

Saccobolus-Schlüssel

J. van Brummelen

The following keys reproduce the keys from J. van Brummelen's "A world monograph of the genera *Ascobolus* and *Saccobolus*", *Persoonia* Supp. Vol. 1 (1967). Furthermore, the descriptions of species from J. van Brummelen "Some new species of *Saccobolus*", *Persoonia* 8, 421 (1976) are included.

1 Key to the sections of *Saccobolus*

1. Receptacle and disk yellow, yellowish or amber. Ascospores ellipsoid or fusiform-ellipsoid with truncate ends; at first arranged according to pattern I, finally sometimes more or less shortened, irregularly arranged or free. Paraphyses, especially in the upper parts, with yellow, lemon-yellow, golden-yellow or orange-yellow contents. Without accumulations of intercellular amorphous pigment in excipulum or hymenium *Saccobolus* sect. *Saccobolus*
1. Receptacle and disk white, pale violet, violet or brown. Ascospores ellipsoid or fusiform-ellipsoid, often with slightly truncate ends, often asymmetrical, ventriculose or somewhat triangular; not arranged according to pattern I. Paraphyses without yellowish or orange contents, mostly colourless. If pigmented, then intercellular and amorphous in excipulum and between the tips of paraphyses *Saccobolus* sect. *Eriobolus*

2 Key to the species of *Saccobolus* sect. *Saccobolus*

1. Apothecia tending to form crusts. Spore-clusters very loose and ascospores free at maturity. Ascospores 16-19.5 x 7.5-9 µm. Episporium smooth or sometimes finely granular *Saccobolus saccoboloides*
1. Apothecia not forming crusts. Spore-clusters compact and ascospores firmly cemented 2
2. Ascospores at maturity with length-width ratio 2.0-2.5; ellipsoid or fusiform-ellipsoid, with truncate ends. Episporium up to 0.8 µm thick 3
2. Ascospores at maturity with length-width ratio about 1.3-1.5; short-ellipsoid or subglobular; 15-17.5 x 10-12.5 µm. Episporium more than 1.0 µm thick; with a net-work of crevices. Spore-clusters rich in extra-episporial pigment *Saccobolus portoricensis*
3. Receptacle and disk vividly yellow or lemon-yellow. Ascospores ventricose with strongly truncate ends; 16-22 x 7.5-9 µm. Episporium with isolated fine warts *Saccobolus citrinus*
3. Receptacle and disk golden-yellow or amber. Ascospores not strongly truncate and ventricose. Episporium smooth or finely granular, sometimes with a few irregular crevices 4
4. Ascospores 22-29 x 8.5-14.5 µm *Saccobolus glaber*
4. Ascospores less than 18 µm long 5
5. Ascospores 14-17.5 x 7.5-8.5 µm. Spore-clusters at maturity shortened and ascospores arranged according to pattern Ia *Saccobolus truncatus*
[with spherical spores, cf. *Saccobolus sphaerosporus*]
5. Ascospores 11.5-13.5 x 5.5-6.5 µm. Spore-clusters not shortened at maturity *Saccobolus minimus*

3 Key to the species of *Saccobolus* sect. *Eriobolus*

1. Ascus with 4 spores; ellipsoid or slightly triangular; 16.5-19.5 × 9.5-10.5 μm . *Saccobolus quadrisporus*
1. Ascus with 8 spores 2
2. Ascospores at first arranged according to pattern II or III. Spore-clusters finally sometimes becoming shortened or somewhat irregular but never loose or subglobular 3
2. Ascospores not arranged according to pattern II or III ; at maturity according to pattern IV or VI, or rather loosely in a shortly ellipsoid or subglobular cluster 9
3. Episporium smooth or finely granular, sometimes with small pits or with an incomplete net-work of fine fissures. Ascospores not shortened at maturity 4
3. Episporium coarsely or finely warted or with a coarse net-work of fissures; sometimes very thick. Ascospores sometimes shortened at maturity 6
4. Receptacle outside with bunches of hyphae to form tapering squamules. Excipulum of *textura angularis* *Saccobolus caesariatus*
4. Receptacle completely smooth. Excipulum of *textura globulosa* or *intricata* 5
5. Apothecia 0. 1-0.3 mm diameter. Excipulum of *textura globulosa*, rarely with intercellular, amorphous pigment. Central asci 60-95 × 15- 20 μm. Ascospores 10-14.5 × 5-7.5 μm Episporium smooth or finely granular *Saccobolus depauperatus*
[with pale, somewhat smaller ascospores which are only loosely united, cf. *Saccobolus diaphanus*]
5. Apothecia 0.2-2.0 mm diameter. Excipulum predominantly of *textura intricata*, mostly with intercellular, amorphous pigment in excipulum and between the tips of paraphyses. Central asci 100-145 × 22-37 μm. Ascospores 13-21.5 × 6.5-9.5 μm Episporium smooth, sometimes with small pits, with an incomplete net-work of fissures or finely granular *Saccobolus versicolor*
[with very compact spore-clusters and purple-red color, cf. *Saccobolus purpureus*]
[with free ascospores and very pale, irregularly distributed spore pigment, cf. *Saccobolus eleutherosporus*]
6. Episporium very coarsely warted or reticulated, 1-3 μm thick. Ascospores 17.5-23 × 8.5-10 μm *Saccobolus beckii*
6. Episporium not so roughened and thick. Ascospores smaller 7
7. Apothecia lenticular or pulvinate. Spore-clusters at maturity of the ascospores shortened, by which the arrangement becomes more or less irregular (pattern IIIa). Episporium coarsely or finely warted 8
7. Apothecia cylindrical or subglobular. Spore-clusters at maturity not shortened , always arranged according to pattern II. Episporium coarsely warted. Ascospores 14-16 × 8-9 μm. with intercellular, amorphous pigment in excipulum and between the tips of paraphyses. *Saccobolus verrucisporus*
8. Apothecia 0.3-0.8 mm diameter. Ascospores ellipsoid or fusiform-ellipsoid; 13.5-18 × 7.5-9.5 μm; firmly united in the clusters. With intercellular, amorphous, brown pigment in excipulum and between the tips of paraphyses *Saccobolus obscurus*
8. Apothecia 0.1-0.3 mm diameter. Ascospores broadly ellipsoid or fusiform-ellipsoid; 10.5-14 × 7-9 μm; rather loosely united in the clusters. Without intercellular pigment in excipulum and hymenium *Saccobolus thaxteri*
[with considerably smaller ascospores, more slender spore-clusters and much longer asci, cf. *Saccobolus parvisporus*]
9. Spore-cluster at maturity subglobular or shortly ellipsoid. Ascospores 11.5-14.5 × 6-7.5 μm 10
9. Ascospores arranged in a package according to pattern VI (axes of ascospores at right angles with axis of package) 11
10. Ascospores loosely united in the cluster, mostly at all sides covered with fine warts *Saccobolus globuliferellus*

- 10. Ascospores closely compacted in a subglobular cluster; only the exposed surfaces covered with fine and coarse warts *Saccobolus dilutellus*
- 11. Ascospores firmly united in pairs; 10.5-13 × 5-6.5 μm. The pairs rather loosely united in a cylindrical pile. Episorium finely warted *Saccobolus geminatus*
- 11. Ascospores arranged according to package VI, not firmly united in pairs; 9-11 × 5-6.5 μm, Episorium granular *Saccobolus infestans*

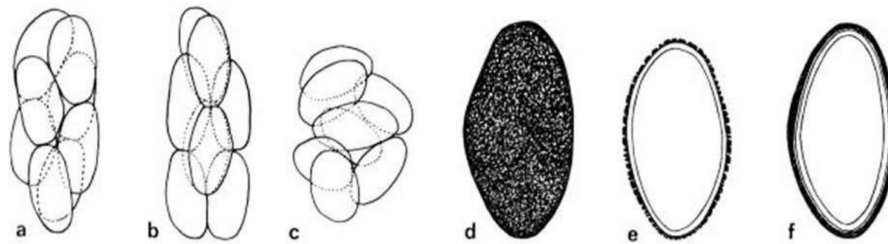


Abbildung 1: *Saccobolus saccoboloides*: a, b, diagram of ascospore arrangement in immature asci $\times 740$; c, diagram of ascospore arrangement at maturity $\times 800$; d, ascospore $\times 1600$; e, f, ascospores in optical section $\times 1600$.

4 Descriptions

4.1 *Saccobolus* sect. *Saccobolus*

4.1.1 *Saccobolus saccoboloides*

Apothecia scattered or gregarious, often confluent, superficial, sessile, up to 1 mm across. Receptacle lenticular, "pale yellowish amber", becoming black with maturity, smooth. Disk convex, dull yellow, dotted with the protruding tips of ripe asci. Hymenium about $125 \mu\text{m}$ thick. Hypothecium and flesh not clearly differentiated. Excipulum rather thin and fugitive, not always distinguishable from the hymenium, of parallel, cylindrical hyphae, some of which may consist of swollen cells and show a globular apex, even up to $16 \mu\text{m}$ thick. Asci broadly clavate, gradually tapering downwards into a slender base, with truncate apex, up to $150 \times 20 \mu\text{m}$, 8-spored; the wall deep blue in Melzer's reagent. Spore-clusters very loose. Ascospores not cemented together by their pigment, at first free, then clinging together according to pattern I, finally often more or less free, fusoid-ellipsoid; hyaline, then purple, finally brown, $16\text{-}19.5 \times 7.5\text{-}9 \mu\text{m}$, smooth or very minutely roughened; pigment in a thin layer $0.4\text{-}0.5 \mu\text{m}$ thick, formed before the spores cling together. Paraphyses filiform, septate, simple, $2.5\text{-}3.0 \mu\text{m}$ thick, not enlarged at the tip, yellowish.

On textile fabrics and on dung of pig.

4.1.2 *Saccobolus glaber*

Apothecia solitary or gregarious, superficial, sessile, $0.2\text{-}1.0$ mm diameter. Receptacle at first globular, then pulvinate, golden-yellow or amber-coloured, smooth; margin not differentiated. Disk convex, golden-yellow, dotted with the almost black protruding tips of ripe asci. Hymenium $120\text{-}200 \mu\text{m}$ thick. Hypothecium not clearly differentiated. Flesh thin, of small, isodiametric cells $8\text{-}12 \mu\text{m}$ diameter, hyaline. Excipulum very thin and rather fugitive, in the lower part of subglobular or ellipsoid cells $10\text{-}22 \times 9\text{-}15 \mu\text{m}$, the upper part consisting of a palisade of paraphyses-like hyphae. Asci cylindrical-clavate, often curved, with a short stalk, flattened above, with a very large operculum, $150\text{-}275 \times 25\text{-}48 \mu\text{m}$, 8-spored, the wall deep blue in Melzer's reagent. Spore-clusters elongated, rather compact, $50\text{-}68 \times 16\text{-}25 \mu\text{m}$, with thick gelatinous envelope. Ascospores arranged according to pattern I, fusiform-ellipsoid, often slightly asymmetrical or angular by pressure, with blunt ends, at first hyaline, then pinkish-violet, finally violet or purplish-brown, $(19\text{-})22\text{-}29 \times 8.5\text{-}14.5\text{-}(16) \mu\text{m}$, smooth or more rarely finely punctate, often with one or a few irregular cracks taking the form of delicate reticulations; pigment in a thin layer $0.6\text{-}0.8 \mu\text{m}$ thick. Paraphyses simple or branched, septate, irregularly cylindrical, $2.5\text{-}4.5 \mu\text{m}$ thick, enlarged up to $8.8 \mu\text{m}$ at the tip, with golden-yellow contents especially in the upper part, embedded in a rather fugacious, colourless, mucilaginous substance.

On dung of cow, horse, zebu, sheep, gnu, deer, and on paper under bear-dung.

4.1.3 *Saccobolus citrinus*

Apothecia solitary or gregarious, superficial, sessile, up to 0.3 mm diameter. Receptacle pulvinate or lenticular, ochraceous yellow, smooth; margin not differentiated. Disk convex, ochraceous yellow or lemon-yellow ("citrin vif" according to Le Gal 1942: 54), dotted with the almost black protruding tips of ripe asci. Hymenium up to $120 \mu\text{m}$ thick. Hypothecium not clearly differentiated. Flesh very thin. Excipulum consisting of a palisade of hyphae resembling paraphyses, thin, pale yellowish. Asci broadly clavate, gradually tapering downwards, with truncate apex, " $130\text{-}150 \times 30\text{-}35 \mu\text{m}$ " (Boudier & Torrend l. c.), 8-spored; the wall blue in Melzer's reagent. Spore-clusters elongated, $43\text{-}51 \times 14\text{-}17 \mu\text{m}$, not shortened with ripening. Ascospores arranged according to

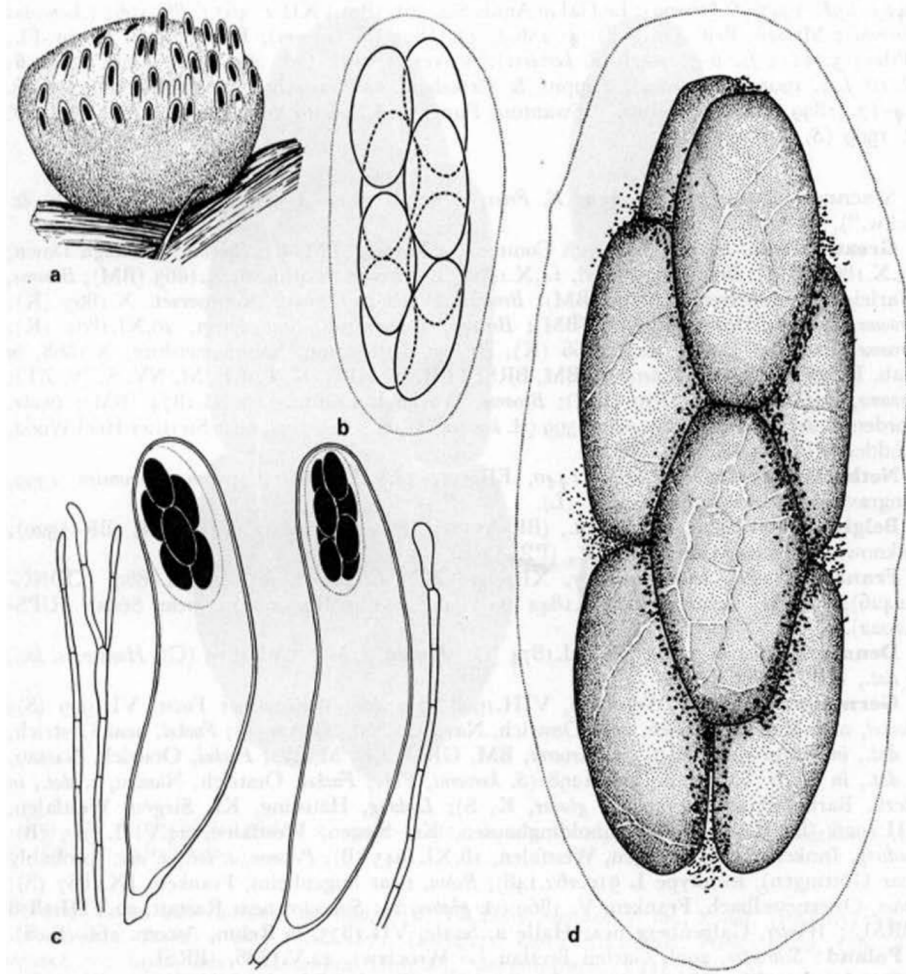


Abbildung 2: *Saccobolus glaber*: a, habit of fruit-body $\times 50$; b, diagram of spore-cluster $\times 740$; c, asci and paraphyses $\times 275$; d, spore-cluster $\times 1600$.

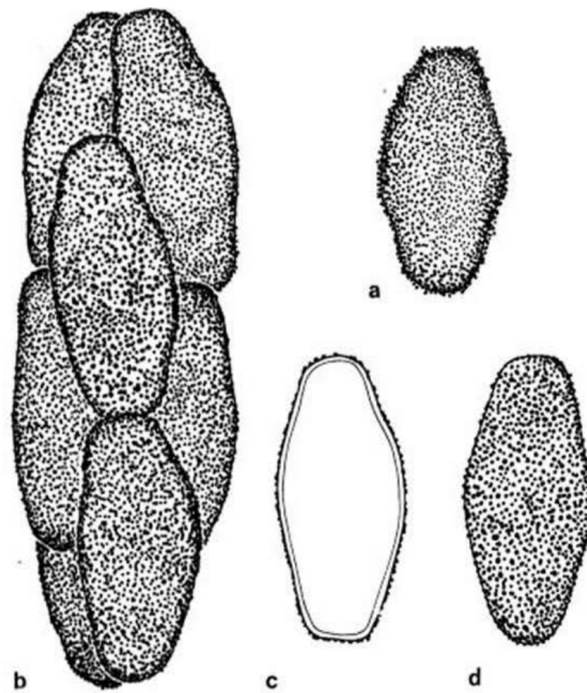


Abbildung 3: *Saccobolus citrinus*: a, d, ascospores; b, spore-cluster; c, ascospore in optical section. All $\times 1600$.

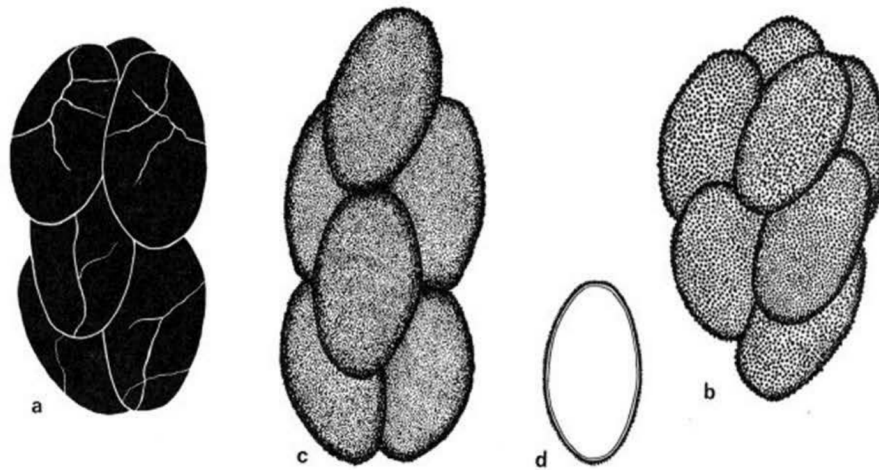


Abbildung 4: *Saccobolus truncatus*: a-c; spore-clusters; d, ascospore in optical section. All $\times 1600$.

pattern I, ellipsoid-fusiform with blunt ends, often slightly asymmetrical or ventricose; at first hyaline, then pinkish, finally brownish-purple, $16-22(-23) \times 7.5-9(-9.5) \mu\text{m}$, ornamented with very fine isolated round warts. Paraphyses simple or branched, septate, cylindrical, $2.0-2.5 \mu\text{m}$, thick, slightly enlarged up to $4 \mu\text{m}$ at the tip, with yellowish contents, especially in the upper parts.

On different kinds of dung. Known from dung of cow, horse, sheep, goat, and an unidentified bird.

4.1.4 *Saccobolus truncatus*

Apothecia solitary or gregarious, superficial or in small cavities, sessile, $0.1-0.3 \text{ mm}$ diameter, about 0.1 mm high. Receptacle semiglobular or lenticular, pale yellow, smooth; margin not differentiated. Disk convex, pale yellow, dotted with the urplish-black tips of ripe asci. Hymenium $50-80 \mu\text{m}$ thick. Hypothecium thin, of closely compacted isodiametric cells $4.5-8 \mu\text{m}$ diameter. Flesh not clearly differentiated. Excipulum consisting of a palisade of hyphae with subglobular cells $7-10 \times 6-8 \mu\text{m}$ (*textura globulosa*), hyaline. Asci clavate, gradually tapering downwards into a rather thick base, with truncate apex, $74-97 \times 16-23 \mu\text{m}$, 8-spored; the wall deep blue in Melzer's reagent. Spore-clusters elongated to very compact, $(20-29)42(-48) \times (14-16)19(-22) \mu\text{m}$; the longitudinal axis becoming increasingly shorter with ripening; surrounded by a thick gelatinous envelope. Ascospores at first arranged according to pattern I, gradually changing into pattern Ia, ellipsoid, sometimes fusiform-ellipsoid, with blunt ends, at first hyaline, then violet, finally often violet-brown, $14-17.5 \times 7.5-8.5 \mu\text{m}$, smooth or very finely punctate, sometimes with an occasional fissure in the episporium; pigment in a thin layer about $0.3 \mu\text{m}$ thick. Paraphyses slightly clavate, branched or simple, septate, $1.5-3.0 \mu\text{m}$ thick, the upper part enlarged up to $4.5 \mu\text{m}$, with yellow pigment in the enlarged parts.

On dung of cow, horse, sheep, rabbit, raven, and partridge.

4.1.5 *Saccobolus sphaerosporus*

Apothecia solitary or closely crowded, superficial, sessile on a rather narrow base, $0.2-0.5 \text{ mm}$ across, $0.2-0.4 \text{ mm}$ high, watery-fleshy. Receptacle at first globular to ovoid and white, then flattened to pulvinate and pale brownish, smooth, without margin. Disk at first convex and yellow to amber-coloured, then more flattened and becoming brownish, dotted with the dark-brown protruding tips of asci. Hymenium $50-80 \mu\text{m}$ thick. Hypothecium very thin, of only a few layers of subglobular or ellipsoid cells $3-10 \times 3-4.5 \mu\text{m}$. Flesh not clearly differentiated. Excipulum consisting of a group of closely compacted subglobular cells $3-6 \times 3-4 \mu\text{m}$ (*textura globulosa*) near the base of the fruit-body and a palisade of thin-walled hyaline hyphae to up $4 \mu\text{m}$ wide more upwards. Asci at first broadly obovate, then broadly clavate, gradually tapering downwards into a rather thick base, with broad dome-shaped apex, $72-100 \times 25-36 \mu\text{m}$, 8-spored, the wall blue in Melzer's reagent. Spore-clusters usually elongated, $44-85 \times 11-22 \mu\text{m}$, but sometimes also very compacted down to $29 \times 22 \mu\text{m}$. Ascospores irregularly disposed in a cluster, often in one row of eight spores or two rows of one to seven spores, more rarely densely united in an ellipsoid mass, spherical, at first hyaline, then pinkish-violet, finally violet to purplish-brown, $9.8-11.2(-12.9) \mu\text{m}$ in diameter, ornamented with a very fine pattern of small pits and short more or less branching curved fissures; pigment $0.4-0.8(-1.2) \mu\text{m}$ thick. Paraphyses cylindric-clavate, sparsely

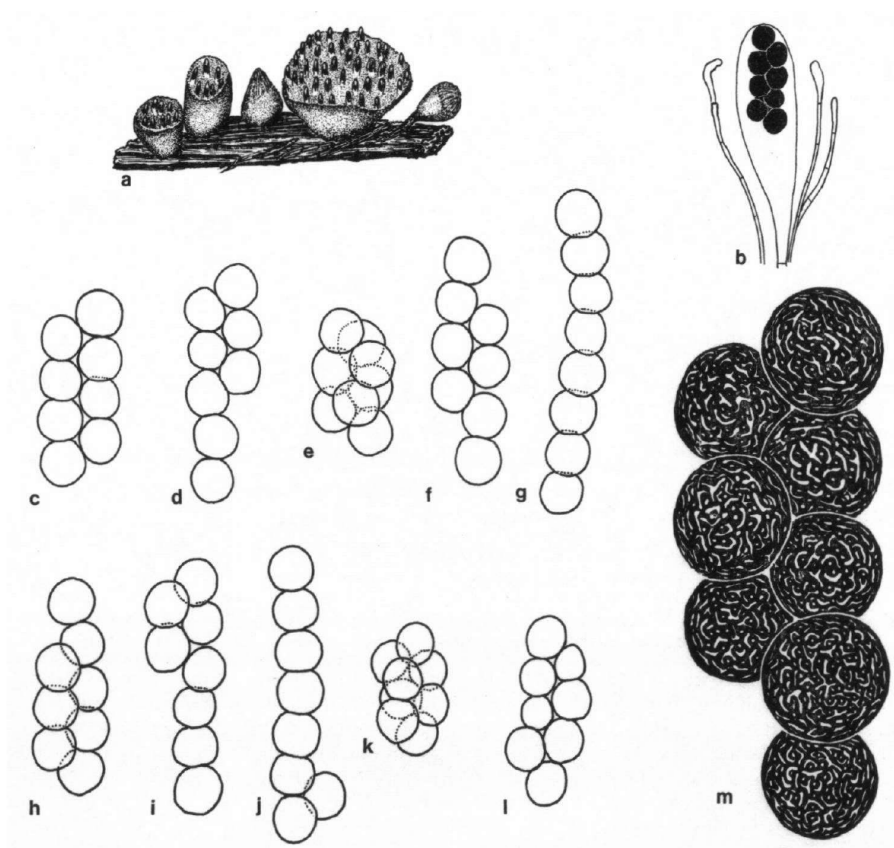


Abbildung 5: *Saccobolus sphaerosporus*. a, habit of fruit-bodies $\times 50$; b, ascus and paraphyses $\times 320$; c-l, diagrams of spore-clusters $\times 630$; m, spore-cluster $\times 1600$

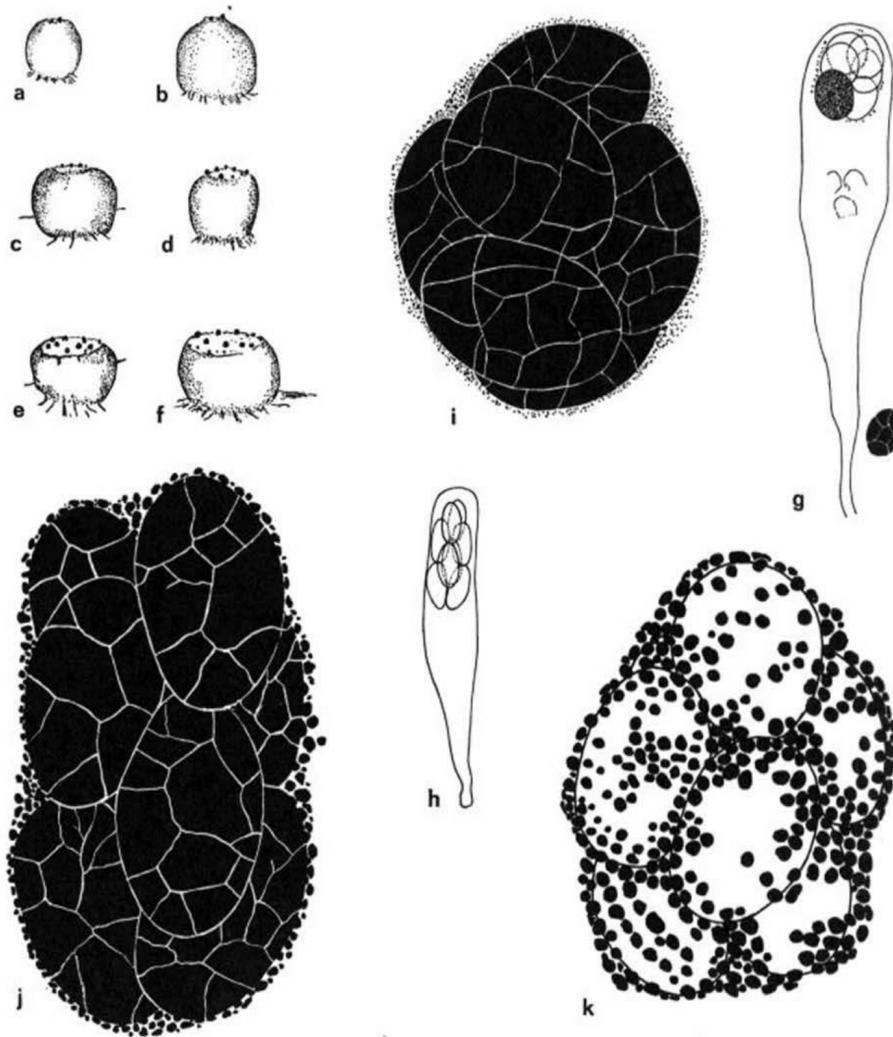


Abbildung 6: *Saccobolus portoricensis*: a- f, habit of fruit-bodies $\times 15$; g, ascus and ascospore $\times 310$; b, ascus with spore-cluster (diagrammatic) $\times 275$; i, j, spore-cluster $\times 1600$; k, spore-cluster with only the extra episporial pigment indicated $\times 1600$.

branched, septate 1.8-2.2 μm thick, enlarged up to 3.5 μm thick at the tip, especially the upper part with yellow contents.

Only known from dung of sheep.

4.1.6 *Saccobolus portoricensis*

Apothecia gregarious or scattered, superficial, sessile, up to 1 mm diameter. Receptacle at first perfectly globose, then short-cylindrical to obconical, finally discoid, pale-amber, smooth; margin not differentiated. Disk flat, then convex, at first similar in colour to the outside of the apothecium, dotted over with the protruding asci, finally almost entirely black. Hymenium about 200 μm thick. Hypothecium not clearly differentiated. Flesh 80-200 μm thick, of rather loosely united roundish or angular cells, hyaline. Excipulum in the lower part not differentiated from the flesh; in the upper part of parallel, paraphysoid hyphae, not clearly distinguishable from paraphyses. Asci clavate, tapering downwards into a rather long, slender base, with truncate apex, 170-200 \times 35-40 μm , 8-spored. Spore-clusters at first elongated, finally subglobular, closely compacted and opaque or nearly so, surrounded by many purple granules, 34-44 \times 22-30 μm . Ascospores arranged according to pattern I, then pressed together in an irregular, subglobular cluster; at first fusiform-ellipsoid, finally subglobular; at first hyaline, then purple, finally pale-brown; mature spores, 15-17.5 \times 10-12.5 μm , shorter and broader than the almost mature ones, 19-21 \times 9-10 μm ; ornamentation consisting of very delicate reticulations; pigment in a 1.0-1.2 μm thick layer and in granules up to 1 μm diameter surrounding the spore-clusters. Paraphyses slender, simple, septate, about 3 μm thick, not or scarcely enlarged above, filled with orange granules.

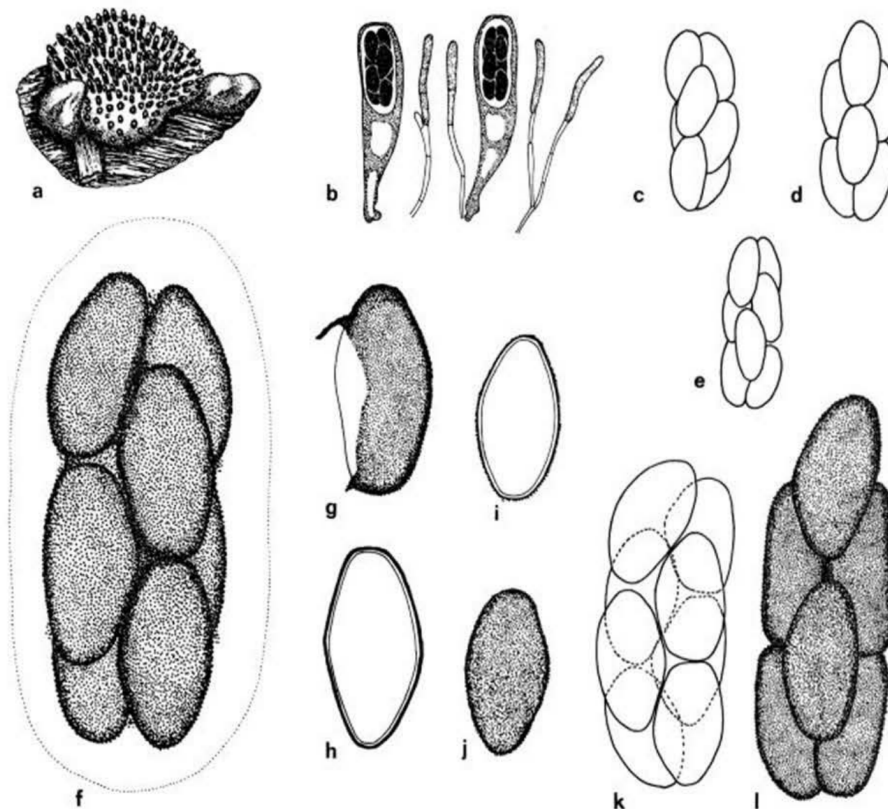


Abbildung 7: *Saccobolus minimus*: a, habit of fruit-body $\times 125$; b, asci and paraphyses $\times 275$; c-e, diagrams of spore-clusters $\times 1600$; f, l, spore-clusters $\times 1600$; g, j, isolated ascospores $\times 1600$; h, i, ascospores in optical section $\times 1600$; k, diagram of spore-cluster $\times 1600$.

On dung of unidentified animal.

4.1.7 *Saccobolus minimus*

Apothecia solitary or gregarious, superficial, sessile, 0.1-0.2 μm diameter. Receptacle at first globular, then pulvinate, transparent amber-coloured to ochraceous yellow ("melina, vitreo-pellucida" according to Velenovsky, 1934: 370), smooth; margin not differentiated. Disk convex, amber-coloured to golden-yellow, dotted with the almost black protruding tips of ripe asci. Hymenium 50-60 μm thick. Hypothecium not clearly differentiated. Flesh thin, of subglobular cells 5-12 μm diameter. Excipulum very thin, and rather fugitive, in the lower part of small subglobular cells, in the upper part consisting of a palisade of paraphyse-like hyphae. Asci cylindrical-clavate, gradually tapering downwards into a rather thick base, with truncate apex, 50-60 \times 14-16 μm , 8-spored, the wall blue in Melzer's reagent. Spore-clusters compact, ellipsoid to elongated, 29-33 \times 12-15 μm , surrounded by a common hyaline, mucilaginous envelope. Ascospores arranged according to pattern I, ellipsoid to fusiform-ellipsoid, often somewhat asymmetrical, at first hyaline, then pinkish-violet, finally violet or purplish-brown, (10-)11.5-13.5(-14.5) \times 5.5-6.5(-7.5) μm extremely fine punctate, or smooth with often some irregular cracks; pigment in a thin layer up to 0.7 μm thick. Paraphyses simple or rarely branched, septate, filiform, 2.0-2.5 μm thick, especially in the upper part with yellow contents not or scarcely thickened above (up to 4 μm).

On dung of cow, goat, sheep, deer, burro, and muskrat.

4.2 *Saccobolus* sect. *Eriobolus*

4.2.1 *Saccobolus depauperatus*

Apothecia scattered or gregarious, superficial, sessile, 0.10-0.20(-0.25) mm diameter, 0.10-0.30 mm high. Receptacle at first subglobular, then more expanded and becoming pulvinate or turbinate-hemispherical, often with a narrow base, white, then pale violet, smooth; margin not differentiated. Disk convex, white, then pale vinous to violet, dotted with the dark purplish protruding tips of ripe asci. Hymenium 70-90(-100) μm thick. Hypothecium thin, of closely compacted isodiametric cells 3-6 μm diameter. Flesh not differentiated or very thin,

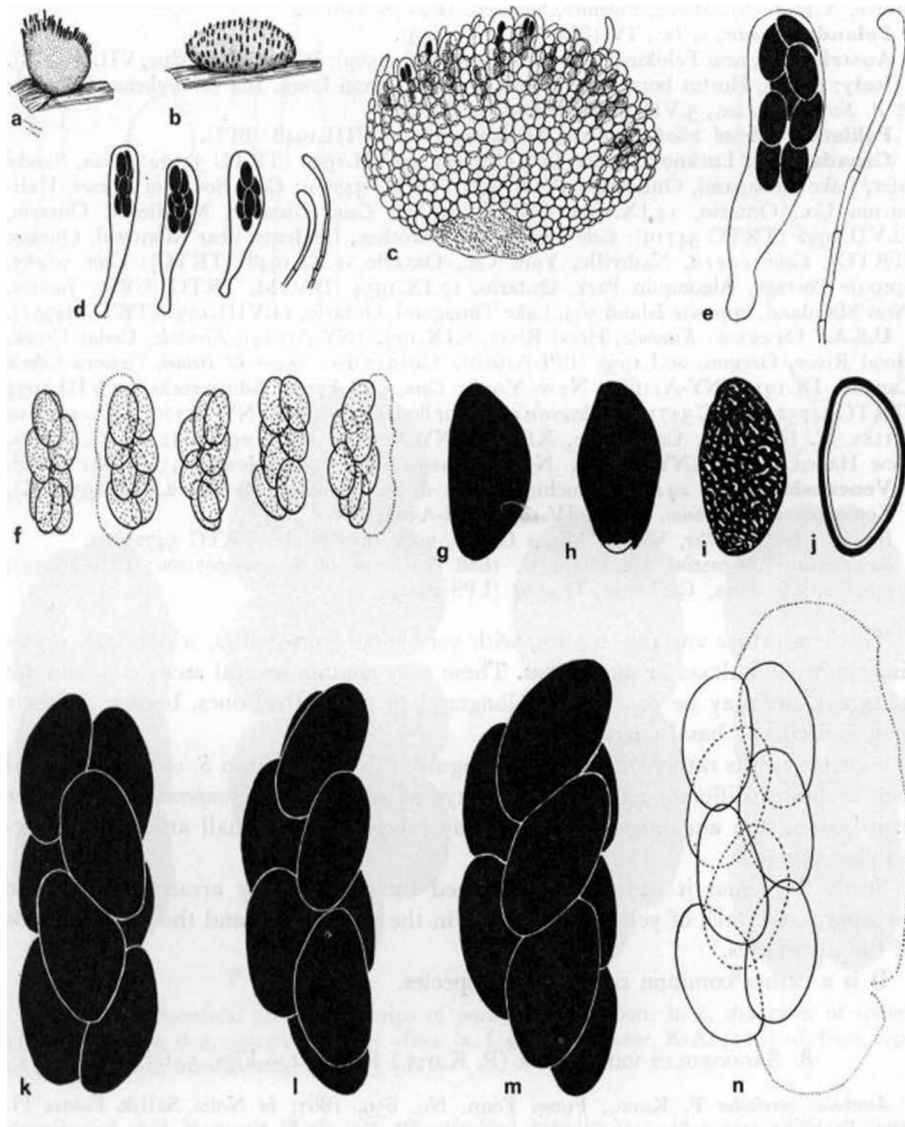


Abbildung 8: *Saccoholus depauperatus*: a, b, habit of fruit-bodies $\times 50$; c, fruit-body in transmitted light $\times 175$; d, asci and paraphyses $\times 275$; e, ascus and paraphysis $\times 600$; f, diagrams of spore-clusters $\times 600$; g-i, isolated ascospores $\times 1600$; j, ascospore in optical section $\times 1600$; k-m, spore-clusters $\times 1600$ (the spores of m relatively long) ; n, diagram of spore-cluster with mucilaginous substance $\times 1600$.

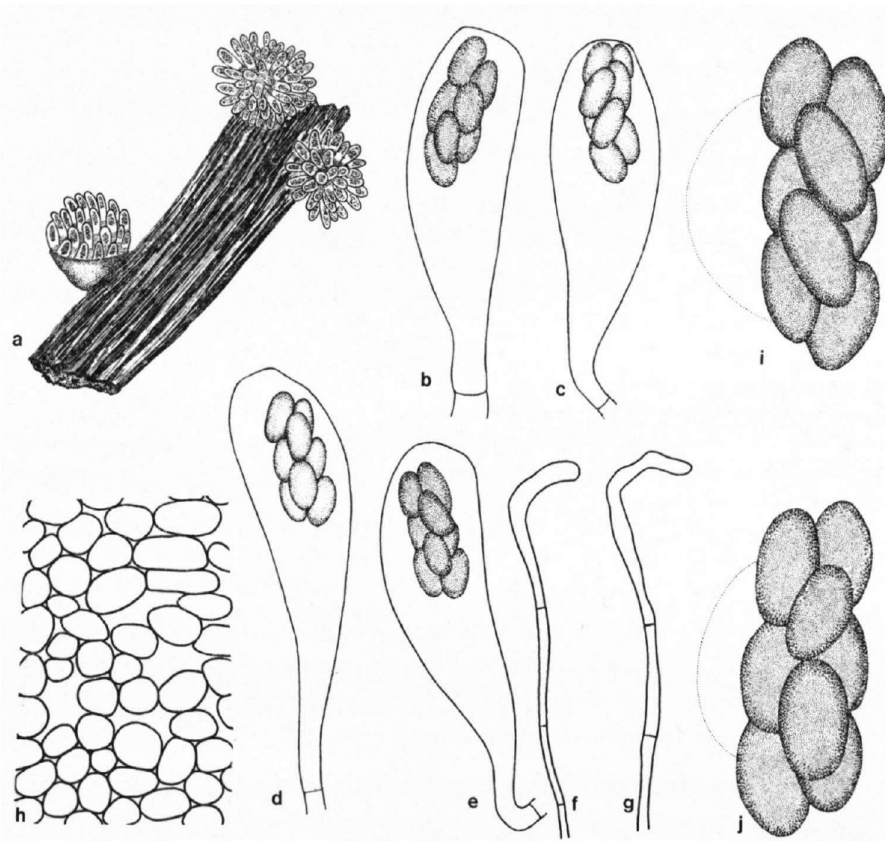


Abbildung 9: *Saccobolus diaphanus*: a, habitat of fruit-bodies $\times 50$; b-e, asci $\times 630$; f, g, upper parts of paraphyses $\times 1000$; c, texture of the excipulum seen from outside $\times 630$; i, j, spore-clusters.

of globular cells 6- 14 μm diameter. Excipulum very thin, consisting of subglobular cells 6-12 μm diameter (*textura globulosa*), hyaline or with pale purplish, intercellular, amorphous pigment. Asci broadly clavate, gradually tapering downwards into a rather thick base, with abruptly truncate apex, 60-95 \times (12-)15-20 μm (the longer ones near the margin of the disk), 8-spored, the wall deep blue in Melzer's reagent. Spore-clusters compact, elongated, 28-37 \times 10-13 μm . Ascospores arranged according to pattern II or III, very rarely in a part of the asci according to pattern I, ellipsoid or fusiform-ellipsoid, sometimes somewhat asymmetrical, with blunt ends, at first hyaline, then pinkish-violet, finally dark violet or purplish-brown, 10-14.5 \times 5-7.5 μm , smooth or extremely fine granular; pigment in a thin or a thick layer (0.5-1.1 μm thick). Paraphyses sometimes rather scarce, simple, septate, filiform, 1.5-3.2 μm thick, colourless or faintly coloured, slightly enlarged up to 4.5(-6) μm at the tip, often slightly curved above, without mucus.

On dung of horse, cow, sheep, deer, porcupine, elk, chamois, elephant, rabbit, and hare, also on the mud plaster of a wall.

4.2.2 *Saccobolus diaphanus*

Apothecia solitary, superficial, sessile, 0.20-0.25 mm across, about 0.20 mm high. Receptacle at first obconical with a narrow base, then more white, expanded, smooth; margin retracted towards the base at maturity. Disk convex, translucent white, then pale violet, dotted with the brown protruding tips of ripe asci. Hymenium to about 65 μm thick. Hypothecium thin, of isodiametric cells 4-8 μm wide. Flesh not or scarcely differentiated. Excipulum of only one layer of isodiametric or slightly elongated (sometimes angular) cells 8-14 \times 8-10 μm (*textura globulosa* to *angularis*), hyaline. Asci broadly clavate, gradually tapering downwards into a rather thick base, with truncate apex, 73-86 \times 21-23 μm , (7-)8-spored; the wall blue in Melzer's reagent. Spore-clusters rather loose, 27-32 \times 10-12 μm . Ascospores loosely arranged according to pattern II or more often irregularly disposed, broadly ellipsoid to ellipsoid (length-breadth ratio 1.5-1.9), at first hyaline, then very pale violet, finally pale brownish violet, 9.5-10.7 \times 5.3-6.5 μm usually wholly smooth, more rarely finely punctate; pigment in a very thin layer 0.2-0.4 μm thick. Paraphyses simple, septate, irregularly cylindrical, 1.7-2.2 μm thick, frequently hooked at the slightly enlarged tips (up to 3 μm), hyaline.

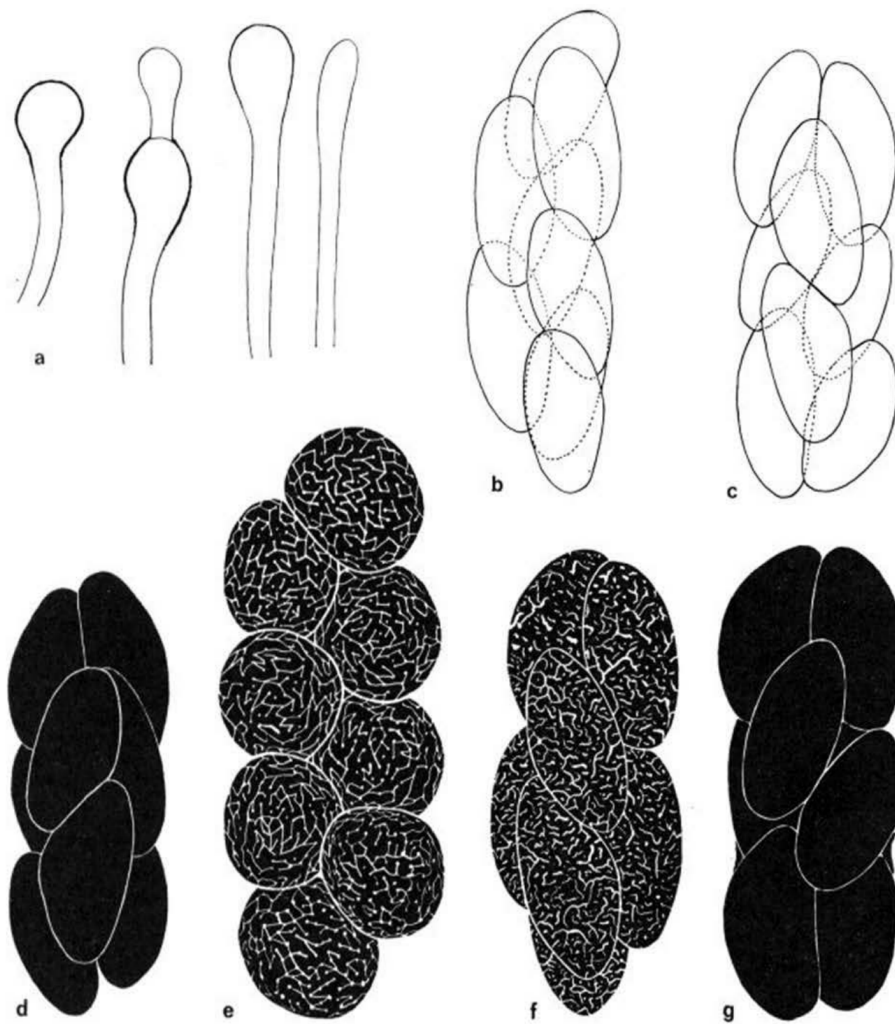


Abbildung 10: *Saccobolus versicolor*: a, tips of paraphyses $\times 1600$; b, c, diagrams of spore-clusters $\times 1600$; d-g, spore-clusters $\times 1600$.

Known only from dung of horse.

4.2.3 *Saccobolus versicolor*

Apothecia scattered or gregarious, superficial, sessile, (0.1-)0.2-1.0(-2.0) mm across. Receptacle at first globular, then hemispherical, and finally often pulvinate or lenticular, pale violet, becoming darker with age, smooth; margin not differentiated. Disk convex or plano-convex, pale violet, dotted with the dark violet or almost black protruding tips of ripe asci. Hymenium 55-120 μm thick. Hypothecium very thin and often not clearly differentiated, of closely compacted isodiametric cells 4-7 μm diameter. Flesh very thin, of isodiametric or elongated cells 5-16 \times 4-7 μm , hyaline. Excipulum 7-13 μm thick, often poorly developed, of closely intertwined hyphae 2.5-4 μm wide, with enlarged apical cells up to 7 μm thick, with amorphous, violaceous, intercellular pigment. Asci broadly clavate, (80-)100-145 \times 22-37 μm , 8-spored; the wall deep blue in Melzer's reagent. Spore-clusters rather compact, elongated, often somewhat curved, 40-62 \times 14-19(-23) μm . Ascospores arranged according to pattern II or III, ellipsoid-fusiform or more rarely fusiform-ellipsoid, very rarely subglobular or globular, often asymmetrical, subtrigonal or ventricose, with blunt ends, at first hyaline, then pinkish-violet, finally violet, purplish-brown or purplish-grey, 13-21.5(-23.5) \times 6.5-9.5(-10) μm , smooth, finely warted or with small pits and short more or less reticulating fissures; with common or individual, lateral, mucilaginous substance. Paraphyses branched, septate, filiform, 2-3 μm thick; not, slightly, or strongly enlarged above, up to 7.5 μm at the tip; hyaline, often with amorphous, violet, intercellular pigment between the upper parts.

On dung of cow, caribou, horse, goat, sheep, deer, hare, rabbit, lemming, muskrat, and mouse, also on rotten stems of cabbage and on pasteboard.

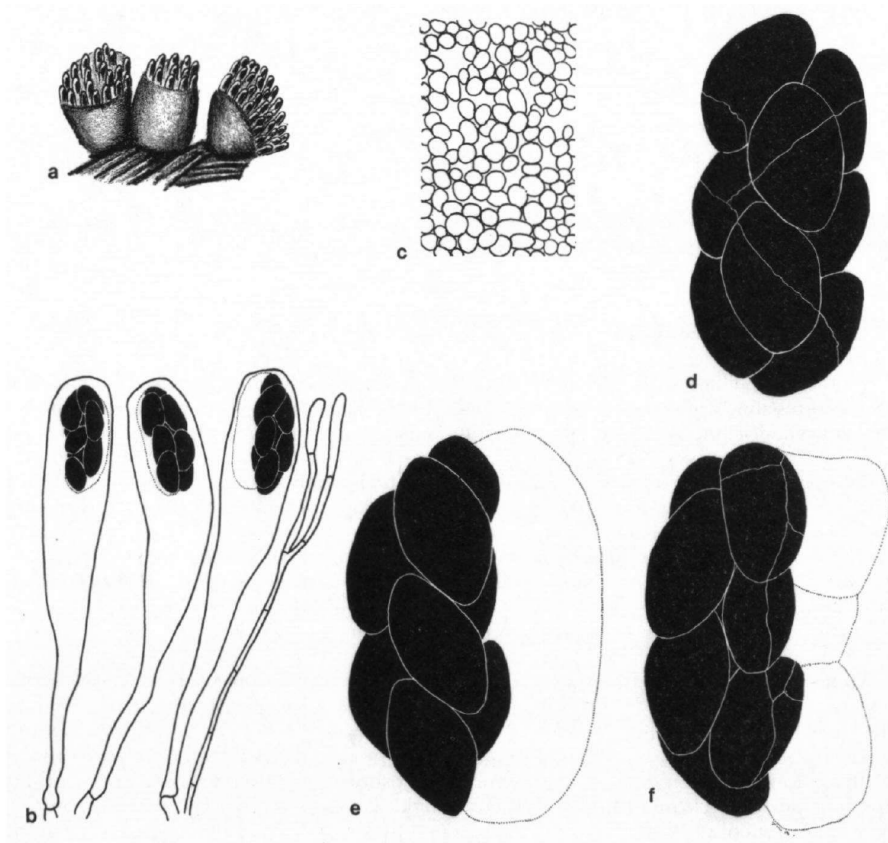


Abbildung 11: *Saccobolus purpureus*: a, habitat of fruit-bodies $\times 50$; b, asci and paraphysis $\times 500$; c, texture of the excipulum seen from outside $\times 1000$; d-f, spore-clusters $\times 1600$

4.2.4 *Saccobolus purpureus*

Apothecia solitary or in small groups, superficial, sessile on a broad base, 0.15-0.50 mm across, 0.25-0.35 mm high, watery-fleshy. Receptacle at first hemispherical and pale purple-red, then obconical and more brownish purple, finally pulvinate or rarely subcylindrical; surface smooth; margin not differentiated. Disk convex, at first colourless, then dark violet from ripe ascospores, roughened by the protruding tips of ripe asci. Hymenium 80-100 μm thick. Hypothecium very thin, of only a very few layers of isodiametric cells 2.5-7 \times 2-5.6 μm . Flesh not clearly differentiated. Excipulum 6-10 μm thick, of one or two layers of isodiametric or slightly oblong cells 5-9 \times 3-7 μm (*textura globulosa*), with maturity restricted to the base of the fruit-body, with purple-red, amorphous, intercellular, water-soluble pigment. Asci clavate, with truncate apex, 110-120 \times 22-26 μm , 8-spored, the wall blue in Melzer's reagent. Spore-clusters very compact, elongated, 34-36 \times 14-15 μm , with unilateral mucilaginous substance. Ascospores arranged according to a very compact form of pattern II, at first fusiform-ellipsoid and hyaline, then asymmetrical, subtrigonal, or ventricose and dark purple-violet, finally brownish-purple, 13.8-15.6 \times 7-3-8.3 μm , smooth with a few irregular secondary cracks taking the shape of delicate lines over the whole of the spore-cluster; pigment in a rather thick layer (0.5-1.3 μm thick). Paraphyses branched, septate, cylindrical, 2.5—3.7 μm thick, not or very slightly enlarged up to 5 μm at the tip, with colourless contents; the apex sometimes covered with small purple-red crystals

On dung of donkey and of unknown insectivorous animal.

4.2.5 *Saccobolus eleutherosporus*

Apothecia solitary or in small groups, not confluent, superficial, sessile on a narrow base, 0.10-0.25 mm across, 0.10-0.15 mm high, soft fleshy. Receptacle at first subglobular and pale pinkish, then flattened to pulvinate and pale purplish pink, in a few cases slightly yellowish; surface finely roughened by subglobular cells; margin not differentiated. Disk convex, at first pink, then pale purplish pink, roughened by the pale violet protruding tips of ripe asci. Hymenium 90-100 μm thick. Hypothecium very thin, of subglobular cells 5-15 μm in diameter (*textura globulosa*). Asci cylindrical-clavate, with a short stalk, truncate at the apex, 95-120 \times 22-27 μm ; 8-spored; the wall blue in Melzer's reagent. Spore-clusters elongated, loose. Ascospores not cemented together

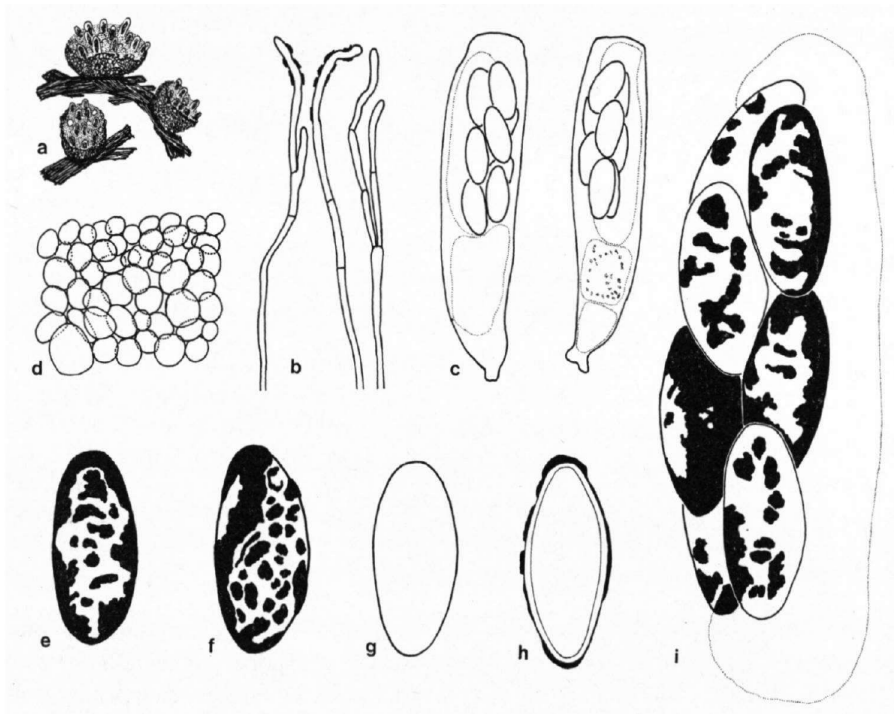


Abbildung 12: *Saccobolus eleutherosporus*: a, habitat of fruit-bodies $\times 50$; b, paraphyses $\times 500$; c, asci $\times 500$; d, texture of the excipulum seen from outside $\times 500$; e-g, ascospores $\times 1600$; h, ascospore in optical section $\times 1600$; i, spore-cluster $\times 1600$

by their pigment, at first free, then very clinging together according to pattern II, finally often more or less free, ellipsoid or elongated-ellipsoid (length-breadth ratio 2.2-2.7), often somewhat ventricose; hyaline, then pale violet, finally pale purplish brown; $16.5-17.5 \times 6.4-7.6 \mu\text{m}$; ornamented with very irregular coarse warts and thick lumps of pigment, leaving large parts of the wall uncovered; with common unilateral mucilaginous substance. Paraphyses rather frequently branched, septate, irregularly filiform, $2-3 \mu\text{m}$ thick, not or only slightly enlarged up to $4 \mu\text{m}$ at the tip; covered near the ends with pale pinkish, amorphous pigment; pigment staining brownish red with iodine.

Known from only dung of pheasant.

4.2.6 *Saccobolus caesariatus*

Apothecia solitary, superficial, sessile, $150-200 \mu\text{m}$ diameter, $200-300 \mu\text{m}$ high. Receptacle ovoid-cylindrical or hemispherical, white in all parts; surface covered with white, flexuous bunches of septate hyphae to form tapering squamules; margin not differentiated. Disk flat or convex, colourless, roughened by the protruding asci. Flesh none or very thin. Excipulum thin, of elongated or angular cells (*textura angularis*), colourless. Asci clavate, gradually tapering downwards into a rather thin base, $175-193 \times 30-33 \mu\text{m}$, 8-spored, the wall blue in Melzer's reagent. Spore-clusters compact, elongated, $38-43 \times 15-17 \mu\text{m}$, with thick gelatinous envelope. Ascospores arranged according to pattern II, fusiform-ellipsoid, at first hyaline, then pale violet, finally violaceous-brown; $16-17.5 \times 7-8.5(-9.5) \mu\text{m}$, smooth or finely punctate. Paraphyses not or scarcely branched, multi-septate, cylindrical, $2.0-3.5 \mu\text{m}$, thick, not enlarged upwards, colourless.

On dung of sheep and rabbit.

4.2.7 *Saccobolus beckii*

Apothecia solitary or gregarious, superficial, sessile, $0.1-0.7 \text{ mm}$ diameter. Receptacle at first semiglobular, then more or less pulvinate, almost colourless, smooth; margin not differentiated. Disk convex, hyaline, at maturity dotted with the black protruding tips of ripe asci. Hymenium $130-150 \mu\text{m}$ thick. Hypothecium not clearly differentiated. Flesh very thin. Excipulum thin, of intertwined, cylindrical hyphae $2.0-3.5 \mu\text{m}$ wide (between *textura intricata* and *epidermoidea*), colourless, or with some pale violaceous or brownish-violaceous, intercellular pigment. Asci broadly clavate, tapering downwards into a rather thick base, with truncate apex,

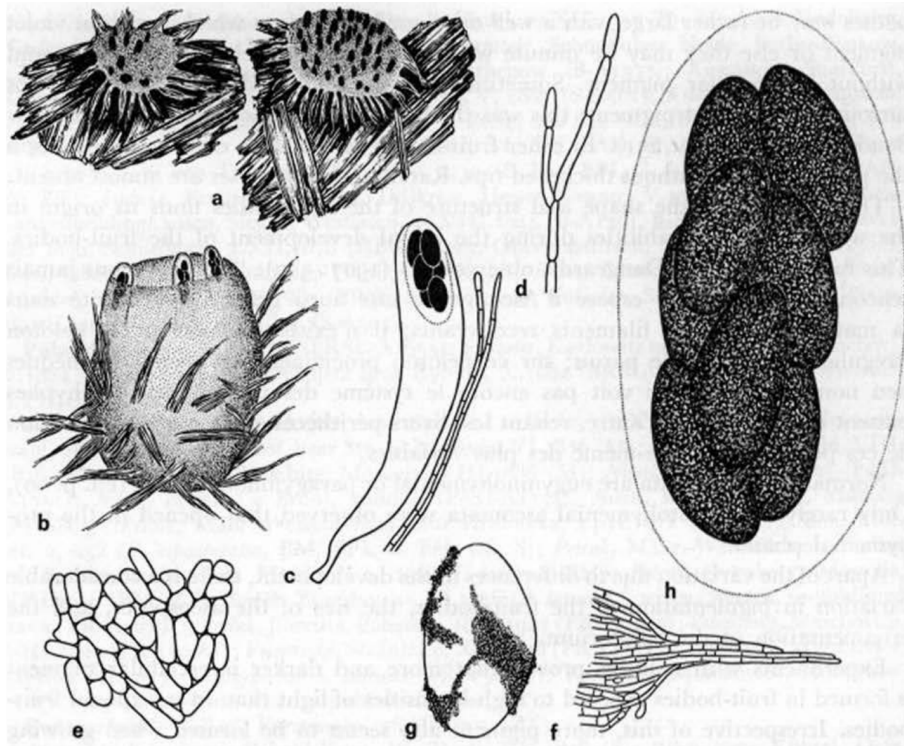


Abbildung 13: *Saccobolus caesariatus*: a, habit of fruit-bodies $\times 50$; b, fruit-body in transmitted light $\times 80$; c, d, ascus and paraphyses $\times 275$; e, texture of excipulum seen from outside $\times 600$; f, bundle of hyphae from the outside of the receptacle $\times 275$; g, isolated ascospore $\times 1600$; h, spore-cluster $\times 1600$.

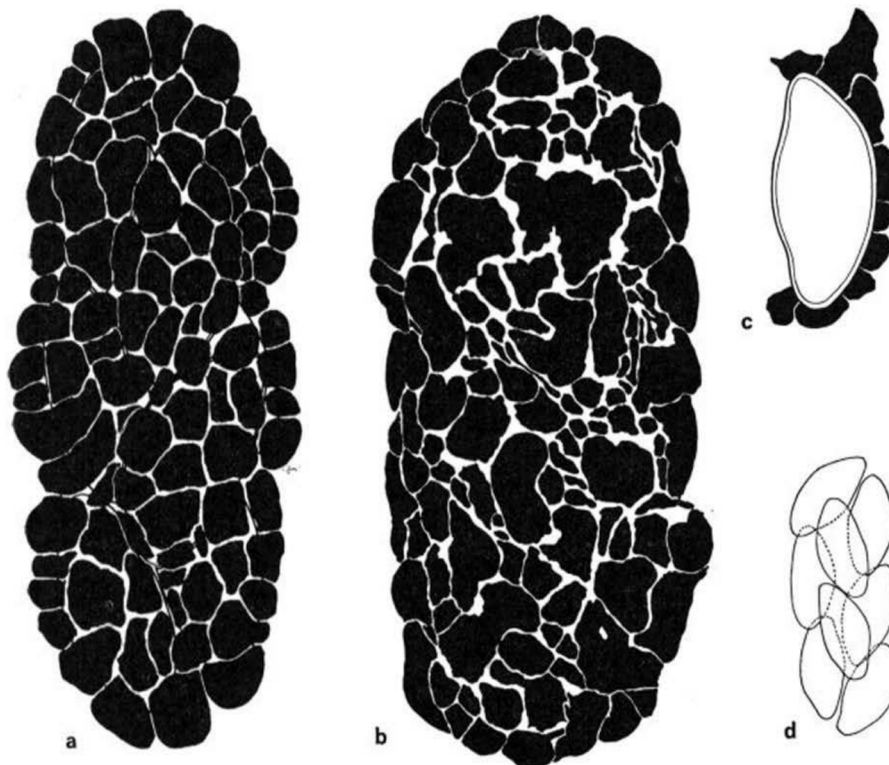


Abbildung 14: *Saccobolus beckii*: a, b, spore-clusters $\times 1600$; c, ascospore in optical section $\times 1600$; d, diagram of spore-cluster $\times 740$.

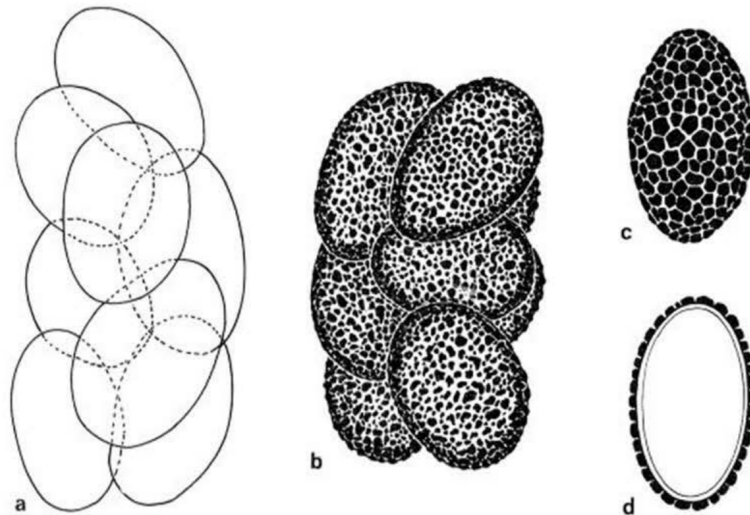


Abbildung 15: *Saccobolus obscurus*: a, diagram of spore-cluster; b, spore-cluster; c, ascospore; d, id. in optical section. All $\times 1600$

130-180 \times 40-47 μm , 8-spored; the wall blue in Melzer's reagent. Spore-clusters rather compact, elongate, 42-60 \times 18-24 μm , "with unilateral gelatinous substance 8-9 μm thick" (Heimerl 1889: 18). Ascospores arranged according to pattern II, ellipsoid-fusiform, often slightly ventricose, at first hyaline, finally black, 17.5-23 \times 8.5-10(-12) μm (15-17 \times 8-9.5 μm without episporium), with very coarse warts or thick lumps of pigment 1-3 μm thick. Paraphyses simple or branched, septate, cylindrical, 2-3 μm thick, hyaline, scarcely thickened above.

With certainty only known from dung of deer and cow.

4.2.8 *Saccobolus obscurus*

Apothecia gregarious or closely crowded, superficial, sessile, up to 0.8 mm across. Receptacle at first lenticular, then often more pulvinate, becoming dark brown with age, smooth; margin not differentiated. Disk convex, pale brown, dotted with the almost black protruding tips of ripe asci. Hymenium about 85 μm thick. Hypothecium not clearly differentiated. Flesh of intermingled hyphae, some of which stain intensively in cotton blue. Excipulum clearly differentiated by the presence of an intercellular brownish pigment, of somewhat intertwined hyphae. Asci clavate with truncate apex, "circ. 100 \times 26 μm " (Heimerl 1889: 19), 8-spored; the wall deep blue in Melzer's reagent. Spore-clusters compact, (23-)26-43 \times 13- 19 μm , longitudinally compressed with ripening. Ascospores at first arranged according to pattern II, gradually changing into pattern IIIa, ellipsoid or fusiform-ellipsoid, at first hyaline, then violet, finally often purplish-brown, 13.5-18 \times 7.5-9.5 μm , ornamented with fine or coarse warts (0.3-2.0 μm diameter); pigment in a rather thick layer. Paraphyses simple, with few septae, filiform, about 2 μm thick, sometimes enlarged up to 4 μm at the tip, hyaline or yellowish-brown due to the presence of intercellular pigment in the upper part.

Especially on linen, old sacking, and rotten fabric, more rarely on dung of donkey, goat, and rabbit.

4.2.9 *Saccobolus quadrisporus*

Apothecia superficial, sessile, 0.5-0.7 mm diameter. Receptacle more or less pulvinate, at first clear watery violet, gradually becoming darker with age, smooth; margin not differentiated. Disk at first convex, then flat, clear watery violet, becoming blackish-violet or black, at maturity dotted with the dark apices of the protruding asci. Asci clavate, tapering downwards into a rather thick base, with truncate apex, 95-110 \times 18-20 μm , 4-spored, the wall staining blue with iodine. Spore-clusters ellipsoid or elongated, 42-48 \times 16-17 μm if ascospores in two rows, 46-51 \times 14-16 μm if ascospores in a single row, surrounded by a common mucilaginous covering. Ascospores arranged in two parallel rows or side by side in a single row, ellipsoid, often somewhat trigonous, at first hyaline, then blackish-violet, 16.5-19.5 \times 9.5-10.5 μm ; with a thick cap or girdle of irregularly reticulated or warted pigment up to 1.6 μm thick, which is surrounded by a narrow zone of greater translucency, in the other warts smooth to finely punctate and with only a thin layer of pigment. Paraphyses simple or branched, septate, filiform, clavate at the apex.

Known only from goose dung.

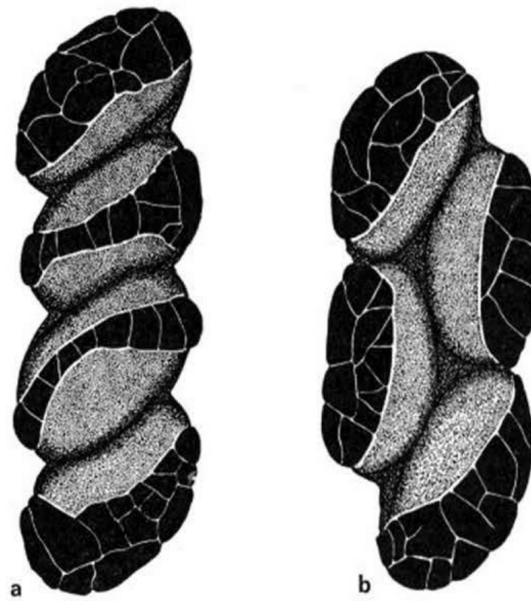


Abbildung 16: *Saccobolus quadrisporus*, spore-clusters $\times 1600$

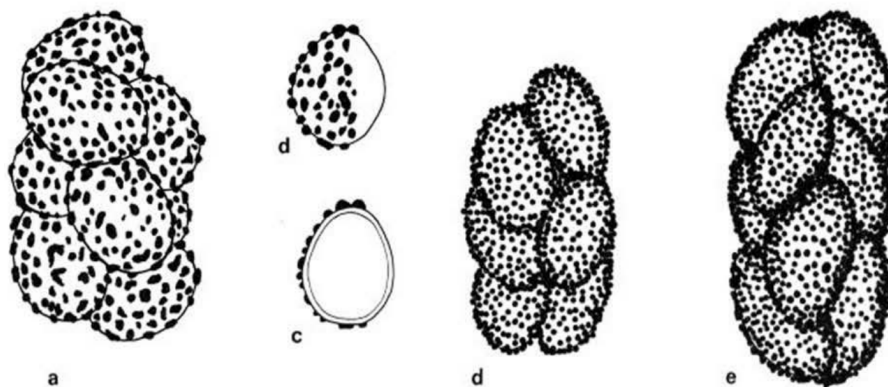


Abbildung 17: *Saccobolus thaxteri*: a, d, e, spore-clusters; d, ascospore; c, id. in optical section. All $\times 1600$.

4.2.10 *Saccobolus thaxteri*

Apothecia solitary or more often gregarious, superficial, sessile, 0.1-0.3 mm diameter, 0.1-0.2 mm high. Receptacle at first globular, then semiglobular, soon pulvinate, whitish or very pale violet, smooth; margin not differentiated. Disk flat, then convex, whitish, dotted with the dark protruding tips of ripe asci. Hymenium about 70 μm thick. Hypothecium not clearly differentiated. Flesh very thin, of hyphae with subglobularly or elliptically swollen cells 4-9 \times 4-7 μm . Excipulum very fugacious, only present in very young fruit-bodies only 4-5 μm thick, consisting of somewhat intermingled hyphae, almost colourless. Asci broadly clavate, tapering downwards in to a rather thick base, with slightly truncate apex, 68-86 \times 19-23 μm ; the wall pale blue in Melzer's reagent. Spore-clusters rather loose to very compact, subellipsoid to subglobular, 23-33 \times 12-20 μm , often becoming shorter and broader with ripening. Ascospores arranged according to pattern II or more often irregularly disposed, broadly ellipsoid or broadly fusiform-ellipsoid, at first hyaline, then pinkish-violet, finally dark purple, 10.5-14 \times 7-9 μm , ornamented with isolated warts. Paraphyses rather strongly branched, septate, irregularly filiform, often with swollen cells, 2.5-6.0 μm thick, colourless, scarcely thickened above, rarely with globularly swollen terminal cells 6-13 μm diameter.

Known from dung of goat and squirrel.

4.2.11 *Saccobolus parvisporus*

Apothecia solitary or in small coherent sometimes apparently confluent, groups, superficial, sessile on a broad base, 0.3-0.6 mm across, 0.3-0.4 mm high, watery- fleshy. Receptacle at first subglobular and pale pinkish

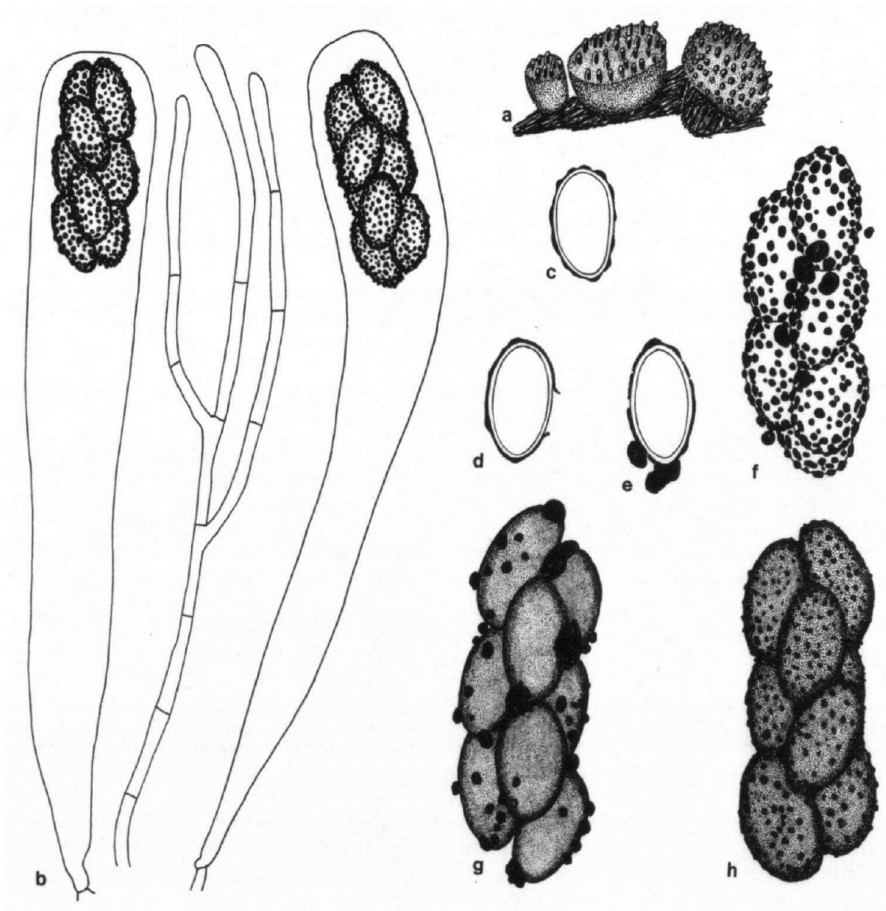


Abbildung 18: *Saccobolus parvisporus*: a, habitat of fruit-bodies $\times 50$; b, asci and paraphysis $\times 1000$; c-e, ascospores in optical section $\times 1600$; f-h, spore-clusters $\times 1600$

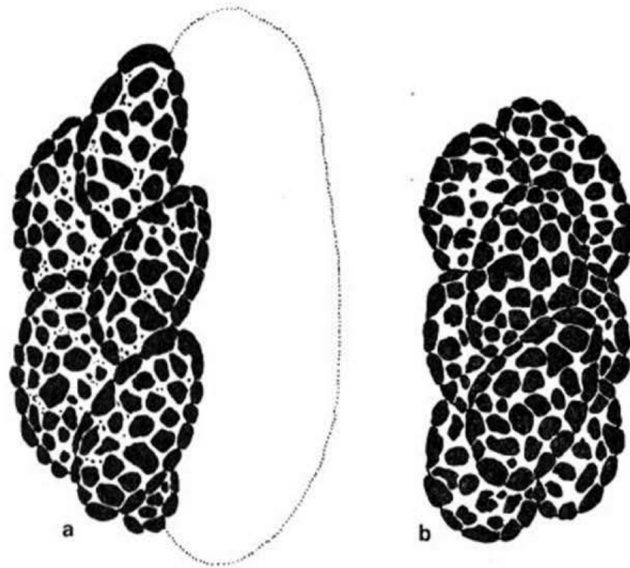


Abbildung 19: *Saccobolus verrucisporus*, spore-clusters $\times 1600$

to pale violet, then pulvinate and dingy pinkish to pale flesh-coloured, smooth, without margin. Disk convex, translucent pale pinkish, roughened by protruding asci. Hymenium 90-110 μm thick. Hypothecium thin, of closely compacted isodiametric cells 3-7.5 μm in diameter. Flesh not differentiated. Excipulum very thin, consisting of subglobular cells (*textura globulosa*), hyaline, scarcely pigmented, with maturity restricted to base of fruit-body. Asci clavate, with a long stalk, with truncate apex, 122-132 \times 15-18 μm , 8-spored; the wall deep blue in Melzer's reagent. Spore-clusters elongated, 27-29 \times 10-11 μm , sometimes becoming more compact 23-26 \times 11 μm . Ascospores rather loosely united in a cluster, arranged according to pattern II, sometimes changing into pattern IIIa, ellipsoid, at first hyaline, then pale violet, becoming darker in concentrations of pigment, 9.5-10.3 \times 5.1-6.3 μm ; ornamented with irregular large warts and granules, often with thin uniform layer at base; mucilaginous substance very fugacious or absent. Paraphyses simple or branched, septate, cylindrical, 1.8-2.3 μm thick, slightly enlarged up to 4 μm at the tip, colourless.

Known only from dung of donkey.

4.2.12 *Saccobolus verrucisporus*

Apothecia solitary or in small groups, superficial, sessile, 130-200 μm diameter, 150-200 μm high. Receptacle cylindrical or subglobular, sometimes on a small base and more or less obconical, whitish with a shade of violet; surface covered with short or long hyphae which are connected with the substratum; margin not clearly differentiated. Disk flat or convex, at first white, then pale violet, dotted with the far protruding tips of ripe asci. Hymenium 100-115 μm thick. Hypothecium very thin, of closely compacted cells 4.5-9 μm diameter, colourless. Flesh not clearly differentiated. Excipulum of one or a very few layers of intermingled hyphae 3-4.5 μm wide, which consist of more or less swollen cells 4.5-9 μm long; with pale violet, intercellular pigment. Asci broadly clavate with truncate apex, 90-110 \times 26-29 μm , 8-spored; the wall deep blue in Melzer's reagent. Spore-clusters compact, elongated, 33-39 \times 14-16 μm , with unilateral mucilaginous substance 7-10 μm thick. Ascospores arranged according to pattern II, fusiform-ellipsoid, at first hyaline, then dark violet, 14-16 \times 8-9 μm , ornamented with coarse, isolated warts. Paraphyses slender, branched, 2.3-3.4 μm thick, not enlarged upwards, colourless, with pale violet, intercellular pigment.

Known only from dung of roe-deer.

4.2.13 *Saccobolus globuliferellus*

Apothecia scattered, superficial, sessile, up to 0.4 mm across. Receptacle semi-globular or lenticular, white, smooth; margin not differentiated. Disk convex, white, dotted with the almost black protruding tips of ripe asci. Hymenium up to 65 μm thick. Hypothecium and flesh very thin or not clearly differentiated. Excipulum fugitive or not differentiated. Asci broadly-clavate, tapering downwards into a stem-like base, the apex somewhat flattened, up to 60 \times 23-25 μm , 8-spored, the wall blue in Melzer's reagent. Spore-clusters at first rather loose, then more compact, short-ellipsoid or subglobular, 17-25(-39) \times 15-19 μm . Ascospores at first loosely

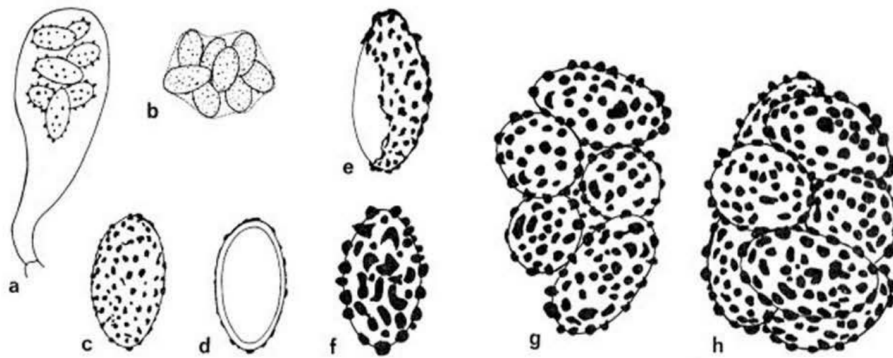


Abbildung 20: *Saccobolus globuliferellus*: a, ascus with ripe ascospores $\times 575$ (after drawing by Seaver); b, spore-cluster $\times 600$ (from slide studied by Seaver); b, spore-cluster $\times 600$ (from slide studied by Seaver) ; c, e, f, isolated ascospores $\times 1600$; d, ascospore in optical section $\times 1600$; g, h, spore-clusters $\times 1600$.

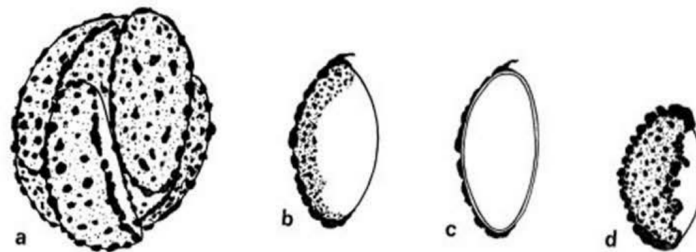


Abbildung 21: *Saccobolus dilutellus*: a, spore-cluster; b, d, ascospores; c, ascospore in optical section. All $\times 1600$.

disposed in the ascus, then loosely united and arranged according to pattern IIIa or IV, finally in most cases becoming compressed, ellipsoid, at first hyaline, then "assuming a faded-blue colour", finally smoky-blackish or dark brown, $11.5-13.5(-14.5) \times 6-7 \mu\text{m}$, ornamented with small, isolated warts. Paraphyses simple, septate, cylindrical, about $3 \mu\text{m}$ thick, not or scarcely thickened above (according to Seaver l. c.: "rather strongly enlarged above, where they reach a diameter of $7-8 \mu\text{m}$ "), hyaline.

On dung of horse and rodents (especially rabbit and wild guinea pig).

4.2.14 *Saccobolus dilutellus*

Apothecia scattered or in small groups, superficial, sessile, up to 0.5 mm across. Receptacle at first semiglobular, then lenticular, white, smooth; margin not differentiated. Disk convex or flat, at first white, then often pale violet, dotted with the almost black protruding ends of ripe asci. Hymenium up to $80 \mu\text{m}$ thick. Hypothecium and flesh very thin or not clearly differentiated. Excipulum fugitive or not differentiated. Asci broadly clavate, short-stalked, with rather abruptly truncate apex, " $70-93 \times 20.5-29 \mu\text{m}$ " (Heimerl 1889: 18), 8-spored; the wall blue in Melzer's reagent. Spore-clusters extremely compact, subglobular, $19-26 \times 18-20 \mu\text{m}$. Ascospores arranged according to pattern IV, ellipsoid, sometimes asymmetrical or even slightly trigonal, at first hyaline, then pinkish-violet, finally greyish- or brownish-violet, $11.5-14.5 \times 6.5-7.5 \mu\text{m}$, only the exposed surface of the spores is covered with pigment; ornamented with small and coarse warts, the former equally distributed over the pigmented area, the latter especially at the outline of it. Paraphyses simple, septate, cylindrical-clavate, $1.5-2.0 \mu\text{m}$ thick, enlarged above, $2.5-4.5 \mu\text{m}$ thick at the tip, hyaline.

On dung of dog, fox, rabbit, mouse, raven, pheasant, and finch.

4.2.15 *Saccobolus geminatus*

Apothecia solitary or gregarious, superficial, sessile, $0.2-0.3 \text{ mm}$ diameter, up to 0.2 mm high. Receptacle at first semiglobular, then pulvinate, white, smooth; margin not differentiated. Disk at first flat, then convex, white, becoming somewhat violet, dotted with the dark protruding tips of ripe asci. Hymenium about $70 \mu\text{m}$ thick. Hypothecium very thin, of hyphae with ellipsoid or elongated, cells $6.5-10.5 \times 4-6.5 \mu\text{m}$, colourless. Excipulum very thin, rather fugitive, in the lower part consisting of hyphae with subglobularly or elliptically swollen cells $4.0-10.5 \times 4.0-7.5 \mu\text{m}$, in the upper part consisting of a palisade of paraphyse-like hyphae ($2.6-4.5$

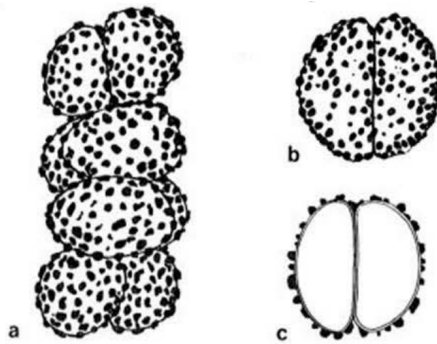


Abbildung 22: *Saccobolus geminatus*: a, spore-cluster; b, pair of ascospores; c, id. in optical section. All $\times 1600$.

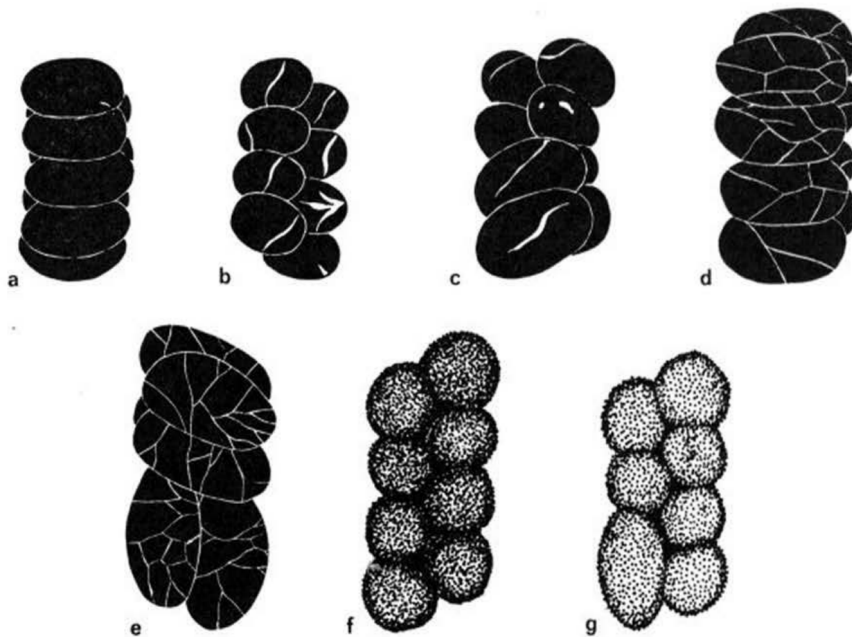


Abbildung 23: *Saccobolus infestans*, spore-clusters $\times 1600$.

μm wide) with slightly swollen cells, colourless. Asci clavate, gradually tapering downwards into a rather thick base, with truncate apex, $65\text{-}75 \times 14.5\text{-}16.0 \mu\text{m}$, 8-spored; the wall blue in Melzer's reagent. Spore-clusters rather loose and easily breaking up into pairs, cylindrical, $27\text{-}37 \times 12\text{-}13 \mu\text{m}$. Ascospores firmly united in pairs; four pairs loosely united in a cylindrical cluster, unequal-sided fusiform; at first hyaline, then pinkish-violet, finally violet or purplish-brown, $10.5\text{-}13 \times 5\text{-}6.5 \mu\text{m}$ ornamented with isolated warts. Paraphyses simple, septate, filiform, $1.7\text{-}2.6 \mu\text{m}$ thick, slightly enlarged up to $3.9 \mu\text{m}$ at the tip, colourless.

Only known from opossum dung.

4.2.16 *Saccobolus infestans*

Apothecia scattered or gregarious, superficial, sessile, $80\text{-}160\text{-}(360) \mu\text{m}$ diameter. Receptacle pulvinate, white, smooth; margin not differentiated. Disk convex, white, becoming violet as ascospores mature, dotted with the dark protruding tips of ripe asci. Hymenium about $60 \mu\text{m}$ thick. Hypothecium and flesh not clearly differentiated. Excipulum consisting of few small isodiametric cells up to $6 \mu\text{m}$ diameter, at the base of apothecium only. Asci clavate, with a rather thick base, flattened above, $60\text{-}100 \times 12\text{-}19 \mu\text{m}$, 8-spored; the wall blue in Melzer's reagent. Spore-clusters rather compact, elongated, $21\text{-}28 \times 10\text{-}14 \mu\text{m}$. Ascospores arranged transversely in two rows or in a similar very regular pattern (pattern VI), ellipsoid, with broadly rounded ends, at first hyaline, then violet, finally brown, $9\text{-}11 \times 5\text{-}6.5 \mu\text{m}$, slightly roughened with small dots; the outer part of the coloured layer of the ascospores dissolves gradually in water and allows spores to separate, while the inner part remains smooth and olive in colour. Paraphyses simple or branched, septate, filiform $1.5\text{-}2.5 \mu\text{m}$ thick, only slightly larger up to $3 \mu\text{m}$ above, with olive coloured contents.

Known from dung of horse and donkey.

4.3 Arrangement of ascospores

In *Saccobolus* the spores are only very rarely free. Mostly they are regularly united into a cluster and cemented together by the episporial pigment. In cases where this pigment was already precipitated before the spores were pressed together, they remain free; this is the case in *S. saccoboloides*. Sometimes the episporial pigment forms only a weak connection; it may be partly soluble in water. As result, the spores of *S. globuliferellus*, *S. geminatus*, and *S. infestans* may easily come apart.

The "common hyaline sack" which is found in some species of *Saccobolus* sect. *Sacchobolus* scarcely plays a role in keeping the spores together, as was supposed by Boudier (1869).

The following patterns of arrangement of the spores are distinguishable in species of *Saccobolus*.

- Pattern I (Fig. 24 a-b): with four rows of two longitudinally disposed spores, and two longitudinal planes of symmetry. This is typical of *Saccobolus* sect. *Sacchobolus*.
- Pattern Ia (Fig. 24 c): a longitudinally contracted form of pattern I (e.g. *S. truncatus*).
- Pattern II (Fig. 24 f-g): with two rows of three and one row of two spores, and a single longitudinal plane of symmetry. The axes of the spores are about parallel to the axis of the package (e.g. *S. caesariatus*, *S. beckii*, and *S. verrucisporus*).
- Pattern III (Fig. 24 h): with two terminal pairs of spores parallel to the axis of the package and two median pairs of obliquely disposed spores (together with pattern II in *S. versicolor* and *S. depauperatus*).
- Pattern IIIa (Fig. 24 i): a longitudinally contracted form of pattern II or III; often rather irregular (*S. portoricensis* and *S. globuliferellus*).
- Pattern IV (Fig. 24 j): a subglobular package (*S. dilutellus*).
- Pattern V: with only four spores in a package,
- Va: (Fig. 24 d): with two rows of two spores with their axes parallel to the axis of the package (*S. quadrisporus*).
- Vb: (Fig. 24 e): with a single row of obliquely disposed spores (*S. quadrisporus*).
- Patter VI (Fig. 24 k-p): with the axes of the spores at right angles to the axis of the package. Of this type only a few of the possibilities are drawn (*S. infestans* and *S. geminatus*). In *S. geminatus* the spores are firmly united into pairs (Fig. 24 q) which themselves are rather loosely united into a cylindrical pile (Fig. 24 l).

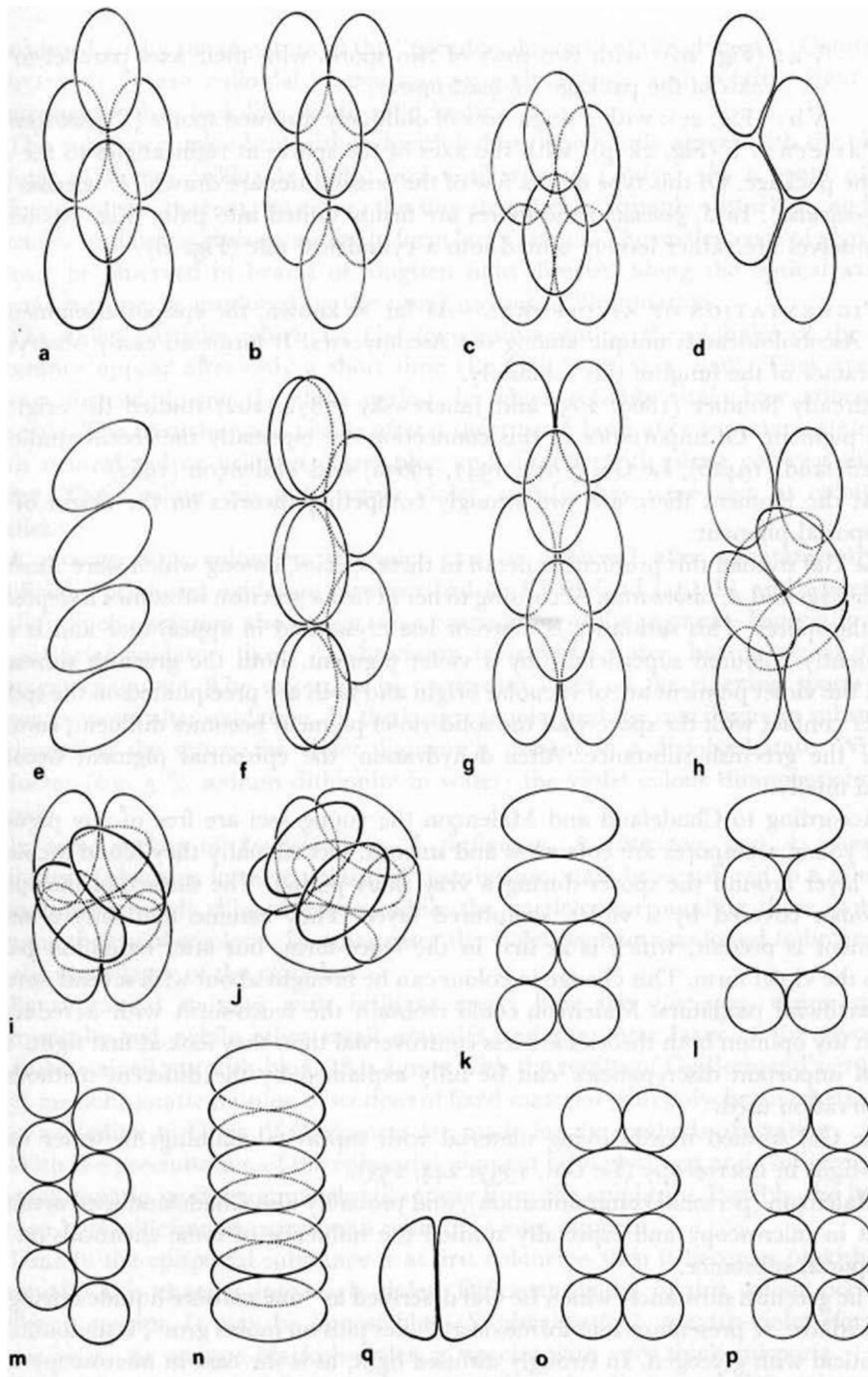


Abbildung 24: Arrangement of ascospores in *Saccobolus*. For explanation see text.