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TWO CONFUSED BOLETES IN THE BENELUX
Boletus impolitus Fries and Boletus depilatus Redeuilh

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Boletus impolitus and *B. depilatus* are known from the Benelux; up to now the latter is found only in Belgium. Both species occur on calcareous soils; *B. depilatus*, however, seems to prefer soils with a higher calcium content than *B. impolitus*. The most reliable diagnostic characters are found in the pileipellis, at both the macroscopical and the microscopical level. It is possible that *B. depilatus* is more thermophilous.

In the past, *Boletus impolitus* has been considered as a well characterized species being easily recognized in the field by its iodoform odour, which is perceptible especially at the base of the stipe.

Recently, Redeuilh (1986) described *Boletus depilatus* which macroscopically strongly resembles *B. impolitus* and has an analogous smell. According to Redeuilh both species are easily recognized at the microscopical level, *B. impolitus* having a 'trichoderme constitué en majorité d'hyphes allongées relativement minces terminées en partie par des extrémités arrondies ou renflées plus ou moins différenciées mais presque toujours identifiables', whereas *B. depilatus* has a 'structure nettement subcelluleuse, au moins partiellement.' The name *Boletus impolitus* has thus been used at least for two different species.

The analysis of herbarium material from the Benelux showed a clear-cut separation into two groups corresponding to the two species recognized by Redeuilh.

The field notes accompanying the collections are often too poor to permit a 'synthetic' description. So we decided to describe only one collection of each species, only citing the others.

Boletus impolitus Fr.—Figs. 6–11, 12, 14, 17, 21

Boletus impolitus Fr., Epicr.: 421 (1838).

Pileus 12 cm in diam., thick (1.5 cm at half the radius), minutely felted to felted-subgranulose, ochraceous yellow (Munsell between 2.5 Y 8/6 and 7/6), locally darker (Mu. 2.5 Y 7/6 to 6/6) or with vague reddish brown tints when bruised. Stipe 7 × 2.4 cm, cylindric with clavate base up to 3.2 cm in diam., bright yellow (Mu. 5 Y 8/8), entirely minutely flocculose-subsquamulose, with slight vinaceous red to pinkish zone at about 2.5 cm from base, later (probably on handling) squamules and locally background turning brick red (Mu. ca. 2.5 YR 4/8). Hymenophore emarginate-adnate; tubes rather long (ca. 1 cm); pores roundish, small, up to 2 mm diam., dark olive yellow (Mu. 5 Y 6/8). Context pale yellowish, rather bright yellow above tubes and beneath stipitipellis, unchanging; smell weak, somewhat chemical.

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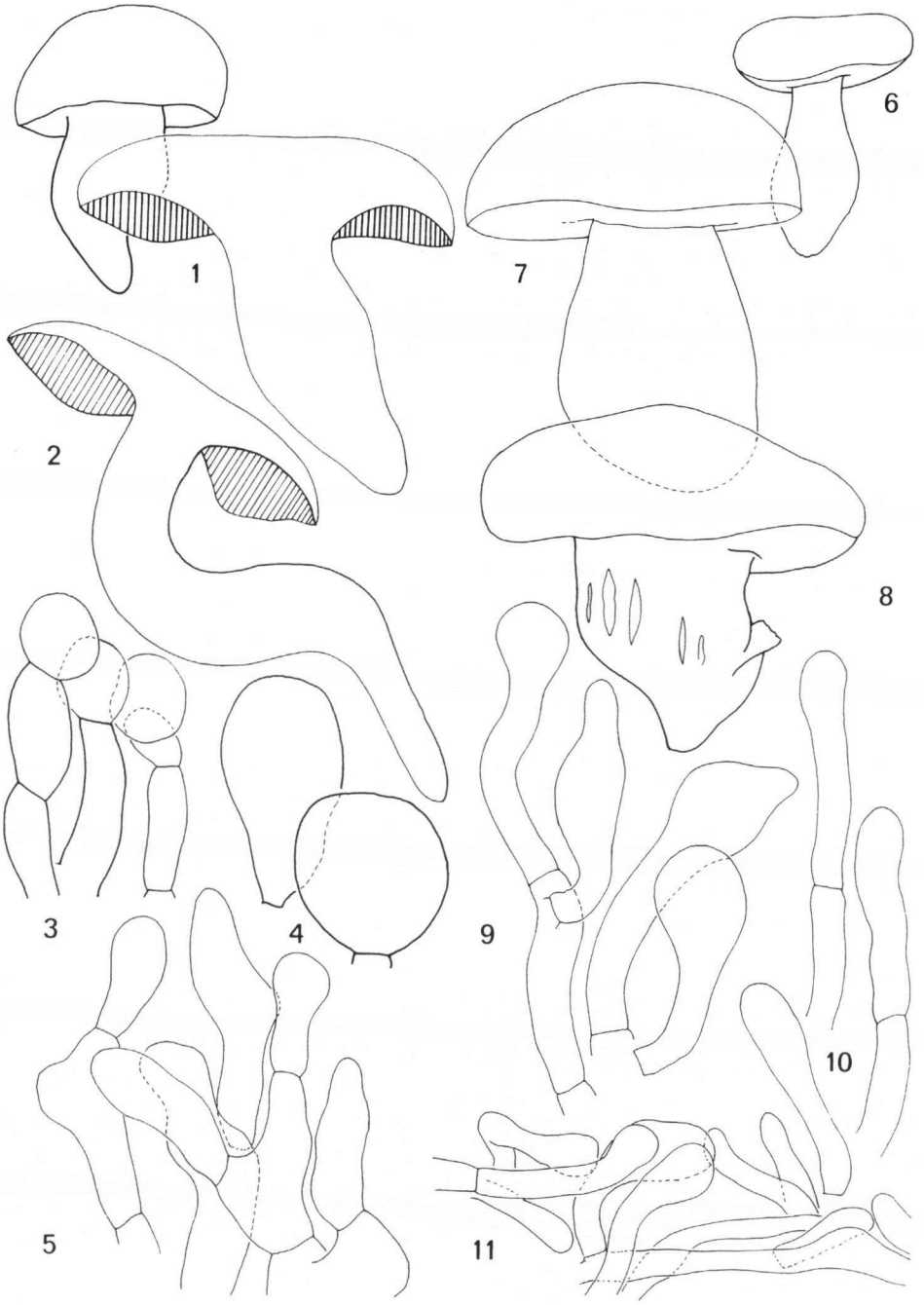
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NH_4OH: pileus orange-ochraceous; NH_3 (vapour): pileus immediately dark vinaceous; KOH: on pileus dark reddish brown, on pale context pale pinkish-brownish, on bright yellow context brown; $FeSO_4$ (crystal): on pileus dark grey to blackish, on context somewhat sordid olive (everywhere); Formol: no reaction.

Spores (10.5–)10.8–12.45–14.1 × 4.3–4.89–5.4 µm (Q = 2.25–2.56–2.86(–2.93); n = 35), pale yellowish brown, elongate, with roundish apex, with a slight supra-apicular depression; wall rather thin, rarely with an apical thinning; in Melzer's reagent at first greyish (flushing reaction) then light reddish brown. Basidia (24–)30–39 × 9.2–11.9 µm, 4-spored, hyaline. Cystidia sparse, 46–55 × 7.5–11.5 µm, narrowly lanceolate, slightly sinuous, thin-walled, hyaline. Gill-trama regular, composed of long, hyaline, cylindrical hyphae of 4–7 µm diam.; subhymenium ramose. Pileipellis only slightly differentiated, in the upper part the hyphae predominantly erect, then ± intricate; hyphae cylindrical 4–8 µm in diam.; underlying context with somewhat broader, entangled hyphae, slightly lacunose. Stipitipellis composed of a disrupted hymenium with basidia high on stipe.

S.E.M.—Spores smooth or only slightly rugose (× 20,000).

Habitat.—Deciduous woodland on ± calcareous soils.

Described collection.—NETHERLANDS: Laagveendistrict: Oegstgeest, Rhijnhof, 29.09.1985, *Bas 8405* (L).

Other collections examined.—NETHERLANDS: Laagveendistrict: Oegstgeest, 10.08.1980, *Bas 7637* (L); id., 28.08.1981, *Bas 7784* (L); Breukelen, 12.08.1972, *de Vries s.n.* (L); id., 20.07.1974, *Daams 74.51* (L); id., *Kuyper 2216* (L). Gelders district : Zeist, 13.09.1953, *Schutz s.n.* (L); id., 26.07.1981, *Kuyper 1640* (L); Utrecht, Bunnik, 23.08.1967, *Arnolds s.n.* (L); id., 15.10.1981, *Schreurs s.n.* (L); id., 30.08.1982, *Schreurs s.n.* (L); Langbroek, 08.08.1977, *Bas 7212* (L); Wageningen, 21.07.1953, *Huysman s.n.* (L). Fluviatiel district: Hemmen, 20.08.1966, *Tjallingii s.n.* (L); Ridderkerk, 09.08.1986, *Noordeloos 8612* (L). — BELGIUM: Brabants district: Meise, 7.10.1976, *Léonard 6904* (BR); id., 18.09.1980), *Léonard 7254* (BR); id., 1983, *Rammeloo 8194* (BR); id., 27.09.1988, *De Meulder 4232* (BR). Maasdistrict: Obourg, 07.07.1975, *Piérart 75 791* (Université de Mons).

The field-notes of the cited collections allow us to add further details to the description.

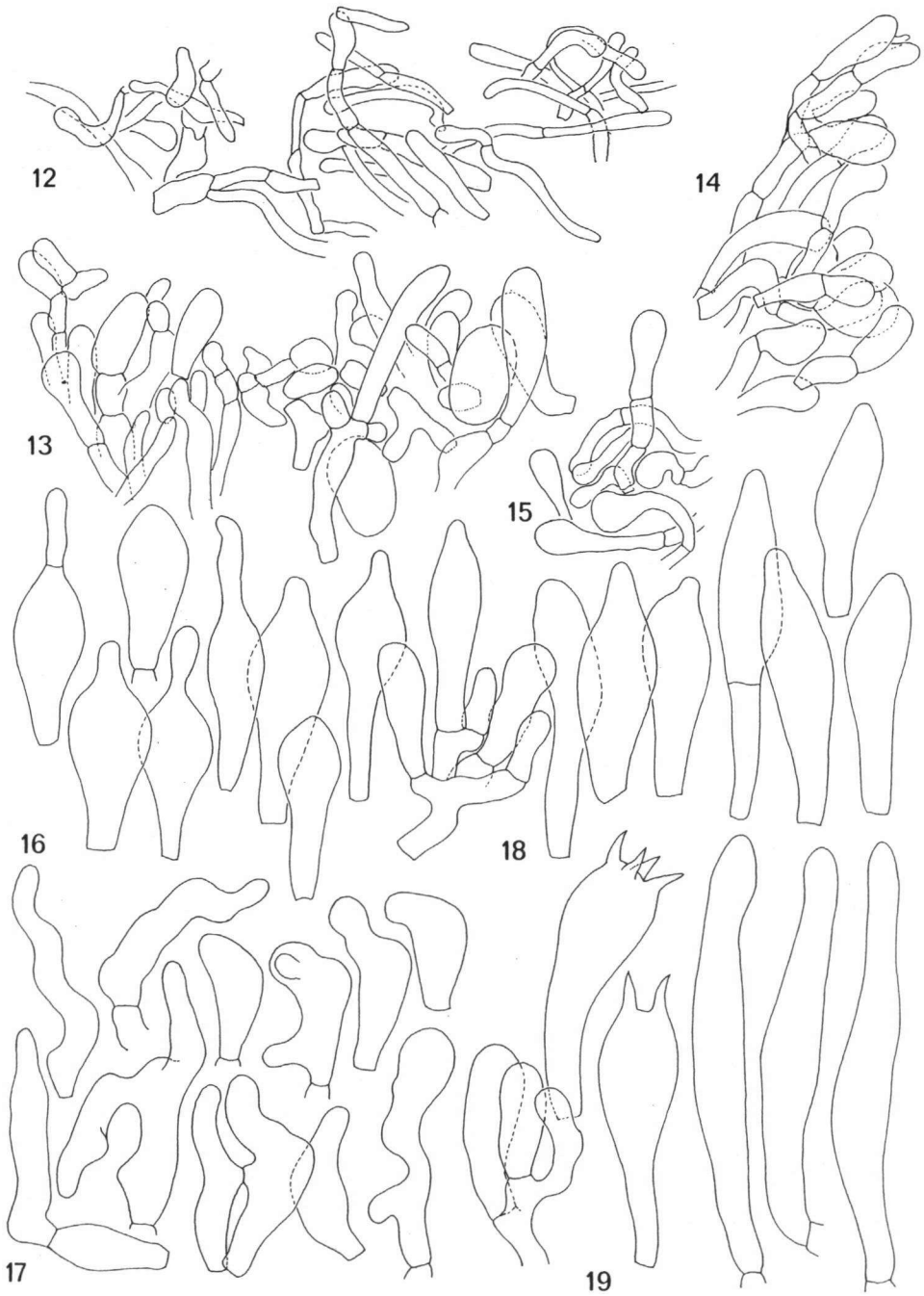
The pileus becomes sometimes squamulose and rarely shows a local tendency to reddening; its margin may be very slightly exceeding. The stipe is generally clavate or somewhat bulbous (Figs. 6–8). The hymenophore is generally said to be bright yellow at first. A slight blueing has been noticed once. The context exhibits rarely a vinaceous tint in the pileus; the smell is constantly 'chemical', sometimes recognized formally as iodoform-like especially at the base of the stipe; the taste is described several times as sweetish (sugar-like) at first, then slightly unpleasant.

Boletus depilatus Redeuilh—Figs. 1–5, 13, 15, 16, 18–20, 22

Boletus depilatus Redeuilh *in* Bull. trimest. Soc. mycol. Fr. 101: 389 ('1985') 1986.
Boletus impolitus auct. p.p.

Figs. 1–5. *Boletus depilatus*. — 1. Habit sketches of carpophore and section, after fresh material (*Kuyper 1207*). — 2. Sketch of section, after fresh material (*Heinemann 8172*). — 3. Elements of the pileipellis at the centre of the pileus (*Kuyper 1207*). — 4. Elements of the pileipellis (*Garcin s.n.*). — 5. Elements of pileipellis at the pileus margin (*Kuyper 1207*).

Figs. 6–11. *Boletus impolitus*. — 6–8. Habit sketches of carpophores, after fresh material (6: *Daams 74.51*; 7: *Bas 7212*; 8: *Schreurs 15.10.81*). — 9–11. Elements of pileipellis (9: *Schreurs 15.10.81;* 10–11: *Bas 7212*).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Pileus 9.5 cm in diam., rather thick (1 cm), pulvinate, matt, uneven, reddish brown. Stipe 15.5 × 2.7 cm, solid, isodiametric, slightly narrowed towards top, attenuated to slightly rooting at base, yellowish, locally reddish, paler yellowish white at base, finely floccose, especially at top striate, loosely fibrillose with fibrils forming a ± loose network. Hymenophore ventricose, deeply emarginate, nearly free, pale yellow then slightly olivaceous, easily separable from context; tubes long (up to 1.7 cm) not easily separable from one another; pores small. Context pale yellowish to yellowish, very faintly blueing; odour unpleasant, not recognized formally as iodoform-like at the base of the stipe. Exsiccatum ochraceous; odour strong, slightly nauseous.

NH_4OH, on fresh pileus: immediately dark blue then black, becoming brown, changing in less than 1 minute.

Spores 10.0–11.91–14.0(–14.5) × 3.9–4.63–5.5 µm (Q = 2.00–2.60–3.36(–3.58); n = 29), yellowish, slightly orthochromatic in Melzer's reagent, elongate, with roundish or slightly conical apex, sometimes with a slight supra-apicular depression; apical pore absent. Basidia 32–40 × 10.2–12.5 µm, (1–)2(3–4)-spored, clavate, hyaline. Cystidia 27–55 × 8–14.5 µm, more frequent near and at pores, lanceolate, with apex elongate cylindraceous or ± rounded or even narrowly subcapitate; at and near pores apex more elongate. Gill-trama subregular, with long hyphae of 4–10 µm diam. Pileipellis with erect hyphae composed of ± inflated cells, some globulous, others elongate, the terminal one generally shorter, even sphaerocyte-like, rarely attenuated, 10–40 × 7.5–39 µm; underlying context lacunose with hyphae with inflated, more elongate cells, (8–)17–30 µm in diam., interwoven. Stipe surface with cylindraceous hyphae, 6–22 µm in diam.; flocci, especially in upper part, formed by hymenial elements comprising basidia. Clamp connections absent.

S.E.M.—Spores smooth or slightly rugose (× 20,000).

Habitat.—Deciduous woodland on calcareous soil.

Described collection.—BELGIUM: Brabants district: Tervuren, under *Fagus* and *Carpinus*, beside a pond, 31.08.1989, *Heinemann 8172* (BR).

Other collections examined.—BELGIUM: Brabants district: Hoeilaart, Zoniënbos, 12.10.1970, *Heinemann 4931*; Uccle, 20.09.1987, *Heinemann 8038* (BR). Maasdistrict: Han, Belvaux, la Chéfiri, 02.10.1970, *Kuyper 1207* (L); Nismes, Matricolo, 12.09.1971, *Heinemann 5102* (BR); Couvin, 25.09.1970, *Heinemann 4893* (BR); Couvin, 18.09.1975, *Marchal 75.163* (BR).

FRANCE: Trélon (Nord), forêt de Trélon, 13.09.1981, *Heinemann 7302* (BR); Pont-de-Claix (Isère), 12.08.1987, *Garcin s.n.* (BR).

Details of the analyzed collections permit us to complete the description of *B. depilatus* based on *Heinemann 8172*.

The pileus is velvety and sometimes minutely cracked. This can be explained by the microscopical pileipellis-structure. With age the surface becomes somewhat scrobiculate i.e. with small shallow depressions. Occasionally vinaceous reddish tints are observed; the narrow outer margin may be reddish brown. The hymenophore is at first decidedly clear yellow. The context sometimes shows no blueing; a vinaceous red tinge may occur under the pileipellis. The

Figs. 12, 13. Pileipellis structure. — 12. *Boletus impolitus* (*Léonard 6904*). — 13. *B. depilatus* (*Marchal 75.163*).

Figs. 14, 15. Stipitipellis structure. — 14. *B. impolitus* (*Kuyper 1640*). — 15. *B. depilatus* (*Kuyper 1207*).

Figs. 16, 17. Cheilocystidia. — 16. *B. depilatus* (*Heinemann 8172*). — 17. *B. impolitus* (*Bas 8405*).

Figs. 18, 19. Pleurocystidia and hymenial elements of *B. depilatus*. — 18. Deeply in the tubes (*Heinemann 8172*). — 19. Near the pores (*Kuyper 1207*).

(Figs. 12, 13, × 350; Figs. 14–19, × 875).

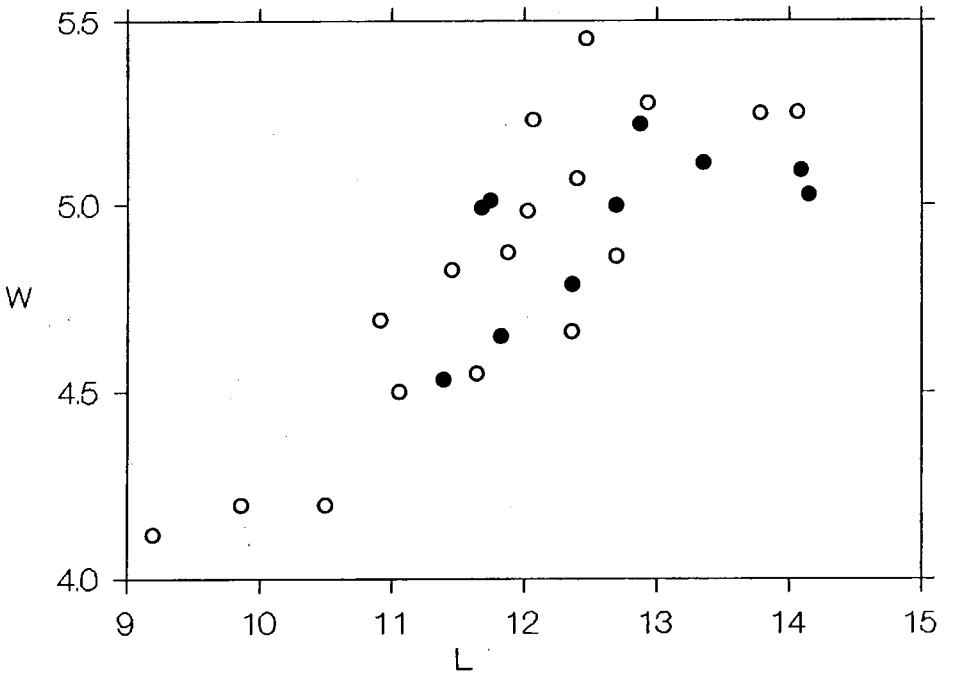


Fig. 20. Comparison of the spores of *Boletus impolitus* (○) and *B. depilatus* (●); x-axis: mean length in µm; y-axis: mean width in µm.

smell is sometimes formally iodoform-like or iodine-like at the base of the stipe; the exsiccatum (recently made) has a somewhat nauseous melleous smell. The taste is mild, bolete-like.

Microscopically the lacunose structure of the underlying context of the pileipellis does not exist in younger sporophores.

Illustrations of *B. depilatus* are very scarce. Old plates attributed to *B. impolitus* may represent *B. depilatus* as well, but in the absence of herbarium material assimilations are doubtful. Redeuilh (1986) gives two plates from which only one figure (middle right of plate 241) has an acceptable colour, the other carpophores being printed with a dominating blue tinge. Estades & Lambert (1986) published a plate which is too red; this plate has been, equally badly, reproduced in a calendar of the Fédération Mycologique Dauphiné-Savoie (January 1989). The plate of Peltereau, reproduced by Redeuilh (1986), has the correct colours but could just as easily be *B. impolitus*.

HABITAT AND DISTRIBUTION

Both species are, at least locally, limited to more or less calcareous substrates, *B. depilatus* perhaps more strictly than *B. impolitus*.

In our region, thermophily and calcarophily are not easily separated. *Boletus depilatus* is possibly a southern species whose northern limit lies in Belgium where it appears sporadically in warmer habitats.

Boletus impolitus is rare in the Netherlands (Arnolds, 1984). The rather numerous collections are made in a limited number of localities, apparently well known to the Dutch mycologists, indicating that the species is constant in these habitats.

In Belgium, *B. impolitus* is formally reported for the first time by Léonard (1977) in the National Botanical Garden, Meise. This species is subsequently reported nearly every year at the same place. It has to be considered as a rare species, the senior author (P.H.) never collected it himself in more than 50 years.

DISCUSSION AND CONCLUSIVE REMARKS

If the affinities of these two boletes is out of discussion, their taxonomic position, even so, remains unreliable.

The delimitation of Bolete genera is far from being solved. Two tendencies exist: recognizing a large number of small genera or only a few 'traditional' ones. The difference between both tendencies is not that important: authors using a large genus concept are obliged to create infrageneric taxa corresponding generally to the small genera of the splitters.

Boletus impolitus has been assigned to at least three genera: *Boletus, Xerocomus,* and *Leccinum.* For the time being we reserve judgement, some characters (e.g. the structure of the tube trama) have to be studied in more detail for the boletes. Recently, Šutara (1989) using the anatomical structure of the stipitipellis, places both species in *Leccinum* and considers *B. impolitus* a synonym of *Leccinum fragrans* (Vitt.) Šutara.

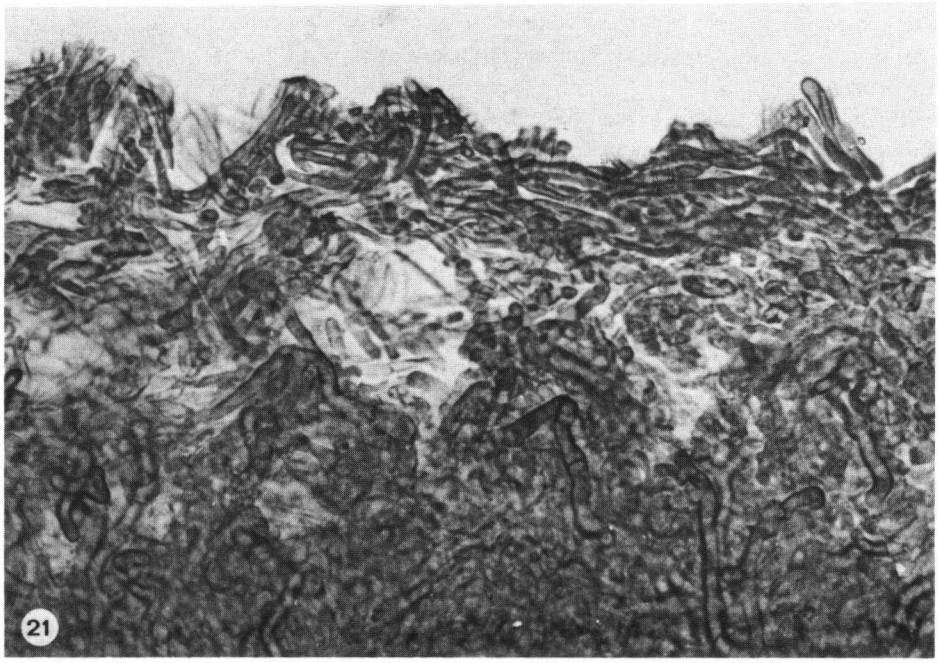
Boletus impolitus and *B. depilatus* are very closely allied species which share most of their macroscopic and microscopic characters. The pileipellis structure is the most reliable diagnostic character.

Redeuilh (1986) groups both species in a 'stirpe impolitus' of *Boletus.* This 'stirpe' is essentially characterized by the finely flocculose stipe, the ± chemical iodoform-like smell at the base of the stipe, the yellow pores exhibiting the same general coloration and discoloration, a blueing generally being absent or being only very faint. The hymenial characters are not distinctive with regard to other Boleti. Macroscopically, the distinctive characters are mostly quantitative: colour range, scrobiculation of the pileus. The aspect of the pileus surface seen under a good lens allows one to guess the microscopical structure. The most obvious macroscopical feature, yet one that is not always adequate, is the shape of the stipe which is generally attenuated and nearly rooting in *B. depilatus* (Figs. 1, 2).

Spores and spore dimensions are not distinctive as shown in Table I and Fig. 20.

The slightly larger dispersion of the spore dimensions of *B. impolitus* (Fig. 20) cannot be regarded as being important. Both collections with the mean length lower than 10 µm concern very young specimens in which it is hard to find sufficient spores that can be considered to be mature.

The pileipellis structure is until now the best character to separate the two species (Figs. 3–5, 9–11, 12–13). The structure is slightly age-dependent and is best observed in young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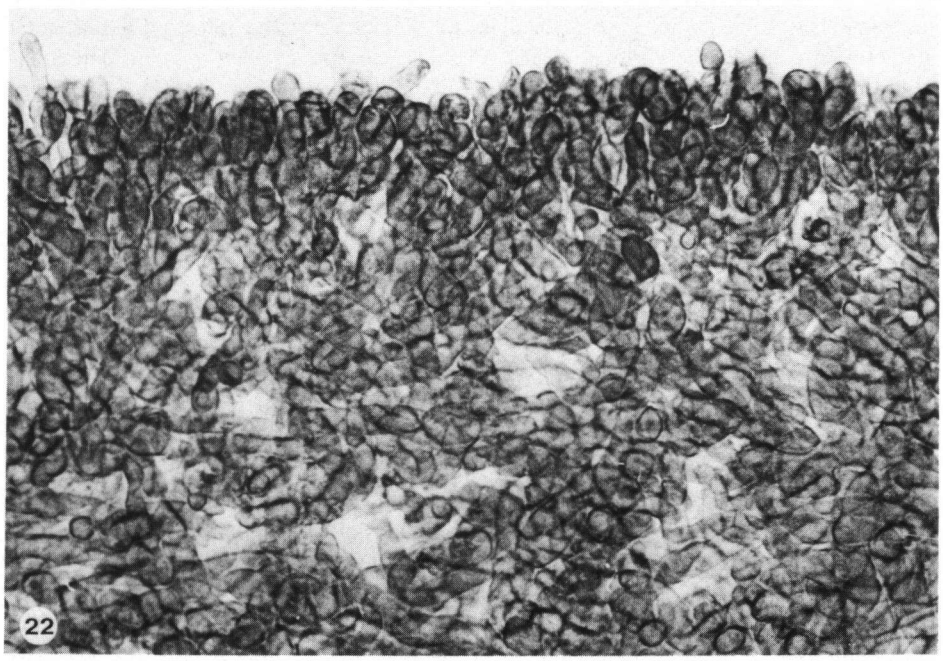
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Table I: Spore parameters based on the measurements of 30 spores in side-view. L: length; Ls: standard deviation on length; W: width; Ws: standard deviation on width; Q: L/W; Qs: standard deviation on Q.

Boletus depilatus					
L	Ls	W	Ws	Q	Qs
Heinemann 7302					
11.39	1.05	4.53	0.31	2.51	0.23
Heinemann 4931					
11.74	0.65	5.01	0.35	2.35	0.16
Heinemann 8172					
11.82	1.23	4.65	0.39	2.56	0.37
Heinemann 8038					
12.36	1.15	4.79	0.28	2.58	0.23
Marchal 75.163					
12.69	0.80	5.00	0.27	2.54	0.17
Garcin s. n.					
12.88	0.54	5.22	0.24	2.46	0.11
Heinemann 5102					
13.35	1.26	5.12	0.26	2.61	0.24
Kuyper 1207					
14.09	0.80	5.10	0.47	2.78	0.22
Heinemann 4893					
14.15	1.15	5.03	0.38	2.82	0.27
mean					
12.62	–	4.94	–	2.55	–
Boletus impolitus					
L	Ls	W	Ws	Q	Qs
Arnolds s. n.					
9.19	0.84	4.12	0.38	2.23	0.16
Bas 7212					
9.86	0.51	4.20	0.24	2.35	0.12
Schutz s.n.					
10.49	1.04	4.20	0.24	2.50	0.26
De Vries s. n.					
10.91	1.11	4.69	0.33	2.32	0.15

Boletus impolitus (continued)					
L	Ls	W	Ws	Q	Qs
Heinemann 2937					
11.05	1.03	4.50	0.25	2.45	0.18
Kuyper 2216					
11.45	0.49	4.83	0.28	2.37	0.15
Bas 7784					
11.64	0.78	4.55	0.24	2.56	0.13
Huysman s. n.					
11.88	1.51	4.87	0.39	2.43	0.24
Kuyper 2811					
12.02	0.65	4.99	0.22	2.41	0.15
Bas 7637					
12.06	0.56	5.23	0.44	2.32	0.24
Daams 74.51					
12.36	0.62	4.66	0.18	2.65	0.17
Tjallingii s. n.					
12.40	2.07	5.07	0.66	2.45	0.30
Bas 8405					
12.45	0.83	4.87	0.28	2.56	0.15
Schreurs s. n.					
12.47	1.09	5.45	0.56	2.30	0.22
Piérart 75791					
12.69	1.45	4.89	0.30	2.61	0.31
Rammeloo 8194					
12.93	0.81	5.28	0.31	2.45	0.19
Heinemann 7330					
13.78	1.05	5.25	0.30	2.62	0.16
Schreurs s. n.					
14.06	1.26	5.25	0.33	2.68	0.22
mean					
11.87	–	4.83	–	2.46	–

specimens. The underlying context, just beneath the most superficial hyphae, is lacunose in the specimens described but the examination of young sporophores did not confirm this peculiarity. The lacunose state is formed with ageing. Nevertheless there is a clear-cut difference in the context, even in young sporophores. In *B. impolitus* the hyphae are ± cylindrical whereas in *B. depilatus* they are inflated. Other microscopical characters have proved to be of no diagnostic value.

Figs. 21, 22. Pileipellis structures. — 21. In *B. impolitus* (*Kuyper 1640*). — 22. In *B. depilatus* (*Garcin s. n.*).

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