

CHLOROPHYLLUM

Else C. Vellinga - vellinga@nature.berkeley.edu

Chlorophyllum Massee is a genus in the family *Agaricaceae*, where *Agaricus*, *Lepiota* and puffballs of the *Lycoperdaceae* and *Tulostomataceae* belong.

Chlorophyllum species form big fleshy mushrooms with the following characters: cap with big, flat, brown or pale scales, made up of erect tightly packed cells, stipe without small bands or other material, with an annulus, spores not-coloured or green, with metachromatic wall in Cresyl Blue, with or (in one species) without truncate germ pore (a depression in the spore wall), pleurocystidia absent, lamella trama trabecular, and in most species clamp-connections present.

Originally the genus only accommodated green-spored species, like the poisonous *Chl. molybdites*. Recently it appeared that some species always reckoned to *Macrolepiota*, like *M. rachodes*, are much closer related to *Chl. molybdites* than to *M. procera*, so they were transferred to *Chlorophyllum*. This conclusion was based on molecular evidence (from DNA sequences) and on the similarities in morphology.

Another new 'face' in the genus is *Endoptychum agaricoides*, which is very close to *Chl. molybdites*; this transfer is based on molecular evidence.

Endoptychum depressum, another *Endoptychum* species, of the dry forests of the Sierras and beyond, is in fact a secotioid *Agaricus* species, and is now called *Agaricus inapertus* (there was already an *Agaricus depressus*). Figure 1 shows the species belonging to *Chlorophyllum* and their relationships (based on ITS sequences). A key to the North American species follows.

Chlorophyllum species are widespread, and they grow often in urban and ruderal habitats.

- *Chl. molybdites* is known from all over the tropics, and expands into the summer-warm and relatively wet or irrigated areas of North America. This is a common lawn species in the east of the USA. It causes **severe** stomach upsets.
- *Chlorophyllum hortense* has many other names and is just as widespread as *Chl. molybdites*; it is known from Hawai'i and North America (as *Leucoagaricus hortensis* or *Lepiota humei*), Africa (as *Leucoagaricus bisporus*), Japan (as *Macrolepiota alborubescens*), and it also occurs in Central and South America, Australia, and in India and other parts of Asia. Considered edible by some, suspect by others.
- *Endoptychum agaricoides* grows in dry areas, like steppes, from China to North America, throughout Europe; this species is considered a good edible by some, but horses and dogs (and people?) can get pretty sick from eating it.
- *Chlorophyllum rachodes* and *Chl. brunneum* are both very widespread. The former is known from Europe and North America, and the second one is found in Europe, North America, and Australia. Other records from these species might be this or another species, and should be checked. These two species are eaten, but adverse reactions occur in some people.

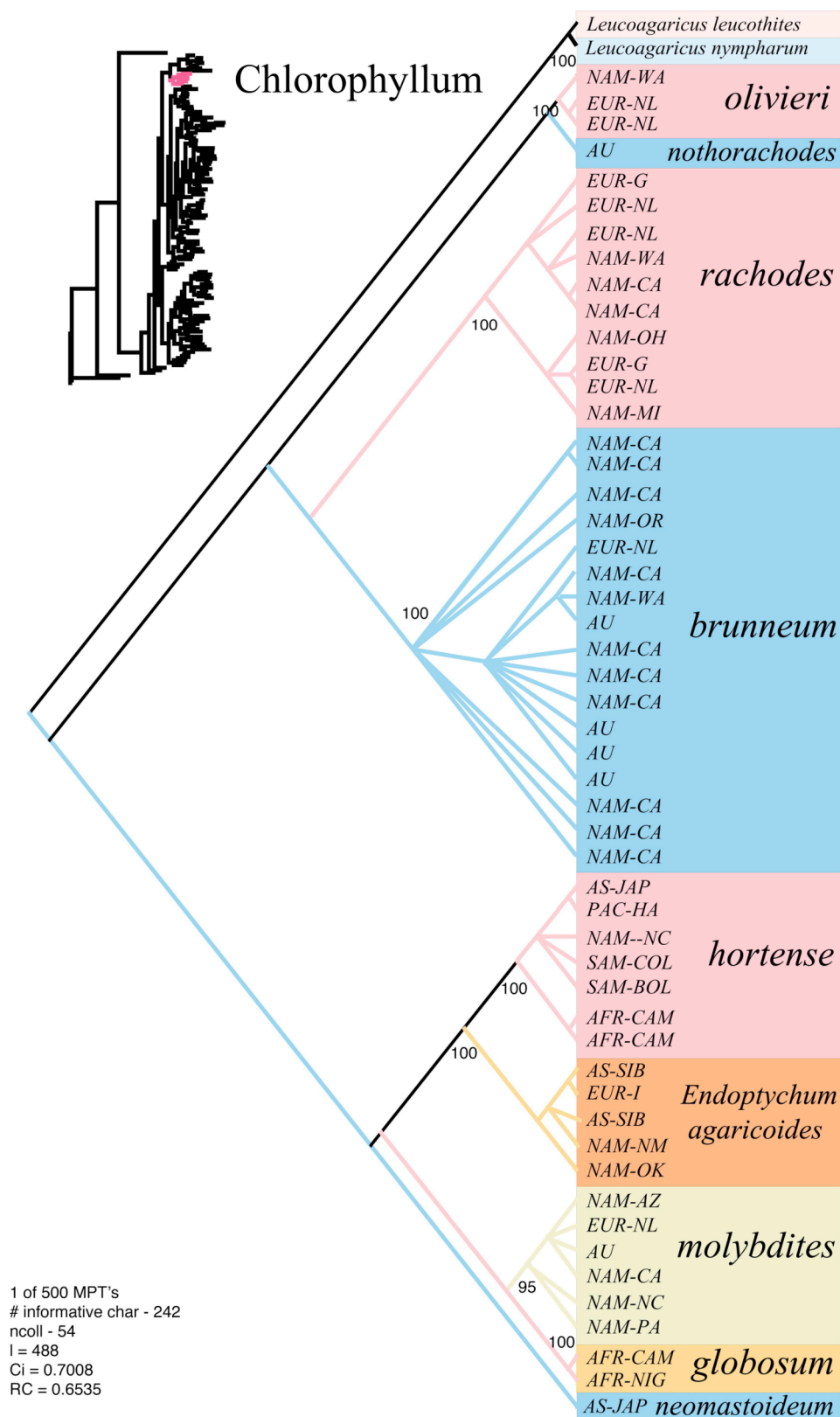


Fig. 1. *Chlorophyllum* in the *Agaricaceae* (inset), and species (color coded), based on collections from all-over the world. This picture of phylogenetic relationships is based on ITS-sequences. AFR=Africa; AS=Asia; AU=Australia; EUR=Europe; NAM=North America; PAC=Pacific Island; SAM=South America.

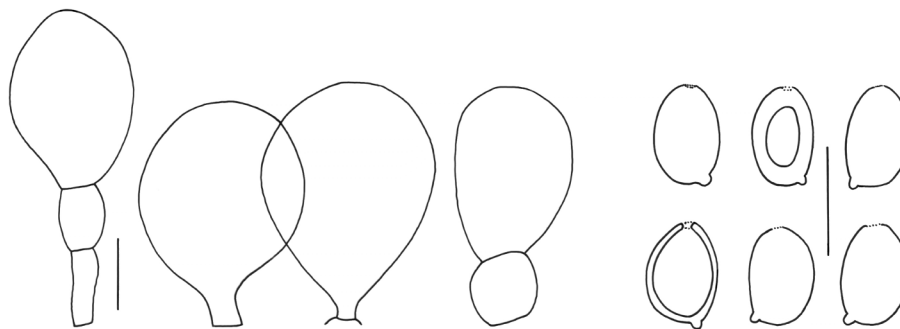
KEY TO THE AGARICOID SPECIES OF CHLOROPHYLLUM IN NORTH AMERICA

1. Spore print green; lamellae completely greenish with age..... **Chl. molybdites** (G. Mey. : Fr.) Masee
1. Spore print white or off-white; lamellae whitish or brownish with age, never totally green; sometimes a bluish green shade is present near the stipe
 2. Pileus squames of similar colour as background, either completely greyish or olivaceous brown or predominantly white to cream
 3. Pileus olivaceous brown, greyish brown; basidia 4-spored; spores with germ pore; cheilocystidia clavate; known from the Pacific North-West..... **Chl. olivieri** (Barla) Vellinga
 3. Pileus white with yellow scales and yellow-brown umbo; basidia 2-spored; spores without germ pore; cheilocystidia cylindrical; known from the south-eastern states, Illinois and Hawai'i..... **Chl. hortense** (Murrill) Vellinga
 2. Pileus squames brown (different shades) on white to cream background, which is distinctly paler than squames (though may become concolorous with age)
 4. Clamp-connections absent at base of basidia and cheilocystidia; cheilocystidia 19-53 x 8.5-20 µm, very variable in shape, often clavate, some with moniliform apical excrescence; known from Florida **Chl. subrhacodes** (Murrill) Vellinga
 4. Clamp-connections present at base of basidia and cheilocystidia
 5. Basidiocarps with abruptly to marginately bulbous stipe base; annulus relatively simple, without a double crown, but with a tough brown patch on the underside; spores often with a truncate apex; cheilocystidia 20-51 x 9-19 µm, clavate, narrowly clavate **Chl. brunneum** (Farlow & Burt) Vellinga (syn. *M. rachodes* var. *hortensis*)
 5. Basidiocarps with widened base of stipe, but not abruptly so; annulus complex, with double crown; spores either with truncate or with rounded apex; cheilocystidia 10-38 x 8.5-25 µm long, spheropedunculate, broadly clavate to clavate..... **Chl. rachodes** (Vittadini) Vellinga

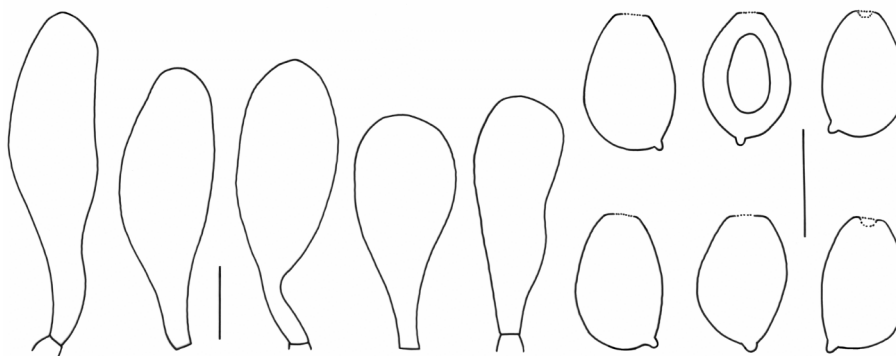
Literature on *Chlorophyllum* & *Macrolepiota* (*pdf available on web site)

- Bon, M., 1993. Flore mycologique d'Europe 3. Les Lépiotes. Documents mycologiques. Mémoire hors série 3: 1-153. *Lepiotaceae* Roze.
- Candusso, M. & G. Lanzoni, 1990. *Lepiota* s.l. Fungi Europaei 4. Giovanna Biella, Saronno. 743 pp.
- Vellinga, E.C., 2002. New combinations in *Chlorophyllum*. Mycotaxon 83: 415-417. (*)
- Vellinga, E.C., 2003. Notes on *Chlorophyllum* and *Macrolepiota* (Agaricaceae) in Australia. Australian Systematic Botany 16: 361-370. (*)
- Vellinga, E.C., 2003. Type studies in the Agaricaceae – the complex of *Chlorophyllum rachodes*. Mycotaxon 85: 259-270. (*)
- Vellinga, E.C., 2004. Genera in the family Agaricaceae – Evidence from nrITS and nrLSU sequences. Mycological Research 108: 354-377. (*)
- Vellinga, E.C., ('2006') 2007. What ever happened to the Shaggy Parasol? *McIlvainea* 16 (2): 11-17. (*)
- Vellinga, E.C. & R.P.J. de Kok, 2002. (1539) Proposal to conserve the name *Chlorophyllum* Masee against *Endoptychum* Czern. Taxon 51: 563-564. (*)
- Vellinga, E.C. & Z.-L. Yang, 2003. *Volvolepiota* and *Macrolepiota* – *Macrolepiota velosa*, a new species from China. Mycotaxon 85: 183-186. (*)
- Vellinga, E.C., R.P.J. de Kok & T.D. Bruns, 2003. Phylogeny and taxonomy of *Macrolepiota* (Agaricaceae). Mycologia 95: 442-456. (*)

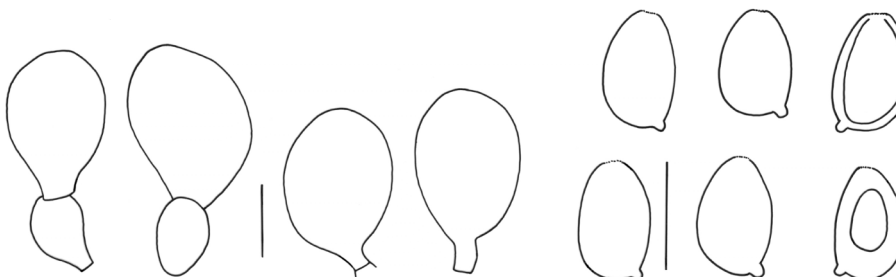
OVERVIEW OF CHEILOCYSTIDIA & SPORES



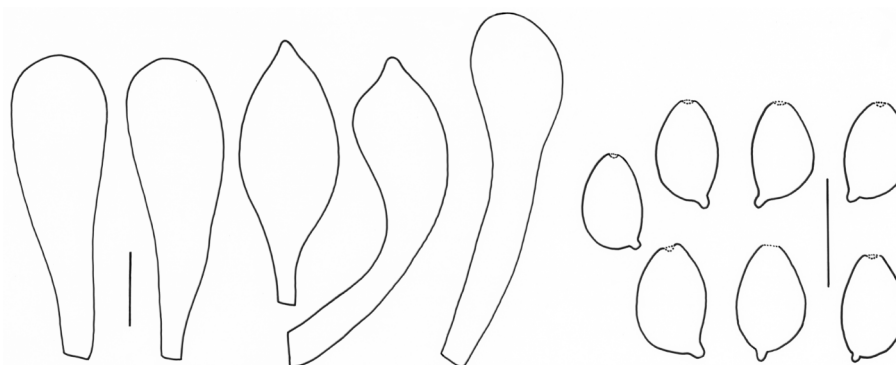
Chlorophyllum olivieri – cheilocystidia and spores. Bar is 10 μ m.



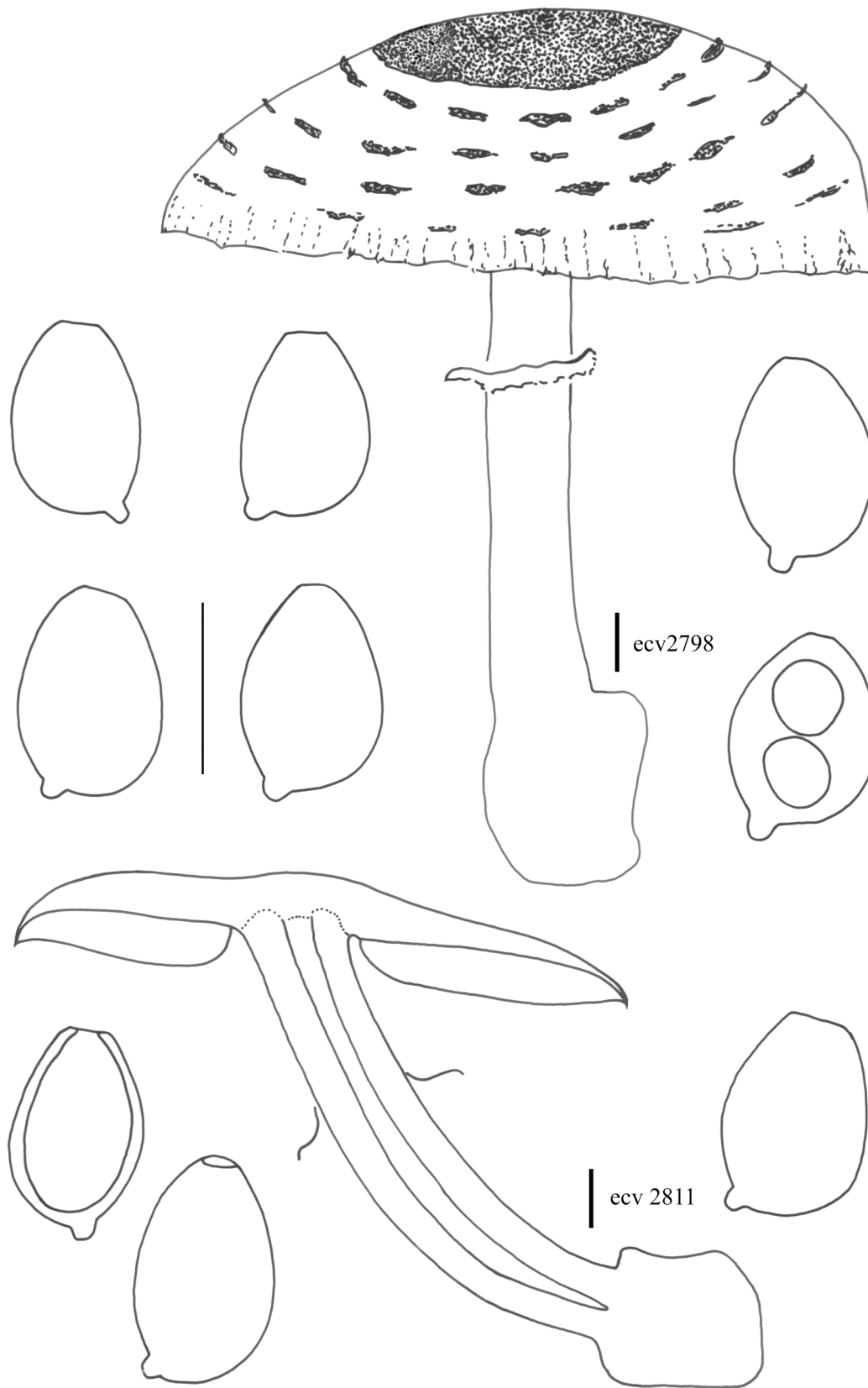
Chlorophyllum brunneum – cheilocystidia and spores. Bar is 10 μ m.



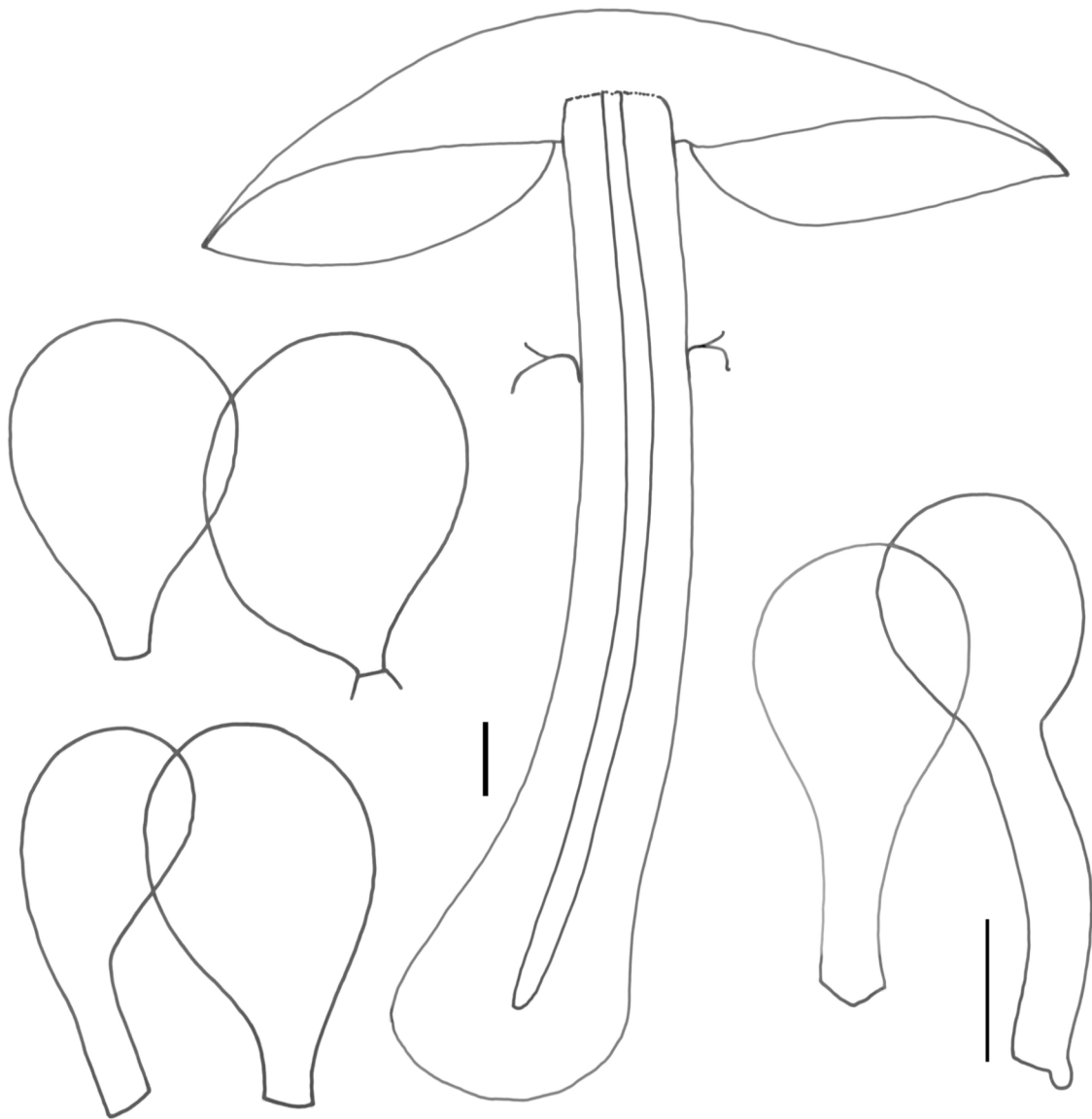
Chlorophyllum rachodes – cheilocystidia and spores. Bar is 10 μ m.



Chlorophyllum subrhacodes – cheilocystidia and spores. Bar is 10 μ m.



Chlorophyllum brunneum – Note the abrupt bulb at the base of the stipe & the simple ring



Chlorophyllum rachodes – Note the gradual bulb at the base of the stipe, and the double ring.