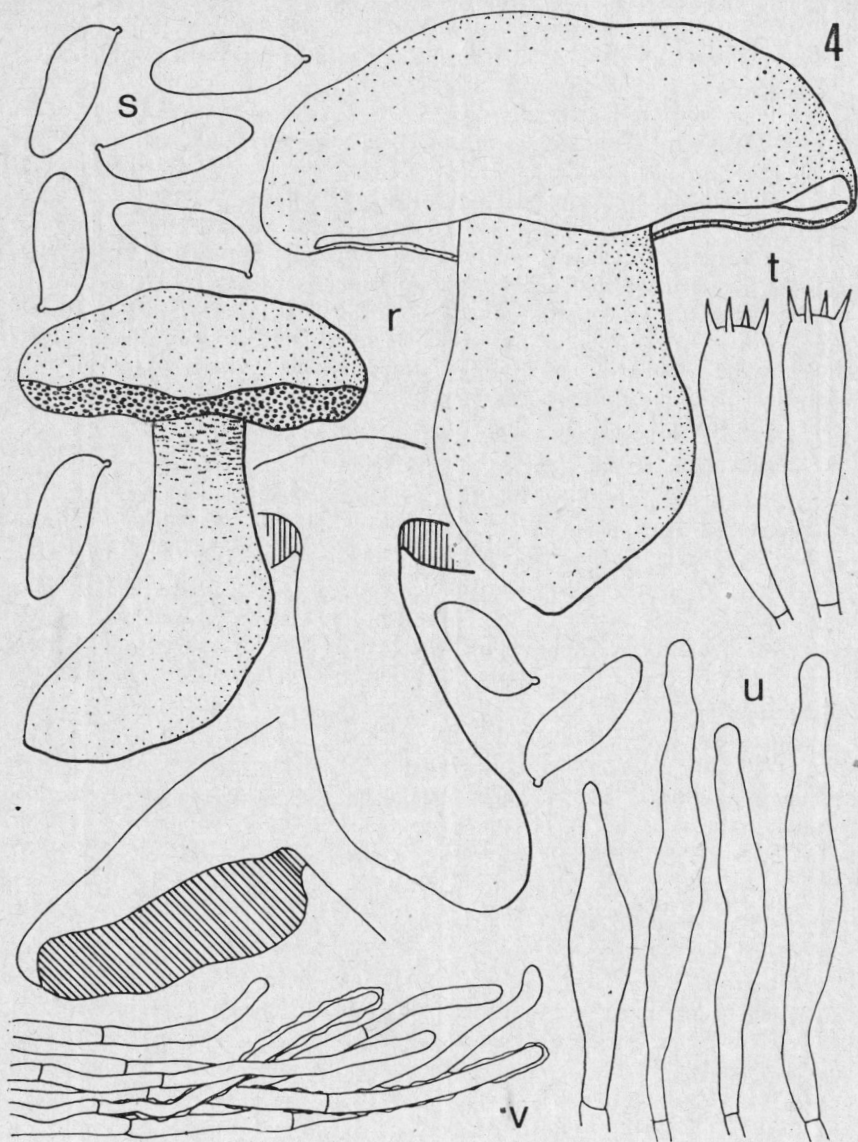


Fig. 4. — *Boletus putidus* Hk. sp. n. (type): r) Carpophores; s) Spores; t) Basidia; u) Cheilocystidia; v) Cuticle.

Pileus -110 mm diam., hemispherical when young, becoming flat or depressed at disc; evenly dark brown, fuscous or umber; dry, subviscid when moist, velutinous, not cracking, occasionally with membranaceous, overlapping margin. Tubes -15 mm long, emarginate-depressed around stipe, ventricose, "vorkragend"; yellowish with pink tints when young, turning olive-yellow or olive-brown; pores concolorous, polygonal, after bruising not or slightly bluing only. Stipe 50-100/15-40 mm, clavate or fusoid, base of stipe conspicuously tapering, gradually attenuated towards apex; apex yellow, reddish brownish towards base; dry, velutinous or pruinose, minutely floccose, any signs of net absent, solid, single. Context: pale wine red or pinkish brownish in pileus and stipe, upper portion of stipe yellow, not or indistinctly cyanescent. Odour and taste sourish. Chemical reactions: KOH - on pileus: orange; on context and tubes: negative. Spores 8-10,5/3-4 μ , fusiform, smooth, yellowish, thinwalled. Basidia 30-36/7-10 μ , 4-spored. Cystidia 35-70/5-8 μ , fusoid, hyaline, thinwalled. Caulocystidia 15-30/7-10 μ , clavate, hyaline. Cuticle a cutis of repent or irregularly interwoven cylindrical hyphae (4-8 μ diam.), walls of hyphae slightly gelatinized, encrusted with brown pigment. Clamp connections absent.

Habitat: On soil under *Nothofagus* (*dombeyi*, *obliqua*).

Distribution: Chile (selva valdiviana)

Material examined: Holotype (SGO), isotype (ZT, 75/272): "Chile, Valdivia, Cuesta Sta. Elvira; leg. Horak, 9.IV.1975." - ZT, 75/264: "Valdivia, Cuesta Sta. Elvira; leg. Horak & Oehrens, 8.IV.1975."

Boletus leptospermi McNabb (1968) keys out with *B. putidus*. However, the stipe of the New Zealand bolete is more or less cylindrical, its spores are larger, the exposed context in the cracks of the cuticle turns red in mature carpophores and the flesh changes deep blue where cut or bruised.

No doubt *B. putidus* is akin to *Boletus chilensis* Sing. with which species it shares similar colours and size of the fruitingbodies. The conspicuous net at the apex of the stipe and the different cystidia represent the principal characters to separate the two taxa in the field and under the microscope as well.

5. *Boletus chilensis* Sing. 1967: *Biología* 41: 69. (Fig. 5: m, n, n; fig. 5a: n, p.)

Pileus 80-140 mm diam., convex then pulvinate, expanded, finally depressed in centre; yellow-brown to reddish brown (reminds of the colours of *Xerocomus subtomentosus* [Fr.]); viscid when moist, soon dry, minutely velvety or velutinous, not becoming areolate, without sterile overlapping margin.

Tubes emarginate, subdecurrent with short tooth, - 15 mm long; yellowish, mustard yellow when old, pores concolorous or red-brown (especially in aged carpophores), polygonal, -1,5 mm diam. Stipe

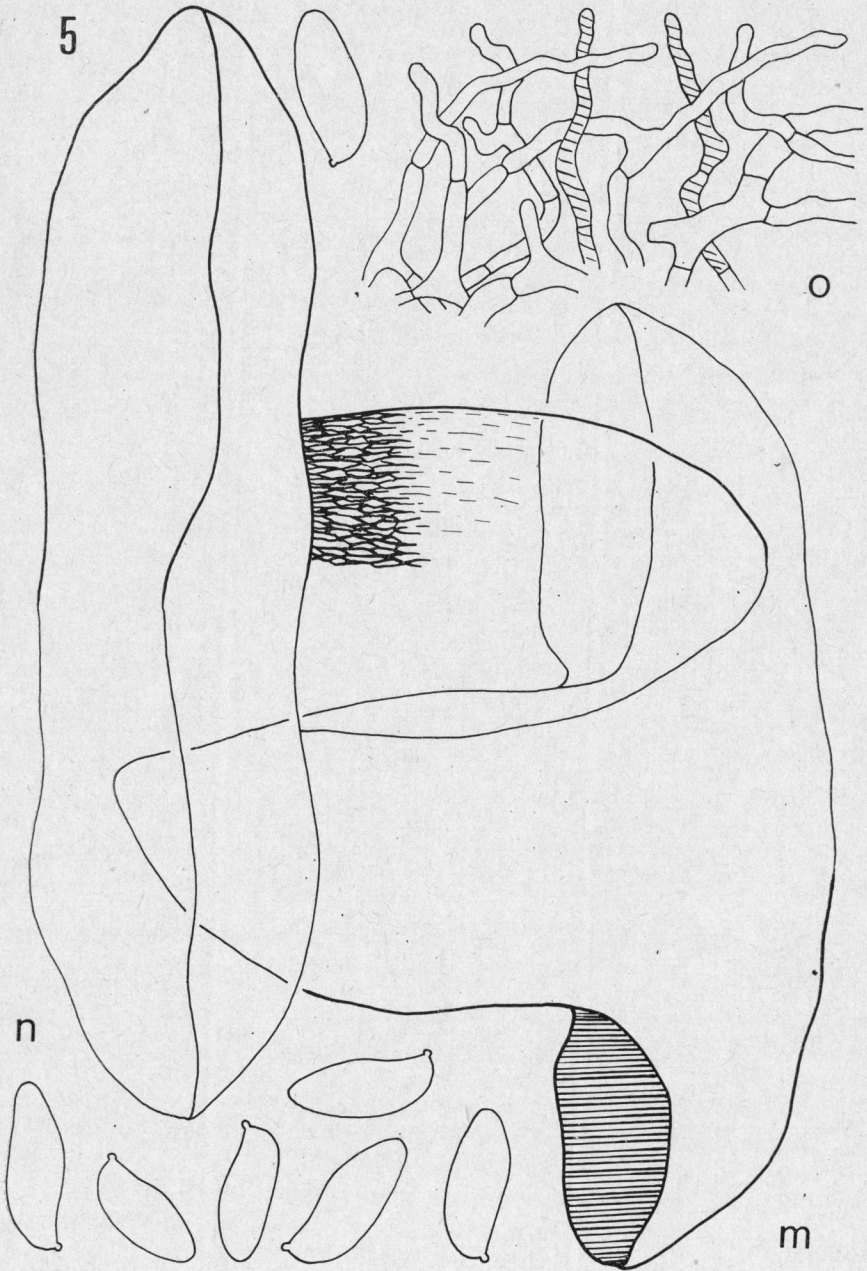


Fig. 5. — *Boletus chilensis* Sing. (ZT, 75/233): m) Carpophores; n) Spores; o) Cuticle.

40-100/30-40 mm (at apex), conical, distinctly attenuated towards base, rooting, robust; yellow at apex, wine red below, brownish (concolorous or paler as pileus) from midportion to base; distinctly reticulated in upper half; dry, glabrous, solid, single in groups. Context whit, reddish brownish in upper part of stipe, yellow at base, after cutting immediately bluing above tubes. Odour and taste not distinctive. Chemical reactions on pileus: KOH - negative. Spores 8-11/3,5-4 μ , fusoid, yellowish, smooth, thinwalled, germ pore absent. Basidia 30-40/7-10 μ , 4-spored. Cystidia 25-50/5-8 μ , cylindrical or clavate, with yellow (KOH) plasmatic and encrusting pigment, inconspicuous and scattered. Cuticle consisting of interwoven, cylindrical hyphae (4-7 μ diam.), membranes slightly gelatinized, with brownish (KOH) plasmatic pigment. Clamp connections absent.

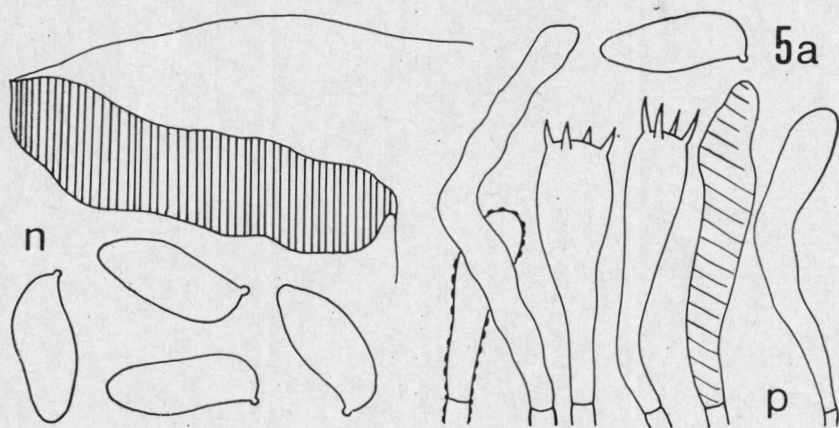


Fig. 5a. — *Boletus chilensis* Sing. (ZT, 75/233): n) Spores; p) Basidia and cheilocystidia.

Habitat: On soil under *Nothofagus obliqua*.

Distribution: Chile.

Material examined: ZT, 75/233: "CHILE, Valdivia; leg. Horak & Oehrens, 6.IV.1975." (Topotypical material).

The description is based upon topotypical material.

Macroscopically *B. chilensis* could be taken as *Boletus radicans* (Fr.) ss. Kallenbach, *B. fragrans* Vitt. or *B. junquilleus* (Quél.) (all from Europe) but none of these species do have the conspicuously short spores of the Chilean relative.

REFERENCES

- ESP-NOSA M., 1926: Enumeración de hongos chilenos. *Rev. Chil. Hist. Nat.* 30: 297.
- McNABB R. F. R., 1968: *The Boletaceae of New Zealand*. *N. Z. Journ. Bot.* 6: 137.
- MUJICA F. & OEHRENS E., 1967: Addenda a Flora Fungosa Chilena. II. *Bol. Tecn.* Nº 27, Est. Exp. Agr. Univ. de Chile (Maipu).
- OBERDORFER E., 1960: Pflanzensoziologische Studien in Chile. *Flora Veg. Mundi*, vol. 2 (Cramer, Weinheim).
- PHILIPPI F., 1893: Die Pilze Chiles, soweit dieselben als Nahrungsmittel gebraucht werden. *Hedwigia* 32: 115.
- SINGER R., 1961: Fungi of Northern Brazil. *Inst. Mic. Univ. Recife*, Nr. 304.
- 1964: Boletes and related groups in South America. *Nova Hedwigia* 7:93.
- 1967: Nuevos hongos descubiertos en Chile. *Biológica* 41: 69.
- 1969: Mycoflora Australis. *Beihefte Nova Hedwigia*, Nr. 29 (Cramer, Weinheim).
- 1970: *Flora Neotropica. Strobilomycetaceae*. Monograph Nr. 5 (Hafner, New York-London).
- SINGER R. & DIGILIO A. P. L., 1960: Las Boletáceas de Sudamérica Tropical. *Lilloa* 30: 141.
- SINGER R. & MOSER M., 1965: Forest mycology and forest communities in South America. *Mycopath. Myc. Appl.* 26: 129.
- THIERS H. D. & TRAPPE J., 1969: Studies on the genus *Gastroboletus*. *Brittonia* 21: 244.