

***Tremella mesenterica* Retz.: Fr. 1822**

(Figs. 11-24)

Fries, Syst. Myc. 2: 214.

?=*T. lutescens* Pers.: Fries, Syst. Myc. 2: 213.**Macromorphology**

Basidiocarps large and conspicuous, ca. 5 cm ø, gelatinous, pustular when young, foliose when mature, lobes undulate-plicate; pure yellow to yellowish orange; pallid to whitish yellow under dark environment; young basidiocarps orange, color reduced when basidiocarps are mature; dry becoming pure yellow to yellowish orange.

Micromorphology

- Basidia:** two types: type I, subglobose to broadly ellipsoid, 20-23(-25) x (17-)18-22(-23) µm [Q=(0.95-)1.12-1.31]; type II, oval, (20-)24-31(-35) x (15-)16-20 µm [Q=1.40-1.82(-2.19)]; longitudinally or obliquely cruciate-septate, 4-spored; sterigmata up to 105 µm in length, 2-3 µm ø, apically swollen up to 5-7 µm.
- Spores:** broadly ellipsoid to oval, (10-)12-15.5 x (7-)9-10(-12) µm [Q=1.20-1.40(-1.61)], smooth, hyaline, germinating by repetition or budding.
- Conidia:** ellipsoid, fusiform to cylindrical, 3-5(-7) x 1.0-2.0 µm [Q=1.5-3.3(-7)], smooth, hyaline, clamped; orange in cluster.
- Vesicles:** variable, sometimes bearing from hyphae, occasionally bearing from swollen vesicle-like cells, globose, subglobose to ellipsoid, (12-)14-21 x (9-)11-16.5(-19) µm [Q=1.00-1.18(-1.42)]; when ovate to clavate, mostly 22-27 x 15-17 µm [Q=1.35-1.92]; sometimes lanceolate (lance-shaped), mostly 34-35 x 7-10 µm [Q=3.5-4.86]; thick-walled, 2-3.5 µm in thickness.
- Swollen cells:** constantly on basal parts of mature basidiocarps close to the substrate, big, clamped, colorless; when citriniform, mostly 26-37 x (13-)16-22 µm [Q=1.30-1.85(-2.19)]; when broadly pyriform, 18-24 x 13-18 µm (not including stalks) [Q= 1.14-1.40], stalks often 2-5 x 1-2 µm, sometimes up to 16 µm [if data including stalks, then mostly 20-39 x 13-18 µm, Q=1.31-1.95]; when subglobose to oval, (15-)21-29(-34) x (12-)17-26 µm [Q=(1.00-)1.06-1.42(-1.61)]; bearing on citriniform, broadly pyriform (mostly with short stalk) or subglobose to globose cells. Terminally swollen cells in the hymenium colorless, globose to ellipsoid, mostly 3-9 x 3-8 µm [Q=1.00-1.23], sometimes oval, 7-10 x 4-5 µm [Q=1.71-2.22]. Some terminally and laterally swollen cells in subhymenium and mostly in the inner part of basidiocarps, oval, 12-17 x 5-6 µm [Q=2-3.4], smooth, thin- to mostly thick-walled.
- Hyphidia:** present but not abundant, 2-4 µm ø; thin- to slightly thick-walled, gelatinous.
- Hyphae:** mostly 2-3 µm ø, sometimes up to 4 µm in the inner part of basidiocarps; thin- to thick-walled, gelatinous; clamps abundant,

Haustoria: closed or medallion-like, sometimes loop-like forming a big hollow. abundant in the inner part of basidiocarps close to bark, globose to oblong, 3-6(-7) x 2.5-4 μm [Q=1.3-2.0(-2.3)], mostly with slender, long branched, tortuous hyphae.

Habitat and substrate: on decayed branches of *Fagus sylvatica* or *Abies alba*.

Specimen studied: Germany, Baden-Württemberg: Schönbuch in Tübingen, leg. Z.-L. Yang, 26. V. 1996, CCJ 1543; France, Wintzfelden, leg. C.-J. Chen, 10. V. 1997, CCJ 1542; Germany, Baden-Württemberg: Schwarzwald, Wildenreute-Sexau, bei Emmendingen, leg. F. Oberwinkler, 02. IX. 1975, FO 23014; Taiwan, Taichung county, Tahsueh Shan Forest, 2000-2300 m, leg. C.-J. Chen, 21. III. 1995, CCJ 1040 & CCJ 1041; Germany, Baden-Württemberg, Tübingen, Schönbuch, leg. R. Kirschner, 6. IX. 1996, CCJ 1556.

Type locality: Europe.

Distribution: China, Europe, Japan, North America, Taiwan (Bandoni, 1957a; Binyamini, 1983; Bjørnekaer, 1944; Bourdot, 1932; Breitenbach & Kraenzlin, 1986; Kobayasi, 1939; Looney, 1933; Lowy, 1955; McIlvaine, 1900; Neuhoff, 1931; Olive, 1946; Roberts, 1995; Torkelsen, 1968; Wojewoda, 1981).

Remarks

Brefeld (1888) treated *Tremella lutescens* as a synonym of *T. mesenterica* because they are apparently not specifically distinct. Since then these two names have been used as synonyms by a number of mycologists (Coker, 1920; Looney, 1933; Whelden, 1934; Olive, 1947; Donk, 1966; Lowy, 1971; Binyamini, 1983), while most European and some other mycologists still had retained them as distinct taxa until 1960th (Neuhoff, 1936; Kobayasi 1939; Olive 1946, Lowy, 1955, Pilát, 1957). However, they have been generally accepted to be synonyms by most of the mycologists right now. Both taxa were originally described from Europe according to an existing (*T. mesenterica*) or absent (*T. lutescens*) conidial stage. Bandoni (1957a) thought that these two taxa can only be cleared by studying and comparing the European material since the taxonomy is in such a confused state. A number of mycologists have studied both species (listed in Table 7), however, those data are ambiguous to understand their measurements of basidia and basidiospores.

Tremella mesenterica is one of the few European species of *Tremella* which produces typically abundant minute and globular conidia (Donk, 1966). The globular conidia of *T. mesenterica* were detected very often (Bandoni, 1987). However, in European material the conidia are definitely dikaryotic and oblong to cylindrical in shape. Torkelsen (1968) observed that the young orange basidiocarp is owing to the density of the orange conidia.

In the specimens FO 23014 and CCJ 1543, two kinds of basidia, globose to subglobose and ellipsoid to ovoid, are existing in the hymenium. However, the specimen FO 23014 has 70-80% globose to subglobose basidia, but, in contrast, the specimen CCJ 1543 has 70-80% of ovoid basidia which are obviously larger, 26-31(-35) x (15-)18-20 μm , than reported before. Basidiospores are not variable,

while few mycologists might probably mistake them with secondary spores (see Table 7). Based on observations in the field, Bjørnekaer (1944) thought that *T. mesenterica* was the winter stage and *T. lutescens* the summer stage of the same fungus.

Almost all mycologists thought that the conidia are monokaryotic, however, Whelden (1934) indicated that mostly spherical binucleate conidia are existing. The binucleate conidia of specimen CCJ 1543 are ellipsoid, fusiform to cylindrical, they seem quite different comparing with the descriptions of Whelden, or even other mycologists. Alternatively, the specimen CCJ 1041 has globose to subglobose conidia. Whelden also mentioned large binucleate abnormal "conidia" in *T. mesenterica*. Those large binucleate abnormal "conidia" are probably similar to big, colorless, swollen cells of the specimen CCJ 1543. Whelden (1934) was the only one who had proved dikaryotic conidia of *T. mesenterica*. He also observed abortive cells (10-16 μm) of *T. mesenterica*, that might be the same vesicle-like mentioned by Olive (1948b). Bandoni (1957a) called similar structures "sterile hymenial structures with thick walls" in some species of *Tremella*, e. g. *T. aspera* and *T. foliacea*, but he did not mention this structure in *T. mesenterica*. Olive (1948b) called similar structures "vesicles" in his new species *T. rufobrunnea* Olive. These vesicles are thick walled, always appearing together with basidia in the hymenium. Both specimens, FO 23014 and CCJ 1543, have similar shape and size of vesicles. The typical orange conidia are extremely variable in contrast to literature reports published before. In most descriptions the shape of conidia is spherical or ovoid to ellipsoid, however, in specimen CCJ 1543 they are ellipsoid, fusiform to cylindrical.

Tremella rufobrunnea Olive (1948b) seems to be similar to *T. mesenterica*. The conidia of the latter collected from Europe are oblong to cylindrical, yellowish brown, 2.5-8.5 x 2.5-4.5 μm . However, its vesicles (15-48.5 μm), basidia (13.5-18 μm \varnothing) and basidiospores (9-12.5 x 6.5-8 μm) are distinct from those of *T. mesenterica*.

Table 7. Comparison of described *T. mesenterica* and *T. lutescens* from literature.

authors	basidia (μm)	spores (μm)	big colorless conidia and/or conidiophore (μm)	Vesicles-like	small orange conidia
specimen FO23014	mostly globose-subglobose (ca. 70%) 20-22(-24) x (19-)20-22(-23) Q=0.95-1.15 broadly ellipsoid - ellipsoid (20-)21-24(-25) x 17-20 Q=1.18-1.29(-1.35)	ellipsoid - ovoid (10-)12-14(-15) x (7-)9-10(-12) Q=1.20-1.40(-1.50)	conidiophore when citriniform, mostly 26-37 x 19-22, Q=1.30-1.85(-2.18) conidiophore when ovoid and pyriform (but ohne stalk calculation), mostly 29-34 x 18-25, Q=1.31-1.61 conidia, if they are, when globose - subglobose, mostly 23-31 x 21-26, Q=1.00-1.15	globose to subglobose to broadly ellipsoidal (14-21 x 11-19 μm , Q=1.00-1.18), ovate to clavate (22-27 x (11-)15-17 μm , Q=1.35-1.92(-2.03)), or lanceolate (lance-shaped) (34-35 x 7-10 μm , Q=3.5-4.86) , at least 1 μm	none
specimen Yang D88	subglobose - broadly ellipsoid 22-23(-25) x (17-)18-20 Q=1.12-1.31 mostly ovoid (ca. 70-80%) 26-31(-35) x (15-)16-19 Q=1.4-1.82(-2.19)	ovoid 12-15.5 x (8-)9-10 Q=1.30-1.61	conidiophore when citriniform, mostly 27-35 x 13-16, Q=1.46-2.19 conidiophore when ovoid and pyriform (but ohne stalk calculation), mostly 18-24 x 13-18, Q=1.14-1.40 conidia, if they are, when subglobose to ovoid ($\geq 10 \mu\text{m}$ diam.), mostly 15-21 x 12-17, Q=1.00-1.27 conidia when globose - ellipsoid (< 10 μm diam.), mostly 9-9 x 3-8, Q=1.00-1.23	globose to subglobose to ellipsoidal ((12-)15-21 x (9-)12-16.5 μm , Q=1.07-1.42), thick walled, 2-3.5 μm	ellipsoid, fuciform to cylindrical 3-5(-7) x 1.0-2.0 Q=1.5-3.3(-7)
specimen CCJ1355	subglobose - ellipsoid (18-)19-21(-24) x (14-)15-17 Q=1.13-1.33(-1.40)	subglobose - ellipsoid 12-13(-14) x 8-11(-12) Q=(1.17-)1.20-1.36(-1.50)	conidia, if they are, when globose - ellipsoid($\geq 10 \mu\text{m}$), mostly 15-20x 12-17, Q=1.00-1.20 conidiophore when ovoid-fuciform (stalk without calculation), mostly 22-28 x 13-16, Q=1.67-2.22 conidia when globose - subglobose (≤ 10 μm), mostly 2-7 x 2-6, Q=1.00-1.11 conidia when ovoid-fuciform ($\leq 10 \mu\text{m}$), mostly 4.5-8 x 3-6, Q=1.50-1.67		none
Binyamini, 1983	10-17 x 8-14	10-14 x 8-12	-	-	-

Bourdot, 1932	-	7-9-10 x 6-7, 10-14-16.5 x 8-10-12 7(-9) x 5-6, 6-10-12 x 5-6-10	-	-	-
Breitenbach, 1986	20-25 x 12-17	10-16 x 7-8 7-12 x 6-10 (Pilat, 1957) 10-16(-22) x 7-10 (lutescens)	-	-	3-4.5 x 2.5-3.5 µm
Coker, 1920	3916: 18-20 x 13.7-15.5 4069: 16-20 x 14.8-16.6 4204: 14-20 x 11.2-15.5	8-11 x 7.4-9 9.3-14.8 x 7.4-10 9.3-12.5 x 7-8.5	-	-	3.4-5 x 2.8-3.7 - -
Courtecuisse, 1990	20x13	6-7 x 4-5 (maybe second spores)	-	-	-
Donk, 1969	13-22 x 10-20	7-13 x 6-9	-	-	3-6.5 x 2-4 µm
Ingold, 1982		ovoid, 10-14 x 7-9	-	-	-
Liu, 1992	(12-)16-23 x 10.5-18	10-14.5 x 7.5-12.5 (lutescens)	-	-	-
Lowy, 1971	12-17.5 x 1.5-16	subglobose - ovoid, 10-14.5 x 8.5-12	(lutescens)	-	2.5-3.5 µm
McIlvaine, 1900	-	subglobose, 12-16 (lutescens) 6-9 (mesenterica)	-	-	1-1.5 µm(mesenterica)
Neuhoff, 1931	18-25 x 15-20	10-16(-20) x 8-12	(T. lutescens)	-	-
Neuhoff, 1931	14-20 x 8-12	7-10(-12) x 6-10	(T. mesenterica)	-	mostly spherical, 2-4 µm
Olive, 1946	13.6-16.4 x 15.5-23.3	7.8-9.7 x 9.7-13.6 (15.5)	-	-	-
Olive, 1947	-	11.7-15.6 x 8.5-10.4 (lutescens)	-	-	-
Olive, 1948	-	12.2-15.7 x 7.8-10.4 (lutescens)	-	-	2.6-5.9 x 1.8-4.2
Pérez-Silva, 1992	-	5-7 x 3.5-4.5 (lutescens)	-	-	-
Robert, 1995	15-21 wide	(8.0-)10-16(-18.0) x 6.0-9.5(-12.0) Q=1.2-1.8)	-	-	subglobose, ovoid, or ellipsoid 2.0-3.0 x 2.0-2.5 µm
Torkelsen, 1968	15-22 x 12.5-20	11.25-13.75 x 7.5-9	-	-	elliptical to subglobose 2.5-3.5 x 2
Whelden, 1934	15 x 9.7	9 x 7	large binucleate abnormal "conidia"	abortive structure 10-16 µm	mostly spherical binucleate conidia, 2.5-3.0 µm
Wojewoda, 1975	10-26 x 10-20	7-18(-22) x 6-10(-12)	-	-	2.5-3.5 x 2 µm
Wong, etc. 1985	average range of 46 collections		-	-	dikaryophyses absent

	20.7-22.8 x (16.5-)17.5-18.8 authors' own study (19-)20-24(-25) x (14.5-)15.5-20(-21)	12.3-13.3 x 9.0-10 (9.5-)10.5-16 x (7.5-)8.5-10.5 (-11.5)			ellipsoid to subglobose 3-5 x 2-3 μm
--	---	---	--	--	---

Fig. 11. Fresh basidiocarp of *Tremella mesenterica* CCJ 1542 collected from Wintzfelden in France neighboring to Freiburg in Germany.

Fig. 12. Fresh basidiocarp of *Tremella mesenterica* CCJ 1041 collected from Tahsueh Shan Forest in Taiwan located in high mountain at altitude 2200 m.

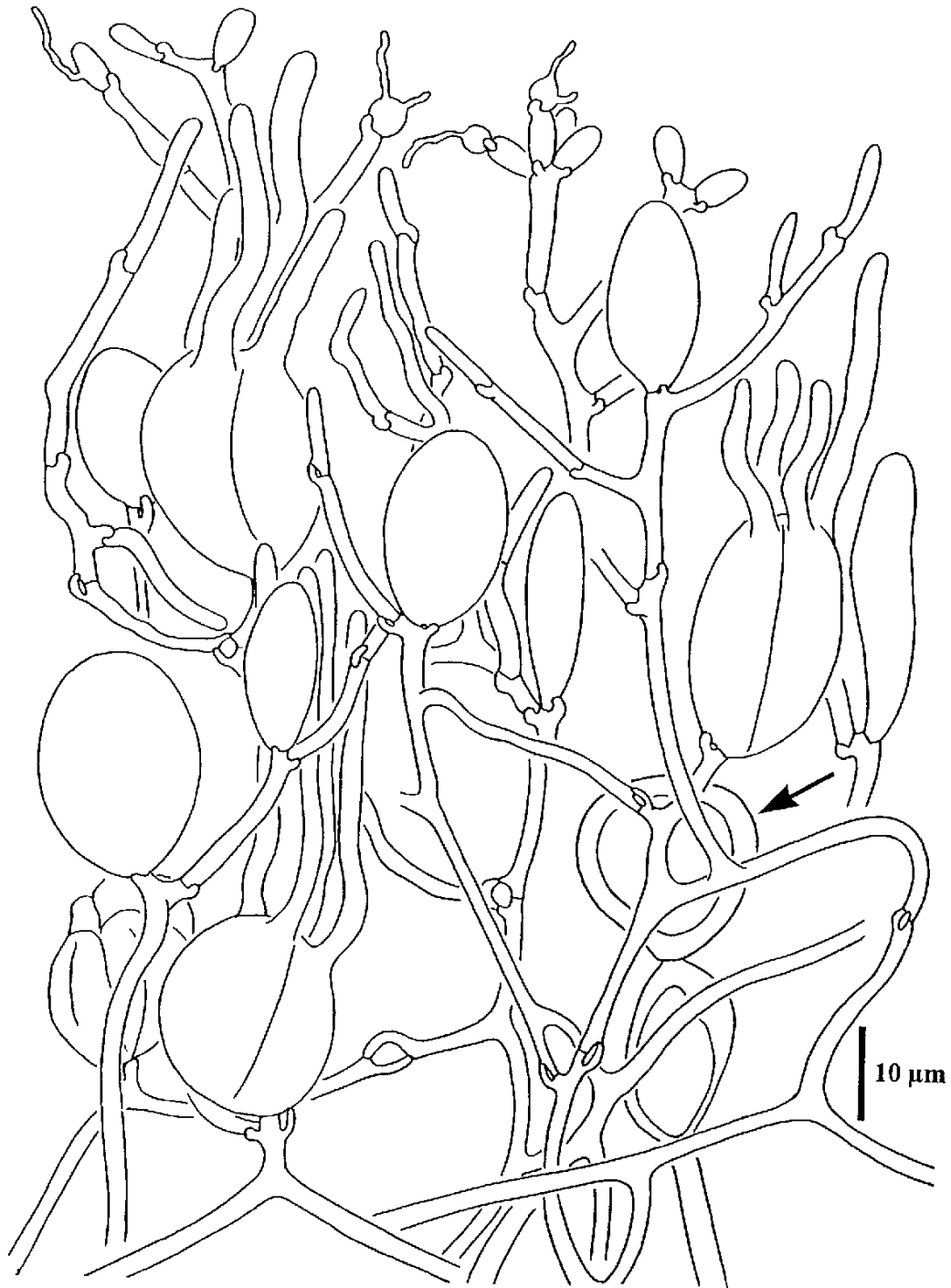
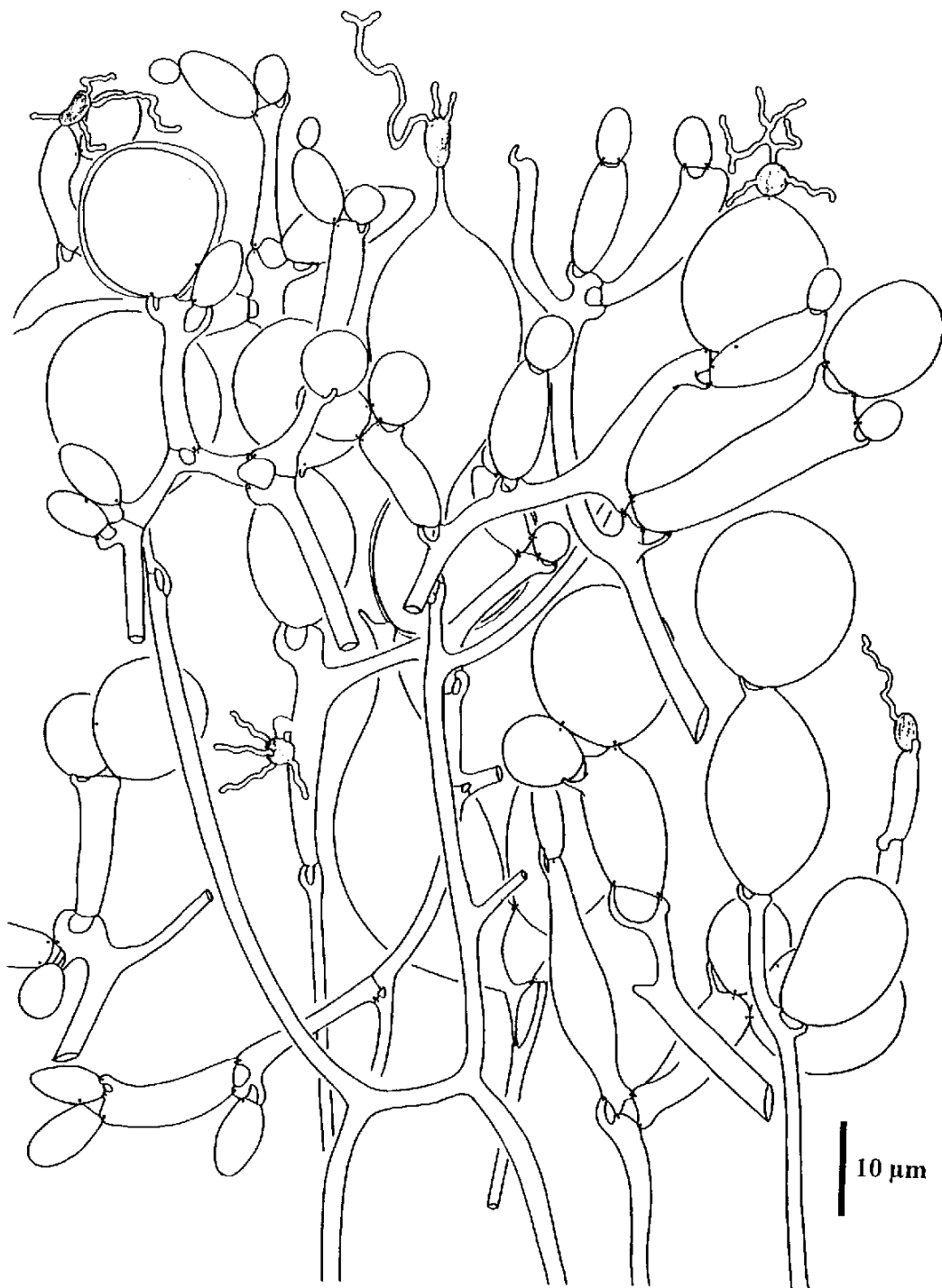


Fig. 13. *Tremella mesenterica* CCJ 1543. Part of hymenial structure on the surface of a mature basidiocarp with basidia of different developmental stages, hyphidial hyphae, and haustoria on the top of hyphidia. Note that the hymenial structure is loose and with hyphidia and vesicles (arrow).



ig. 14. *Tremella mesenterica* CCJ 1543. The swollen cells of hymenial structure in the basal part of a mature basidiocarp close to the substrate.

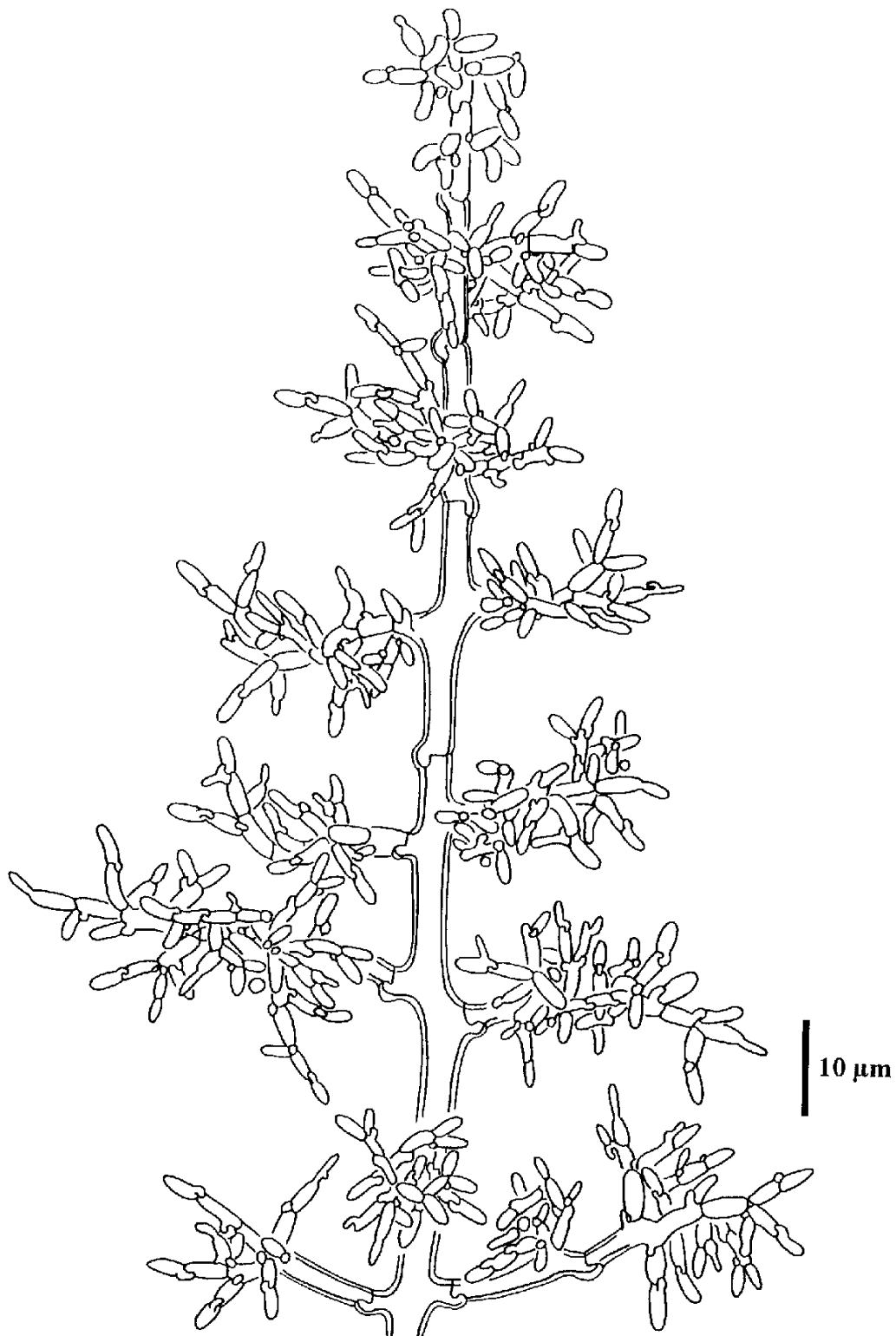


Fig. 15. *Tremella mesenterica* CCJ 1543. The conidial stage. Note that the clamped conidia are dikaryotic.

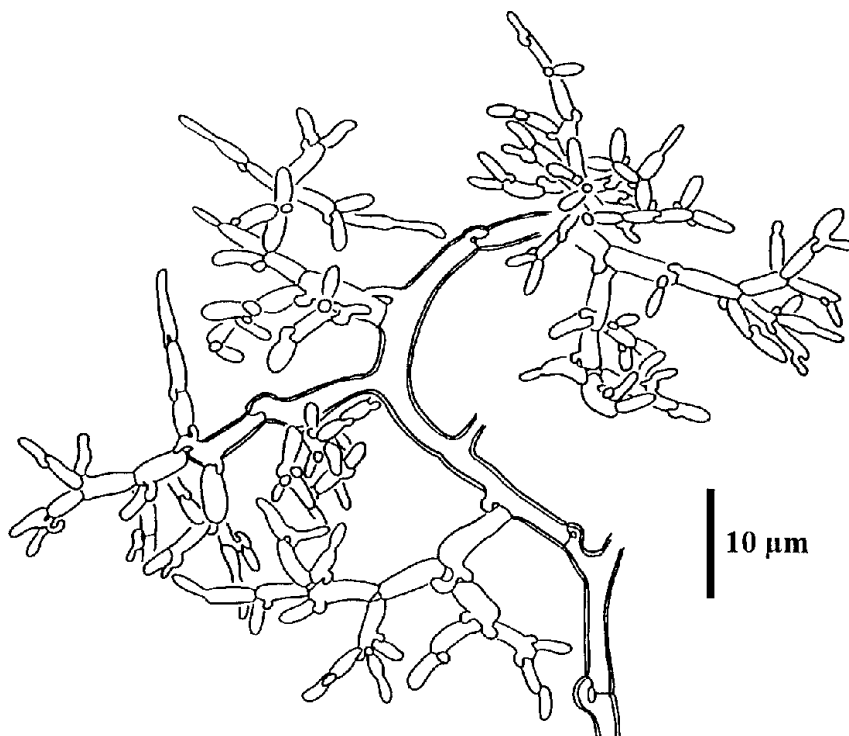


Fig. 16. *Tremella mesenterica* CCJ 1543. The oval to fusiform dikaryotic conidia.

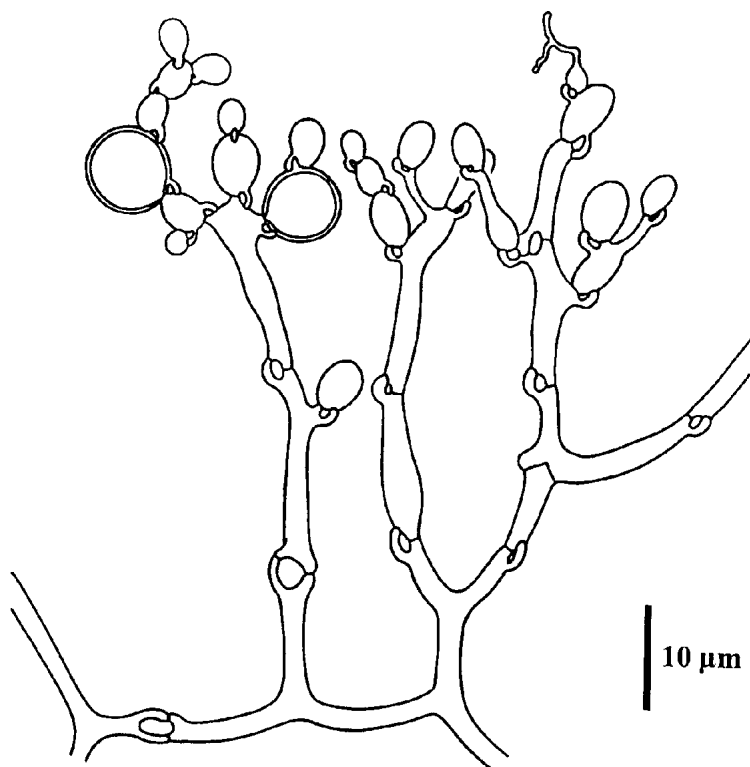
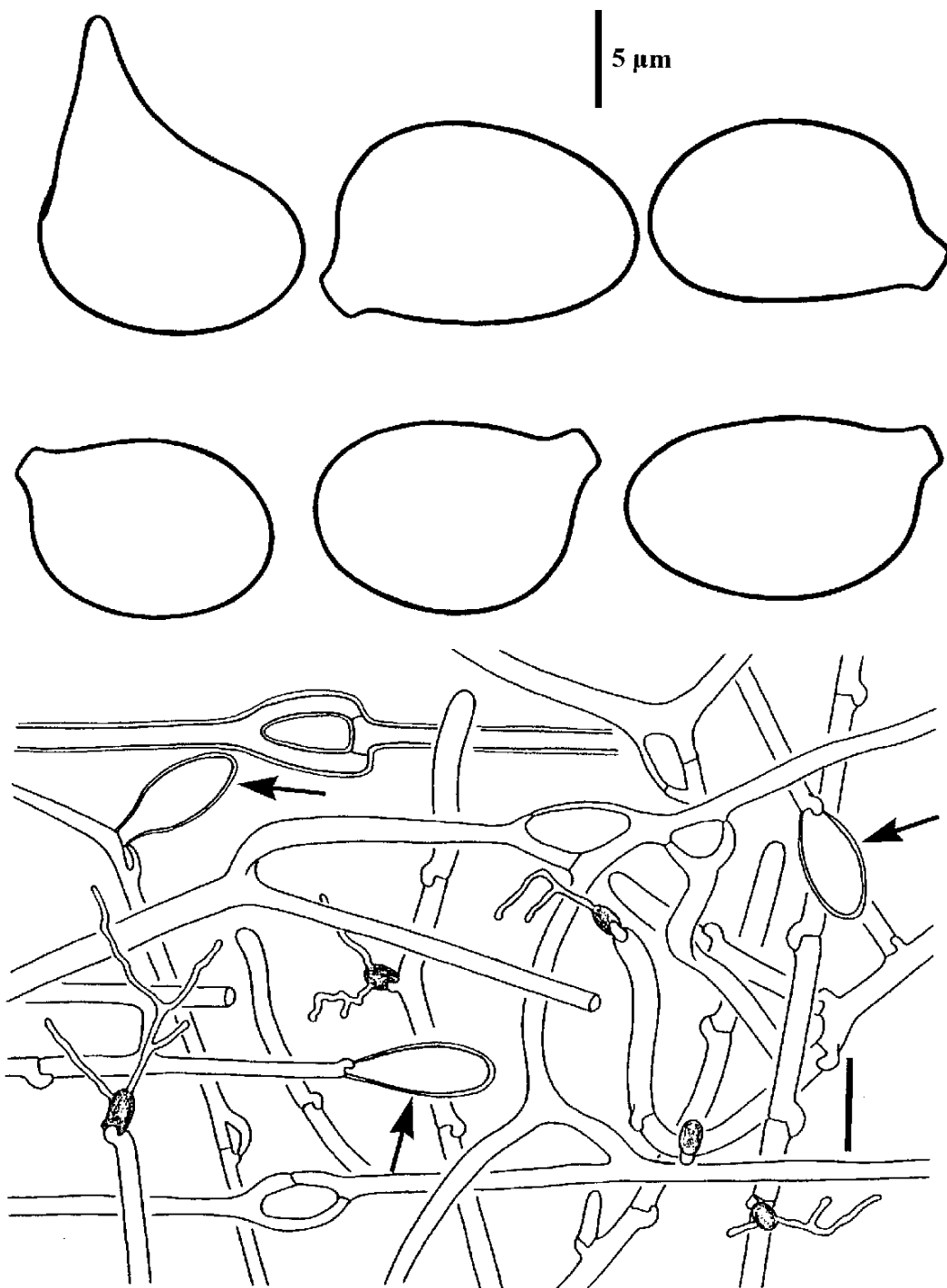


Fig. 17. *Tremella mesenterica* CCJ 1041. The globose to subglobose dikaryotic conidia.



Figs. 18-19. *Tremella mesenterica* CCJ 1543. 18. Basidiospores. 19. Structure in the inner part of the basidiocarp. Note the terminally swollen cells (arrows).

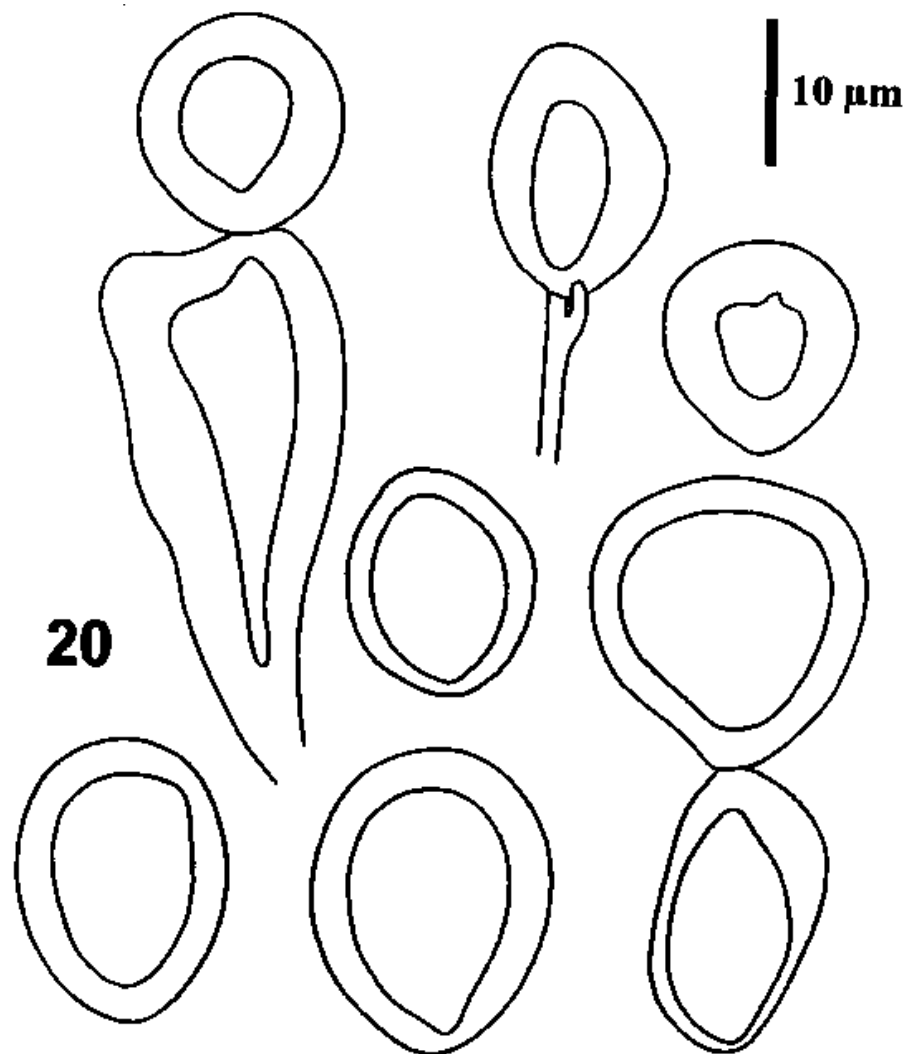


Fig. 20. *Tremella mesenterica* CCJ 1543. Various vesicles.

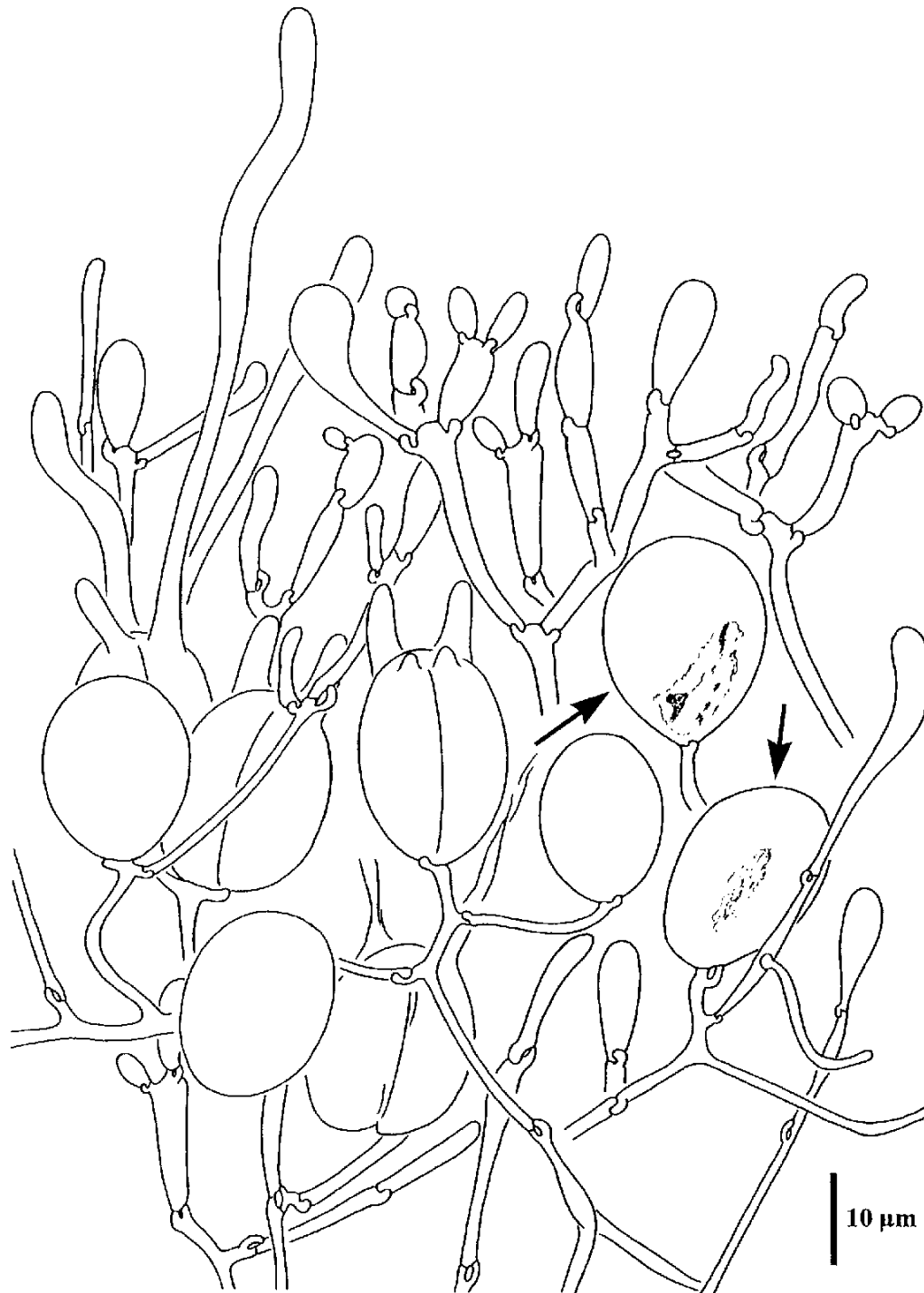


Fig. 21. *Tremella mesenterica* FO 23014. The hymenial structure on the surface of a mature basidiocarp. Note that the hymenial structure is loose and hyphidia are present. Arrows show the vesicles.

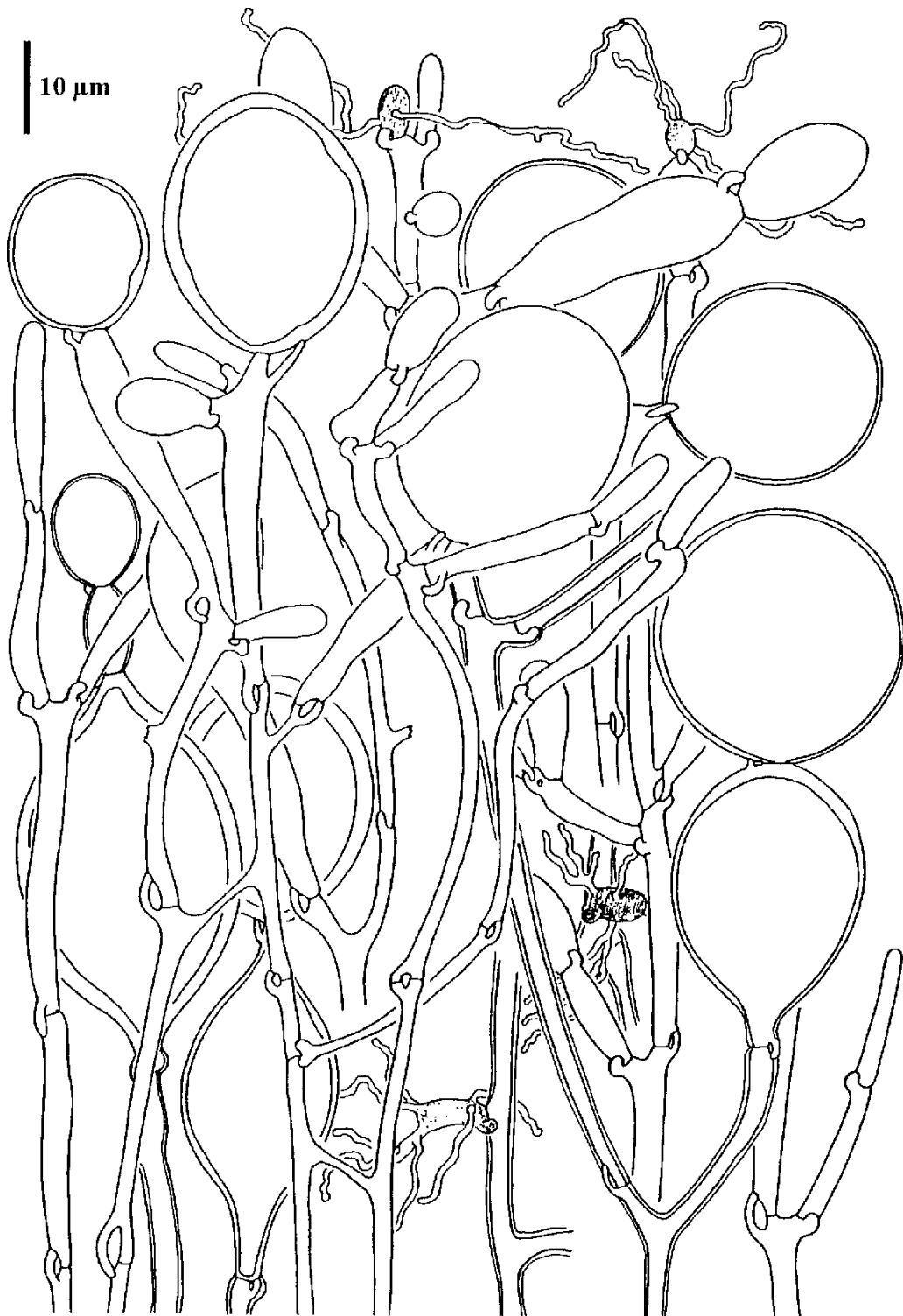


Fig. 22. *Tremella mesenterica* FO 23014. The swollen cells of hymenial structure in the basal part of a mature basidiocarp close to the substrate. Note that the haustorial hyphae are branched.

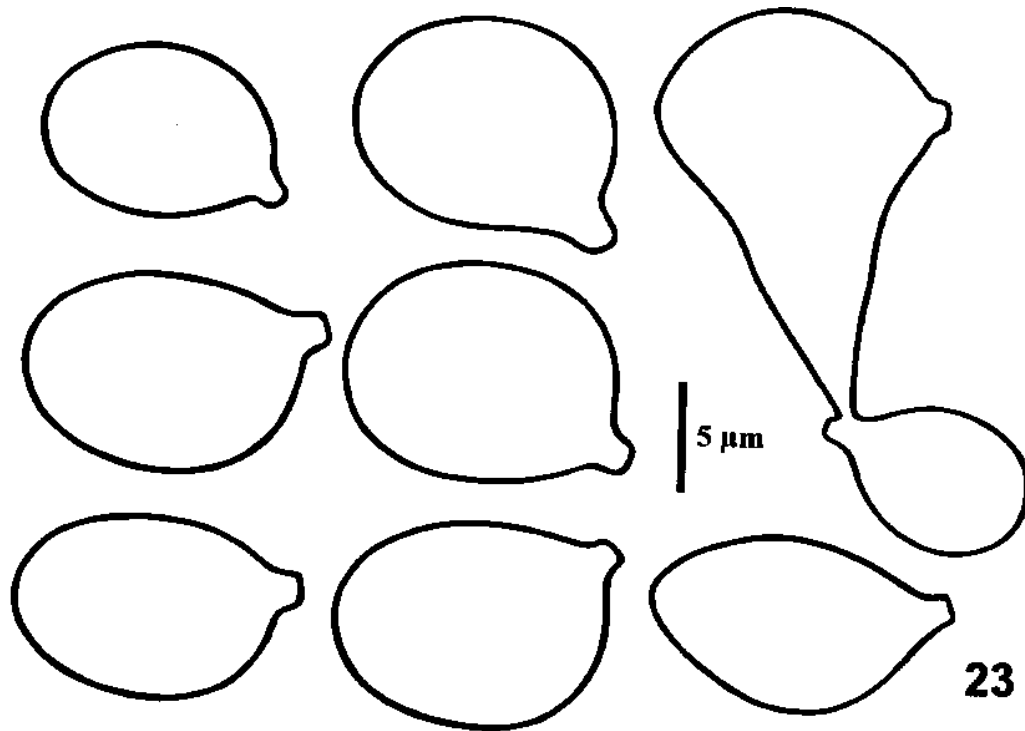


Fig. 23. *Tremella mesenterica* FO 23014. Basidiospores, one of them producing a secondary spore by repetition.

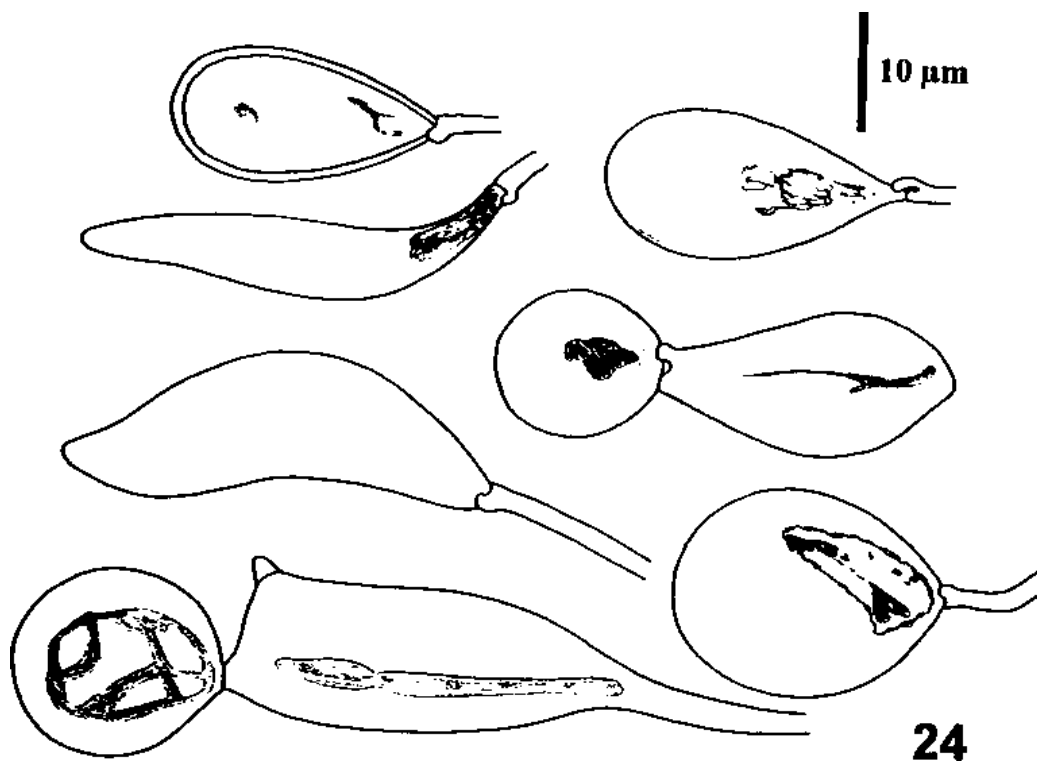


Fig. 24. *Tremella mesenterica* FO 23014. Various vesicles.