

## *Agaricus* Studies VII.

By G. BOHUS

Természettudományi Múzeum Növénytár, H-1146 Budapest, Hungaria

### A. The problem of *Agaricus crocodilinus*—*kuehnerianus*—*macrosporus*

About 100 kg of a very fresh mushroom has been conveyed on 10 June, 1975, from the neighbourhood of the Szelidi Lake to a market in Budapest. <sup>1)</sup> This material, grown in the meadow, allowed a study of the problems posed by *A. crocodilinus* and *A. kuehnerianus*. In our material, the diameter of the pileus was 10—30 cm, but some specimens reached even 50 cm. Among the younger specimens, there were some highly similar to the figure published by LANGE (1939, Tab. 139 C), while among the older ones some showed a cap surface agreeing with HEINEMANN'S description concerning *A. kuehnerianus* (1974), as follows: "on observe quelques longues crevasses radiales, puis se crevassant en profondeur en grosses squames pyramidales". A detailed description was made of the collected material, and specimens of various stages of development have also been conserved by our method, among them an exemplar with a cap exceeding 30 cm in diameter.

The reddening of the flesh, the yellowing of the pileus surface, the large stature and the thick flesh, when young, the fine and dense scales at least towards the margin of the pileus, the squamules or scales of the stem, the large spores, the special marginal cells and the habitat in meadows or pastures are the complex of features which characterize *A. macrosporus*.

A discussion of the problems on the basis of characteristics:

#### a. Colour and colour-changes of the flesh

##### *A. macrosporus*

Hungarian material: white, in pileus mostly unchanging, in stem changing more or less rusty flesh colour.

ss. BRESADOLA (1931): "albida, in stipite vero fracta ochraceo-sublateritia"

ss. LANGE (1939): It is not mentioned.

ss. MOELLER (1951): "white, shot with flesh colour or rust, when cut in the stem"

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<sup>1)</sup> In the followings: „Hungarian material“, preserved in the herbarium (PB) of the Botanical Department, Hungarian Natural History Museum, Budapest.

*A. kuehnerianus*

ss. HEINEMANN (1974): It is not mentioned.

*A. crocodilinus*

ss. SMITH (1939): "white, unchanging"

ss. BON—CHEVASSUT et al. (1974): "un peu rosissante mais vite ocracé brunâtre en haut du stipe et sous la cuticule"

b. Colour and colour-changes of the pileus

*A. macrosporus*

Hungarian material: first white, creamy, then creamy ochre, scales eventually ochre brownish

ss. BRESADOLA (1931): "luride stramineus, mox in squamulis, fulvidulis decorticatus"

ss. LANGE (1939): "white, slightly alutaceous with age"

ss. MOELLER (1951): "white or alutaceous, on hard pressure becoming pale lemon yellow, sometimes in dry weather quite ochre yellow"

*A. kuehnerianus*

ss. HEINEMANN (1974): "blanc ou blanchâtre exsiccatum crème"

*A. crocodilinus*

ss. SMITH (1939): "color white or tinged cinnamonbuff over the disc, the tips of the scales frequently tinged brownish (near avellaneous), no yellow color noted at any stage either when wet or dry"

ss. BON—CHEVASSUT et al. (1974): "d'abord d'un blanc pur puis + ou — jaunissant sur l'extrémité des squames"

On the basis of the two characteristics discussed above, the American *A. crocodilinus* appears to be different, since its flesh does not turn red nor is there any yellow colour "noted at any stage" on its pileus.

Cap diameter

*A. macrosporus*

Hungarian material: 10—30—(50) cm (thickness of stem even 8 cm)

ss. BRESADOLA (1931): 10—20 cm

ss. LANGE (1939): 10—16 cm or more

ss. MOELLER (1951): 10—15 cm

*A. kuehnerianus*

ss. HEINEMANN (1974): 20—50 cm

*A. crocodilinus*

ss. SMITH (1939): 10—35 cm

ss. BON—CHEVASSUT et. al. (1974): 15—30 cm

Cap surface

*A. macrosporus*

Hungarian material: mostly half or two-thirds rather densely with squamules-squames, in some specimens only towards margin, and in one exemplar wholly and densely scaly, then in middle cracking as in *A. bernardii*

ss. BRESADOLA (1931): “mox in squamulis ... decorticatus”

ss. LANGE (1939): “minutely scaly in the outer half”

ss. MOELLER (1951): “markedly floccose-squamose everywhere with concolorous scales, which, however, later partly drop off, in the centre sometimes cracking when dry”

*A. kuehnerianus*

ss. HEINEMANN (1974): “d’abord squamuleux sur toute sa surface, par rupture superficielle en squamules plus ou moins disposées en cercles concentriques, généralement de taille décroissante vers la marge où l’on observe quelques longues crevasses radiales, puis se crevassant en profondeur en grosses squames pyramidales”

*A. crocodilinus*

ss. BON—CHEVASSUT et al. (1974): “cabossée (strobiliforme), surtout au centre”

ss. SMITH (1939): “pressed scales, ... finally the flesh becomes deeply cracked into a series of overlapping scales ..., sometimes the surface remains merely adpressed-fibrillose and smooth (usually on fruiting bodies in shady places)”

Two remarks could be made with respect to the features of the cap:

1. The separation of *A. kuehnerianus* was made partly on the large stature; the extremely large cap diameter can be observed also in *A. macrosporus*.

2. Surface features are to a certain extent depending also on growth stage and weather. (LANGE shows, for example, the characteristics of the young specimens.)

Stem surface

Every author states unequivocally that the stem, originating from the velum below the ring, is covered more or less with squamules, flocci-squames or squames.

A difference against the opinion of the authors cited above can be found only in the description of BON—CHEVASSUT et al. (1974):

“fortement chiné . . . de bagues de plus en plus annuliformes vers la base à la manière des restes de volve d’Amanites” The cause of this statement might have been the irregular formation of the velum of the examined specimens, with the ring also having stuck to the pileal margin.

## Spore dimensions

### *A. macrosporus*

Hungarian material: 9,5—12—(14) × 6—7—(7,5) μm

ss. BRESADOLA (1931): 12—14 × 6—8 μm

ss. LANGE (1939): 9—11 × 5 μm

ss. MOELLER (1951): 8—12—(14) × 5,5—6,5—(7) μm

### *A. kuehnerianus*

ss. HEINEMANN (1974): 9,5—11,5 × (5,7)—6—6,8 μm

### *A. crocodilinus*

ss. BON—CHEVASSUT et al. (1974): 10—13—(15) × 6—7—(7,5) μm

ss. SMITH (1939): 8—11 × 5,7—6,8 μm and comparatively large numbers: 12—16 × 7—8 μm

ss. MURRILL (1912): 11—13 × 6—7 μm

## Characteristics of marginal cystidia

### *A. macrosporus*

Hungarian material: formed of rows or groups of cells: cells spherical, ovoid, ellipsoid to vesiculose; 7—25 × 7—12 μm

ss. BRESADOLA (1931): —

ss. LANGE (1939): “inflated, often formed of rows of cells (like *Saccharomyces cerevisiae*)”

ss. MOELLER (1951): “ovate-balloon shaped, in rare cases clavate, hyaline” On one of his drawings: clavate-vesiculose, on another one spherical-ovoid cells, loosely connected with each other, in several rows (2 different finds). “8—31 × 6—16 μm”

### *A. kuehnerianus*

ss. HEINEMANN (1974): “brunes ou jaunes, simples, de 20—33 × 9—11 μm, ou plus souvent caténulées à élément globuleux ou ellipsoïdes de 7—22 × 6—16 μm, ± incrustées d’un pigment jaune”

### *A. crocodilinus*

ss. BON—CHEVASSUT et al. (1974): “en chaînettes à éléments petits (10—15—20 × 5—12—15 μm)”

ss. SMITH (1939): “42—50 × 7—12 μm, form a sterile band on the margins of the gills”

There is no essential difference in the size of the spores. In this respect, *A. crocodilinus* ss. SMITH and MURRILL displays no essential difference against the European collections cited above. However, the marginal cystids are different, of a relatively large size, and the characteristics of the European material, namely that they are "formed of rows of spherical to ellipsoid cells like *Saccharomyces cerevisiae*" is not mentioned.

On the basis of the preceding survey one may draw the conclusion that *A. crocodilinus* MURR. ss. SMITH differs, on the basis of the known material, in three essential characteristics from *A. macrosporus* (MOELL. et SCHFF.) PILÁT: the flesh is not reddening in the stem, there is no yellow colour on the cap, and the marginal cystids large and different in form. On the basis of agreements, *A. kuehnerianus* Heinem. and *A. crocodilinus* Murr. ss. Bon—Chevassut et al. are identical with *A. macrosporus*. It is rather striking that *A. macrosporus* occurs both in subalpine localities and in low elevations above sea level, on the meadows and pastures of the lowland plains, but some other *Agaricus* species are similar examples.

### B. The problem of *Agaricus tabularis*

Original diagnosis: *Agaricus tabularis* PECK, Bull. Torrey Bot. Club, p. 325, 1898.

"Pileus very thick, fleshy, firm, convex, deeply rimose-areolate, whitish, flesh whitish, tinged with yellow, the areolae pyramidal, truncate, tomentose; lamellae narrow, close, free, blackish-brown when mature; stem short, thick, solid; spores broadly elliptical, 7,5—9  $\mu$  long, 6—7,5  $\mu$  broad, generally containing a single large nucleus."

Pileus 5—10 cm broad; stem 2,5—5 cm long, 1,5—2,5 cm thick.

In clay soil by roadsides, Craig, Colorado, August, F. BETHEL.

"This species is remarkable for the peculiar upper surface of the pileus which is broken into pyramidal areas. The sides of these are marked by parallel lines in such a way that they appear as if formed by small tablets placed one upon another, each successive tablet being a little smaller than the one immediately preceeding it. Only dried and broken specimens have been seen by me and the notes of the collector do not give the color of the young lamellae. There is a trace of a thick annulus on the broken stem of one specimen."

(The spore dimensions of the description should be modified, because A. H. SMITH found them, according to the letter communication in 1975, to be 6,5—8 $\times$ 5—6  $\mu$ m when examining the type-material.)

The name *Agaricus tabularis* PECK was occasionally cited in the literature of the USA and the Soviet Union. In their ecological study, SCHANTZ—PIEMEISEL (1917) published only photographs when using this name. In the Soviet literature, several authors published occurrence data under this name, the earliest LEBEDEVA (1949). ZEROVA (1974) published a coloured figure under the name *A. tabularis* in her atlas.

The kind examination of the type by A. H. SMITH and the study of the Soviet material by S. P. WASSER — to be thanked also in this place — helped to form a clearer picture concerning *A. tabularis*. SMITH's notes on the type are as follows (letter communication): "The species is not well known over here and I doubt if it has been correctly reported" "Type similar to *A. rutilescens* or possibly more robust, color and cap markings the same. The annulus is double. The breaking up of the cap surface is purely a matter of weathering — find other characters — it is apparently fibrillose scaly at first.

Microscopic data on type.

1.) Spores  $6,5-8 \times 5-6 \mu\text{m}$ , broadly ellipsoid, very dark fuscous under microscope;

2.) Sterile cells on gill edge  $30-35 \times 10-12 \mu\text{m}$ , clavate;

3.) Basidia  $18-24 \times 6-7 \mu\text{m}$ , 4-spored, hyaline;

4.) Oleiferous hyphae present;

5.) Gill trama subparallel; subhymenium cellular;

6.) Cap trama homogenous (interwoven hyphae), yellowish in KOH.

Note: Cannot distinguish this from *A. arvensis*, cap character purely a matter of weathering."

As far as the other literature data of *A. tabularis* are concerned, the situation is as follows: *A. tabularis* as recorded by SCHANTZ—PIEMEISEL resembles, as was already remarked by BOHUS (1961), *A. maskae* PILÁT, but it lacks a description. The exsiccatum in our herbarium, a specimen identified by ZEROVA as *A. tabularis* and originating from the Soviet Union, as well as the coloured illustration of ZEROVA's atlas, extremely resembling of the exsiccatum mentioned above, could be interpreted as *A. maskae* PILÁT. This has smaller spores, with dimensions  $7-8 \times 4,8-5,5 \mu\text{m}$ . S. P. WASSER stated, in the course of investigations on fresh material for the sake of interpreting the other data given in the soviet literature, that (letter communication, 1976) some specimens published under the name "*A. tabularis*" is a distinct species, nearly allied to *A. maskae* PILÁT. The spores of these mushrooms are larger than those of *A. maskae*: according to WASSER's measurements  $(7)-8-10 \times 6-7 \mu\text{m}$ . An "*A. tabularis*" of this kind is recorded by VASILKOV (1974), with the spore measurements  $(7,5)-8-10-(12) \times (5,5)-6,5-7,5-(8,5) \mu\text{m}$ .

One may therefore infer that the species *A. tabularis* PECK does not exist.

### C. The problem of *Agaricus dulcidulus*

A study of literature revealed that there are two kinds of *A. dulcidulus*.

The fungus described by SCHULZER (1874) was questionmarked by PILÁT (1951) as *A. rubellus* (GILL.) SACC. (= *semotus* FR.). It seems

that, on the basis of the description and the figure, it really cannot be distinguished from *A. semotus*.

*A. dulcidulus* ss. LANGE (1926, 1939) should be distinguished from the other species of the group *Minores* by the following characteristics: Pileus conico-convex, somewhat umbonate when expanding, set with minute dark brown fibrils. Marginal cystidia ovoid-globose (in the

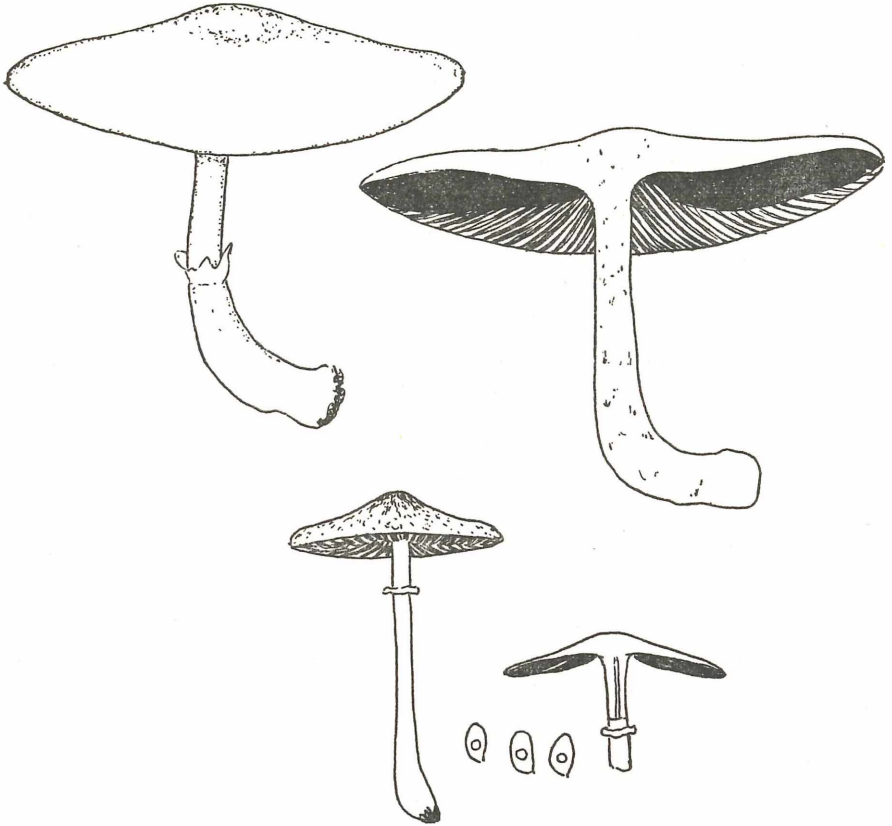


Fig. 1. Above: *Agaricus (Psalliota) dulcidulus* SCHULZER. Sketch executed after KALCHBRENNER—SCHULZER's figures 1 : 1. Below: *Psalliota dulcidulus* SCHULZER. Sketch executed after LANGE's figure 1 : 1

other species of the *Minores*: broadly clavate, balloon-shaped or vesiculose). Stem thin and therefore fruitbody very slender.

Accordingly, it appears to be a well separable species, and therefore its correct name is *A. dulcidulus* ss. LANGE.

For the sake of comparison, I submit the two kinds of diagnosis and the published figures:

KALCHBRENNER, K.—SCHULZER, I. (1874): *Icones selectae Hymenomycetum Hungariae*. Pest, p. 29. Tab. 17/1.

"Ad Magnovaradinum, sub *Quercubus sociatim* degens. Aug. Sept. Stipes subsolidus, fragilis, basi incurvus et subbulbosus, 1—2" longus, 2—3" crassus, glabriusculus, cum annulo membranaceo, medio, persistente, erecto, pileo concolor. — Pileus margine excepto carnosus, e convexo planus, leviter gibbus, 1—2" latus, glabriusculus, siccus, luride albus vel ochraceus, vertice subfuscus vel sordide violascens. — Lamellae liberae, antice latescens, 2" latae, admodum confertae, juniores pallide griseae, demum atrae. Caro alba. Odor suavis. Sapor dulcidulus."

LANGE, J. F. (1926): Studies on the Agarics of Denmark VI. — Dansk Bot. Arkiv, 4, p. 11.

(1939): Flora Agaricina Danica IV. — Copenhagen, p. 61., Tab. 135 C.

"Spores broadly ovate,  $5 \times 3\frac{1}{2}$   $\mu$ . Basidia 4-spored. Sterile cells obovato-spheric, about 10  $\mu$  broad.

Erholm, near Årup, solitary in wood of *Fagus* and *Picea*, Sept. 1913.

Cap only 3 cm broad, conic-convex, then expanding and somewhat umbonate, umbo comparatively fleshy. The fundamental colour of the cap is white (slightly brownish in the middle), but it is everywhere (rather sparsely) set with minute, innate, silky, dark purplish-brown fibrils (especially in the centre). The gills are narrow (2 mm), pallide grey, with a slight flush of brown. The stem is 4—5 cm  $\times$  2 mm (base swollen to about 5 mm), slightly fibrillose-squamulose, whitish, (yellow to the touch), with yellowish flesh and a rather narrow, thin ring."

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Zeitschrift/Journal: [Sydowia Beihefte](#)

Jahr/Year: 1977

Band/Volume: [8](#)

Autor(en)/Author(s): Bohus G.

Artikel/Article: [Agaricus Studies VII. 63-70](#)