

**AGARICUS GEESTERANI, SPEC. NOV.  
A VERY REMARKABLE AGARIC DISCOVERED IN THE NETHERLANDS**

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*Agaricus geesterani*, a new species, is described from material collected at three localities in the Netherlands. It combines strong colour-reactions, a well-developed colouring universal veil, and long (sub)capitate cheilocystidia with *A. bitorquis*-like basidiocarps. The new section *Magici* is created for it.

For several years now a very striking agaric is known to occur in the Netherlands that baffles every mycologist who has the luck to see it. As one of us (P. H.) never had this luck, the present study is based on thorough examinations of the material by the other author, while for the rather precarious taxonomic decisions both authors are to be held responsible.

At first sight the present species resembles a large *Agaricus bitorquis*, but on closer examination the differences are obvious and manifold. There is however no doubt about the fact that it belongs to the Agaricaceae. It combines microscopical characters of the (sub)tropical genus *Micropsalliota* with a type of basidiocarp like that of the heaviest species of *Agaricus*. We think, however, that it should not be classified in *Micropsalliota* but in *Agaricus*, where because of its aberrant characters a new section has to be created for it.

***Agaricus* section *Magici* Bas & Heinem., sect. nov.**

Basidiocarpus grossus, firmus, ponderosus. Pileus valde carnosus, margine crasso, involuto praeditus. Lamellae liberae, confertae, sordide cremeae vel purpureo-badiae, in exsiccatis nigrescentes. Stipes crassus solidus, exannulatus, cingulis vel squamis volvae deorsum ornatus. Caro albida, primo confestim flavescens, dein lente vivescens. Sporae glabrae, crassitunicatae, aporae, endosporio apice lentiforme incrassato. Cheilocystidia filiformia, frequenter (sub)capitata. Reactio Schaefferi purpurea. Typus: *Agaricus geesterani* Bas & Heinem., spec. nov.

Etymology: From *magicus* = magic, because of the remarkable colour changes of the context.

Basidiocarps large, firm, and heavy. Pileus very fleshy with margin at first involute and exceeding lamellae with thick sterile rim. Lamellae free, crowded, from sordid cream

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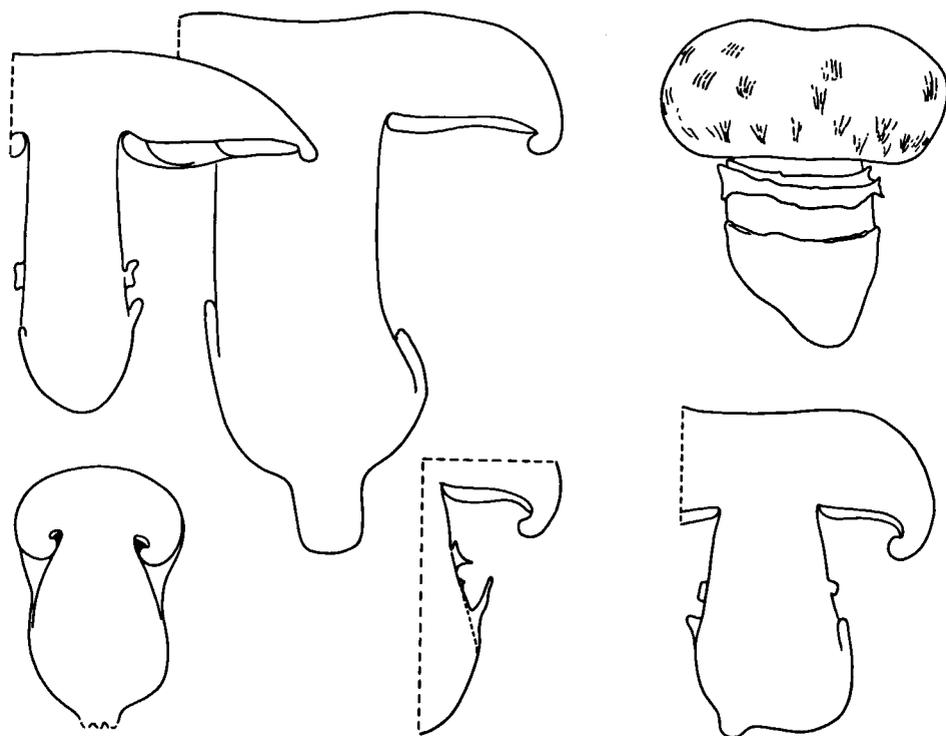


Fig. 1. *Agaricus geesterani* (type). Basidiocarps ( $\times 0.5$ ).

to purplish red-brown, blackening on drying, with pallid edge. Stipe thick, solid, without annulus but with felted-fibrillose volval girdles or scales on lower part. Context whitish but immediately turning bright yellow on cutting, then slowly turning vinaceous pink.

Spores smooth, thick-walled, often with internal lens-like thickening at apex, without pore. Cheilocystidia abundant, long and slender, often (sub)capitate.

Macrochemical colour reactions:  $\text{NH}_4\text{OH}$  25% immediately bright blue-green to greyish blue-green; aniline rather rapidly dark grey; aniline  $\times \text{HNO}_3$  (Schaeffer reaction) deep purple.

Type species: *Agaricus geesterani* Bas & Heinem.

*Agaricus geesterani* Bas & Heinem., *spec. nov.* — Pl. 1, Figs. 1–3

Pileus 90–150(–200) mm latus, valde carnosus, primo hemisphericus, postea convexus, centro applanatus vel leviter depressus, margine sterili 3–5 mm crasso diu involuto, initio volva coactomembranacea, albida vel roseo-brunnea tectus, sed posterior fragmentis volvae squamiformibus, roseo-brunneus vel vinaceo-brunneus fere ornatus, siccus. Lamellae liberae, confertissimae vel conferatae, angustae vel modice latae (3–10 mm), longe sordide cremeae vel isabellinae, denique sordide rubro-brunneae vel purpureo-badiae. Stipes 55–180(–250)  $\times$  22–40(–60) mm, (sub)cylindraceus, solidus, saepe ad basem connatus, exannulatus, albidus vel sordide vinaceus, deorsum volva coac-

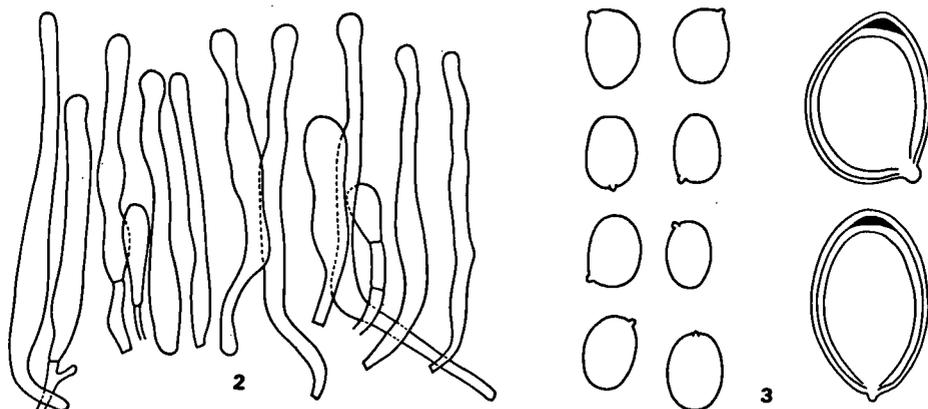


Fig. 2-3. *Agaricus geesterani* (type). — 2. Cheilocystidia ( $\times 550$ ). — 3. Spores ( $\times 1250$  and  $\times 3000$ ).

tato-membranacea, sordide roseo-bubalina vel brunneo-vinacea seu brunneo-lateritia, initio appressa et vaginata, dein cingulis vel squamis diffracta praeditus. Caro perfirma, albida, primo confestim flavescens, dein lente vivescens. Odor leviter gratus tum subfetidus, atque lintea recente lavata ab percussione. Sapor indistinctus vel leviter acidulo-nucioides tum dulcidulus. Sporae in cumulo sordide licacino-brunneae. Reactiones chemici caronis: Anilinum — cinereae;  $\text{NH}_4\text{OH}$  — lazulini-viridae; reactio Schaefferi purpurea.

Sporae  $7.1-8.3 \times 4.8-5.6 \mu\text{m}$ ,  $Q = 1.35-1.6$ ,  $\bar{Q} = 1.4-1.55$ , pallide brunneae vel brunneae, aporae, glabrae, crassitunicatae, endosporio apicale plus minusve lentiforme incrassato. Cheilocystidia  $50-85 \times 3-10 \mu\text{m}$ , filiformia vel anguste lageniformia, (sub)capitata, capitulis 2-4(-6)  $\mu\text{m}$  latis. Pleurocystidia nulla. Pileipellis cutiformis, hyphis 4-20  $\mu\text{m}$  latis composita.

Typus: 'C. Bas (6210) & H. J. van der Laan, 11 Oct. 1973, Netherlands, prov. Noord-Holland, Amstelveen, Amsterdamse bos' (holotypus, L; isotypus, BR).

Etymology: Named in honour of Dr. R. A. Maas Geesteranus, dedicated taxonomist, first of lichens, later of macrofungi, inspiring teacher and colleague.

Basidiocarps large, firm, very heavy (largest specimen found by J. Reijnders: pileus 200 mm, stipe  $250 \times 60$  mm, weight c. 1 kg), long-persisting, growing in clusters arranged in fairy rings, developing rather deep in and bursting out of heavy soil, often lifting large clods of soil on pileus.

Pileus 90-150(-200) mm in diam., thick-fleshed (up to 30 mm thick above proximal ends of lamellae), hemispherical to convex soon becoming (sub)truncate because of early flattened or slightly depressed centre, at first with involute, then inflexed, finally straight margin with conspicuous, 3-5 mm thick, whitish to pale marginal rim, in young stages covered with whitish to very pale or pale brownish-pinkish, but soon darker pinkish brown to sordid vinaceous red-brown (Munsell 5 YR 6/4, 5/6, 2.5 YR 5/4, 4/4) or at centre even dark purple-brown (2.5 YR 3/2, 3/4, 2.5/4) felted layer in some pilei remaining entire and then mature pileus unevenly pale to dark sordid vinaceous red (10 R 5/6, 4/6, 4/4), but mostly with felted layer breaking up into often rather vague  $\pm$  multangular, appressed patches at centre and more pronounced, appressed, usually pointed, subim-

bricate, fibrillose scales towards margin on whitish to pinkish, pinkish-brownish or sordid vinaceous background, dry even after rains, without traces of partial veil except perhaps in very young stages with some inconspicuous, fluffy, white tissue between involute part of margin and stipe.

Lamellae free, very crowded to crowded (14–18.... 22 per 10 mm half-way radius of pileus; 1 = 0–3), long remaining very narrow to narrow (3–6 mm), but finally moderately broad (up to 10 mm), rounded near stipe, free to just touching but not connected with apex of stipe, acute near margin of pileus, sordid cream when very young, slowly becoming pale isabella (10 YR 7/4, 2.5 Y 7/4 or slightly browner) and long remaining so, then pinkish clay brown (7.5 YR between 5/4 and 5/6), finally dark reddish clay brown (7.5 YR 4/4) to rather dark purplish red-brown (5 YR 4/4 to 4/6), with thin, white to pallid, sometimes somewhat uneven edge, in some freshly picked basidiocarps with watery yellowish-brownish droplets and probably therefore later on with scattered minute red-brown spots along edge, with old bruises becoming very dark dull reddish to purplish brown, after drying completely conspicuously blackish purple-brown (5 YR 2.5/2) sometimes with blue-grey reflexion.

Stipe 55–180(–250) × 22–40(–60) mm, at first somewhat broadening downwards but later (sub)cylindrical with not or hardly enlarged base, rarely tapering downwards, solid, firm, often connate at very base and then basal part slightly bent, from whitish to pinkish cream, later with very pale to rather strong pinkish-brownish to sordid vinaceous pink tinges, minutely concolorously flocculose at upper half or third, exannulate (partial veil absent or rudimentary also in very young stages), but lower part covered with felted-fibrillose, thick volval layer usually breaking up into one, two or three incomplete to complete girdles often with one or two projecting edges, sometimes with rings of flat volval patches, and these volval remnants colouring from sordid pinkish buff (7.5 YR 7/4) to sordid brownish vinaceous pink (5 YR 5/4) to brownish-vinaceous brick red (2.5 YR 5/6); mycelial fluff at extreme base first yellowish then pale pink.

Context very firm and heavy, whitish but when cut or scratched almost immediately turning deep yellow (chrome-yellow, K. & W. 2A6 to almost 2A7) in centre and outer margin of pileus and in base of stipe, paler in other areas (2A4–A5), after about 1 min. already paling, after about 2 min. merely pale sordid yellowish, then slowly turning vinaceous pink (sometimes as bright as Munsell 10 YR 5/6). Smell spontaneously weak but pleasant, nutty or even somewhat like anise, in old specimens more unpleasant to sometimes fishy, after cutting immediately strong like freshly washed linen, washing powder, or slightly scented soap, but in older specimens somewhat earth-like with unpleasant component. Taste indistinct to weakly sourish nutty when young but later slightly sweetish. Spore print moderately dark lilacinous grey-brown (5 YR between 4/2 and 4/3), later more greyish lilacinous brown (5 YR 4/3–4/4 to 7.5 YR 4/4).

Macrochemical tests on context: Aniline: rather rapidly dark grey, sometimes with slight bluish or greenish tinge. — Formaline 35%: slowly restoring bright yellow colour after changing of context to pink. — Gaiac: no reaction (solution perhaps too old); blue-green according to Dr G. A. de Vries. — Concentrated HCl, HNO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub>: no or very weak reaction. — KOH 5%: slowly dark greyish olive; 30%: brown with blue-green outer circle. — NaOH 30%: brown with greyish green outer circle. — NH<sub>4</sub>OH 25%: on yellow context immediately bright blue-green; on pink context immediately greyish blue-green; on pileipellis blackish olive. — Phenol and phenol-aniline: no reaction. — Schaeffer-reaction deep purple (K. & W. 12D7–11E7), but on yellow context sometimes weak (when narrow streaks of aniline and HNO<sub>3</sub> are crossed this remarkable colour-change may escape attention because of grey discoloration caused by aniline).

Spores [45/5/3](6.7–)7.1–8.3(–8.9) × 4.8–5.6 μm, Q = 1.3<sup>5</sup>–1.6(–1.7),  $\bar{Q}$  = 1.4–1.5<sup>5</sup>, in profile subellipsoid-subovoid to ovoid, in face view ovoid, without germ

pore, with rather small, abrupt apiculus, pale to moderately dark brown in water and  $\text{NH}_4\text{OH}$ , pale sordid greenish-yellowish in  $\text{KOH}$ , thick-walled (c.  $0.4\text{--}0.6\ \mu\text{m}$ , at least 2-layered) with slight, somewhat lens-like thickening in wall at apex, smooth, in dried material a few spores weakly dextrinoid but stronger so in fresh material, congophilous and cyanophilous when young, only a few relatively young ones somewhat metachromatic in cresyl blue but these with distinctly metachromatic inner wall layer when crushed; in mounts young spores often in tetrads.

Basidia ( $25\text{--}32\text{--}40\text{--}48$ )  $\times$   $8.5\text{--}11\ \mu\text{m}$ , 4-spored, clampless, narrowly clavate, in dried material res soaked in  $\text{NH}_4\text{OH}$  with scattered, small, dark brown, short rod-like, intracellular particles (necropigment), not siderophilous.

Cheilocystidia very abundant, in tufts, rendering lamella edge sterile, ( $42\text{--}50\text{--}85\text{--}95$ )  $\times$   $3\text{--}10\text{--}11.5\ \mu\text{m}$ , with  $3\text{--}7\text{--}9.5\ \mu\text{m}$  wide capitula and  $2\text{--}4\text{--}6\ \mu\text{m}$  wide necks, filiform to very slenderly lageniform, more rarely lageniform or clavate, frequently somewhat irregularly shaped, often subcapitate to capitate, thin-walled but wall of capitulum very slightly thickened, metachromatic in cresyl blue. Pleurocystidia absent.

Hymenophoral trama regular, made up of densely packed  $4\text{--}10\ \mu\text{m}$  wide, thin-walled hyphae often slightly inflated near septa, colourless in water, in res soaked dried material pale brown in  $\text{NH}_4\text{OH}$ , slightly dextrinoid after a few hours in  $\text{NH}_4\text{OH}$  10%; subhymenium rather narrow, up to  $20\ \mu\text{m}$  wide, ramose-subcellular.

Pileipellis consisting of interwoven (particularly near surface) to subradial,  $4\text{--}20\ \mu\text{m}$  wide, frequently septate, repent hyphae with slightly thickened wall, in outer layer (probably = universal veil) with heavily incrusting pigment (fresh: orange-brown in water; dry: sordid yellow-brown to brown in  $\text{NH}_4\text{OH}$ , olive brown in  $\text{KOH}$ ), in inner layer with small incrusting granules and additional intracellular pigment brownish in  $\text{NH}_4\text{OH}$ .

Trama of stipe regular, made up of up to  $20\ \mu\text{m}$  wide, thin- to slightly thick-walled, colourless to (in  $\text{NH}_4\text{OH}$ ) pinkish-brownish hyphae. Apical part of stipe with caulocystidia similar to cheilocystidia but somewhat more variable and tending to elongate. Mycelial fluff at base of stipe (among soil particles) pale pink, dimitic, consisting of up to  $7\ \mu\text{m}$  wide, thin-walled hyphae and  $2\text{--}3\ \mu\text{m}$  wide, thick-walled (almost up to  $1\ \mu\text{m}$ ), non-septate, congophilous and strongly cyanophilous skeletal, with abundant, pale brown, short rod-like, extracellular pigment bodies: skeletal in some samples scarce, in others abundant.

Tissue cultures on malt agar growing very slowly (c.  $1\text{--}2\ \text{mm}$  per week at c.  $20^\circ\text{C}$ ), pale greyish with pale brown centre, sometimes with pinkish tinge, consisting of septate, clampless, thin- to slightly thick-walled, cylindrical or towards septa slightly swollen hyphae sometimes with contents strongly colouring in cotton blue.

Habitat & distribution. — In rather young, planted deciduous woods and lanes on rich, heavy, clayey soil and rather loose, very humus-rich sandy soil. At type locality under *Fraxinus*, *Quercus*, *Crataegus*, *Sambucus*, etc.; later found under *Populus* (Flevoland) and under *Fraxinus*, *Quercus*, *Ulmus*, *Acer*, *Crataegus*, etc. (Maarsveen). Aug.—Oct., but basidiocarps in mild winters persisting till late winter; seems to fruit best after warm summers. Known now from 3 localities in the Netherlands: at Amstelveen observed over a period of more than 10 years and in 1983 on two spots.

Collections examined. — NETHERLANDS: prov. Noord-Holland, Amstelveen, Amsterdamse bos, 11 Oct. 1973, *C. Bas* (6210) & *H. J. van der Laan* (holotype, L; isotype, BR) and 19 Sept. 1974, *H. J. van der Laan* (L); prov. Utrecht, Maarsveen, 23 Aug. 1983, *P. J. Keizer* (L); prov. IJsselmeerpolders, Zuidelijk Flevoland, Spiekweg, 23 Aug. & Sept. 1983, *H. J. Wichers* (L).

*Agaricus geesterani* is highly characterized by: (i) its very heavy, long-persisting basidiocarps, (ii) the absence of a partial veil, (iii) the discolorations of its context as well as

its colour reactions to several chemicals, (iv) its long and slender (sub)capitate cheilocystidia, (v) the apical lens-like thickening in the wall of its spores, and (vi) its weak sporulation.

Depending on which of these characters one wishes to emphasize one is led<sup>1</sup> to *Agaricus* sect. *Agaricus* subsection *Bitorques* or to *Micropsalliota*.

As for *Micropsalliota* of which the members have basidiocarps that are typically mycenoid or collybioid and short-lived, we believe the resemblances between *A. geesterani* and that genus are a matter of convergency. It should be mentioned that an apical thickening in the wall of the spores occasionally occur also elsewhere in *Agaricus* (e.g. *A. campestris*, *A. bingensis*, *A. trisulphuratus*) and that rather long, sinuous, even subcapitate cheilocystidia are also to be found in some species of that genus, particularly in several species of subsection *Bitorques* (*A. bernardii*, *A. maleolens*).

If we neglect the immediate, brightly yellow discoloration of the context and the apical thickening in the spore wall, *A. geesterani* fits subsection *Bitorques* very well on account of the universal veil forming volva-like remnants on the lower part of the stipe (Fig. 1), the reduced or (nearly) absent partial veil, the thick marginal rim of the pileus and the heavy basidiocarps. In view of the fact that the infrageneric classification of *Agaricus* is mainly based on the discoloration of the context, we feel however that in this respect *A. geesterani* differs so strongly that classification in a new section of *Agaricus* is required.

The felted volval layer that in *A. geesterani* at first covers the pileus (and the basal part of the stipe) recalls subgenus *Lanagaricus* in which some species moreover show a bright yellow discoloration of the context. But till now in that subgenus no species are known with volval girdles at the base of the stipe. Nevertheless subordination of sect. *Magici* to subgenus *Lanagaricus* may be considered.

In the basidiocarps studied in fresh condition sporulation started late and was rather weak, causing the lamellae to remain pale for a very long time and making it difficult to obtain a good spore print. We never before encountered in *Agaricus* such a scarcity of spores on mature basidiocarps. It is remarkable that this phenomenon seems to go hand in hand with an aberrant morphology of the subhymenium.

In Agaricaceae, particularly in *Agaricus* the mature subhymenium is typically round-celled, each terminal cell bearing several basidia. Ontogenetically, however, the very young subhymenium is ramose and becomes gradually round-celled when the basidia are maturing (Rammeloo, 1985). This process is also noticeable at the edge of the lamellae of mature basidiocarps where the subhymenium may still be subramose, whereas it is always round-celled at some distance away from the edge.

It seems that in *A. geesterani* the (sub)ramose state of the subhymenium is permanent all through the life of the basidiocarps. This may be a characteristic of the species but may also be due to the species being introduced in the Netherlands and not finding here the optimal conditions for sporulating.

<sup>1</sup>For a key to *Micropsalliota* and *Agaricus* and its infrageneric taxa, see Heinemann (1979).

It is amazing that such a large and conspicuous unknown agaric could be discovered in the 'Amsterdamse Bos', a park near Amsterdam, only a few decades old and frequently visited by mycologists. The large fairy ring of basidiocarps in 1973 suggested that at that time the species had been growing there already several years. Even more surprising was the discovery of the same species in 1983 at two localities at a distance of about 25 and 45 km from the first and about 35 km apart. Here again this remarkable fungus was found in relatively young forest plantations on rather rich soil.

We must assume that *A. geesterani* has recently been introduced in the Netherlands. The fact that the international airport of Amsterdam is only a few kilometers away from the first discovered locality may have something to do with that. More than 10 years already it is able to survive the climatical conditions of the Netherlands and it seems even to be spreading. Besides at the two new localities mentioned, *A. geesterani* was in 1983 still growing at the first locality and also at another spot at about 200 m distance away from it.

At the original locality *A. geesterani* fruits particularly rich near the base of a small building containing transformers; probably the soil is there slightly warmer and drier. The basidiocarps usually grow in clusters rather deep in the soil and start expanding their pilei already before emerging (in which they do not always succeed). Cracks in the soil indicate places where clusters of basidiocarps have started to expand. In relatively dry periods the basidiocarps persist for a long time and are sometimes still visible, and because of size and reddish colours still recognizable, at the end of the winter.

In literature the only illustration we found somewhat resembling *A. geesterani* is that published under the name *A. pequinii* in the Bollettino del Gruppo Micologico «G. Bresadola» 26: 192 (1983) and again in Lazzari, Atlanta Iconografico 1981–1983: 240 (1985). Size and colour of the basidiocarp there depicted resemble that of an overmature basidiocarps of *A. geesterani* but the volval remnants at the base of the stipe are hardly visible and the characteristic, rapid, bright yellow discoloration of the context preceding the slow discoloration to pink is not mentioned (collection: Oct. 1982, Bellinzago, Novara, Italy).

The original *Chitonina pequinii* Boud. certainly is different from the present species and is generally accepted as a member of *Agaricus*, viz. as an independent species (e.g. Singer, 1975: 462; Møller, 1950: 16) or as identical with *A. bitorquis* (Pilát, 1951: 27).

An extensive search in literature did not reveal an earlier description of the present species. Singer (1975: 460) mentioned *Pholiota fulvosquamulosa* Peck and *Stropharia kauffmanii* A.H. Smith as a group of fungi suggested by Smith & Hesler (1968: 185) to represent an undescribed genus close to *Agaricus*. But according to Redhead (1984: 250) the first is a true *Agaricus* identical with *A. subrufescens* Peck and the second a good species of *Stropharia*.

Another volvate species of *Agaricus* is *A. volvatus* (A. Pears.) Heinem. described by Pearson (1950) from South Africa, but that has the context immediately turning blood red and shorter more clavate cheilocystidia.

## ACKNOWLEDGEMENTS

We are very grateful to Mr. H. J. van der Laan (Amsterdam), who was the first to discover *Agaricus geesterani*, for drawing our attention to this curious fungus. Thanks are also due to Mr. A. M. Brand (Leiden), Mr. P. J. Keizer (Utrecht), Mr. J. Reijnders (Badhoevedorp), Dr J. A. Stalpers (Baarn), Mr. H. R. Visscher (Horst), Dr G. A. de Vries (Baarn), and Mr. H. J. Wichers (Eefde) for material, documents, and pictures kindly put at our disposal.

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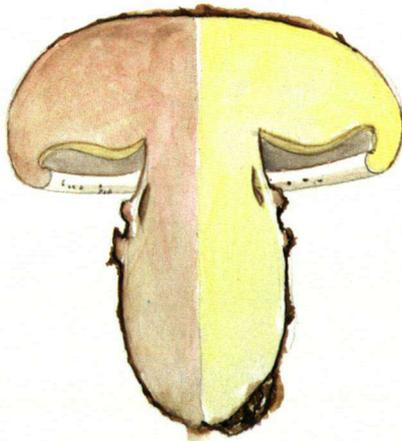


Plate 1. *Agaricus geesterani* (type). — Basidiocarps ( $\times 2/3$ ). Discoloration of context in right half of lower basidiocarp immediately after sectioning, in left half about 5 minutes later.