

Notes on the Mucorales of Indonesia.

By K. B. Boedijn*) (s'Gravenhage, Netherlands).

With 12 textfigures.

Introduction.

On the *Mucorales* of Indonesia only a restricted number of papers has been published. Van Overeem (84) in his list of the Fungi of this region mentions the following 9 species;

Amylomyces Rouxii Eykman

Mucor dubius Wehmer

Mucor javanicus Wehmer

Mucor Mucedo L.

Chlamydomucor Oryzae Went et Prinsen Geerlings

Rhizopus Artocarpi Rac.

Rhizopus nigricans Ehrenb.

Rhizopus Oryzae Went et Prinsen Geerlings

Syncephalastrum javanicum Rac.

From these species *Amylomyces Rouxii* Eykman (non *Amylomyces Rouxii* Calmette) and *Chlamydomucor Oryzae* Went. et Prinsen Geerlings are the same species and this is also true for *Mucor dubius* Wehmer and *Mucor javanicus* Wehmer. The records of *Circinella spinosa* Van Tieghem et Le Monnier and *Syncephalis bispora* Rac. have been forgotten in the above mentioned list.

Up to the present I am now able to list 55 species as occurring in Indonesia, most of which were collected on the island of Java. However it is probable, that nearly all of them may be found over the whole Archipelago. From my records it is once more evident, that the majority of the *Mucorales* are of world-wide distribution. Furthermore descriptions or notes are furnished for most species, especially the critical ones, as the existing diagnoses are often too short or too vague.

Synonyms are only mentioned when used for the first time. In studying the *Mucorales* it soon becomes manifest, that the variations in spore-shape and size are far greater than in other Fungi; reaching its culmination in such species as *Mucor inaequisporus* Dade. In other species we find alongside the normal spores a small number of very large ones as f. i. in *Cunninghamella echinulata* (Matruchot) Thaxter, where those large spores are called "conidies tardives" by Ling

*) The author gratefully acknowledges a grant towards the cost of illustrating this paper from the Netherlands Organization for Pure Research (Z.W.O.).

Young (68, 69) to distinguish them from the "conidies proprement dites". This phenomenon that very large spores are found in a species with normally much smaller ones, was discovered to occur also in some other genera except *Cunninghamella*.

Concerning the literature, I have with the exception of some papers, which I had to mention in the text, listed only those articles, which were published after 1934, because in Zycha (101) most of the publications on the *Mucorales* up till that date are to be found.

The author takes the opportunity to express his gratitude and indebtedness to his former assistant Mrs. Sri Sabani for her lasting activity in collecting material, to Miss Dr. J. Ruinen for the presentation of some cultures of soil fungi, to Prof. Dr. Ir. Tojib Hadiwidjaja for cultivating and confronting the different strains of *Blakeslea trispora* and to Dr. H. C. D. De Wit for his help with the latin diagnoses.

Under the heading of the different families I have also added the genera not found in Indonesia.

M u c o r a c e a e .

Mucor, *Zygorhynchus*, *Actinomucor*, *Circinella*, *Pirella*, *Rhizopus*, *Rhizopodopsis*, *Absidia*, *Phycomyces*, *Spinellus*, *Parasitella*, *Syzygites*, *Sporodiniella*.

The genus *Saksenaea* placed by Hesseltine (51) in the *Mucoraceae* seems so aberrant, that it may probably be better to accomodate it into a separate family.

M u c o r .

Mucor pusillus Lind Arch. exp. Path. u. Pharm. **21**. 272. 1886.

Colonies 1—3 mm high, at first pale later greyish brown about Drab Ridgway. Sporangiophores strongly branched at first subhyaline later pale brown, often with a crosswall near the sporangia; $2\frac{1}{2}$ —15 μ in diam. Sporangia globose, dark, varying much in dimensions, 16—60 μ in diam. Very small ones on the short thin side branches. Columella globose, oval till egg-shaped, subhyaline till pale brownish, with mostly a very low collar at the base; 10 — 51×10 — 41μ ; the very small ones 8—9 μ in diam. Spores dirty brown in mass, singly subhyaline globose till oval 3— $4\frac{1}{2} \mu$ in diam.

Java, Djakarta, as a contaminant in a yeast culture.

Mucor plumbeus Bonorden, Abh. Naturf. Ges. Halle **8**. 109. 1864.

Verlaten eiland (one of the isles of the Krakatau group) isolated from soil by D. Feher. No other collections of this species were made.

Mucor globosus Fischer in Rabenhorst Krypt. Flora
1. 202. 1892.

Colonies 2 cm or more high, of a very pale yellowish color, about cartridge buff till cream buff Ridgway. Sporangiohores branched 7—33 μ in diam. occasionally with a crosswall. Sporangia globose, dark colored, 60—125 μ in diam. Columella globose till oval, subhyaline, sometimes with a low collar at the base; 54—60 μ in diam. or 90—104 \times 75—80 μ . Spores subhyaline, globose till subglobose 3½—7 μ in diam. Chlamydo spores intercalary in the hyphae, mostly cylindrical, with granular contents, 50—85 \times 18—29 μ .

Java, Bogor, isolated from soil.

Mucor racemosus Fres. Beitr. z. Mycologie 12. 1850.

Verlaten eiland, isolated from the soil by D. Feher. — Java, Bogor, isolated from the soil.

Mucor javanicus Wehmer, Zentralbl. f. Bakt. etc. Abt. II,
6. 610. 1900.

Colonies 1—2½ cm high, silvery grey in color. Sporangiohores strongly branched, often with septae in the main thread above the side branches. Main hyphae 14—27 μ in diam. side branches 3—10 μ in diam. Sporangia globose, dark greenish till black, very variable in dimensions, 14—100 μ in diam. Sporangial-wall very delicately spinulose, soon diffluent. Columella colorless till faintly brownish, with very distinct bent down collar at the base; globose till oval, sometimes subpyriform 7—51 μ in diam. or 34—81 \times 24—68 μ . Spores dirty yellowish in mass, singly subhyaline, variable as to shape and dimensions, subglobose, oval till elliptic, 3½—7 μ in diam. or 4—8½ \times 3½—5 μ . Chlamydo spores mostly intercalary, colorless or pale yellowish, wall hardly thickened, cylindric 17—51 \times 14—17 μ .

Java, Bogor, on chicken dung, on rotting seeds of *Mucuna*.

Mucor circinelloides V. Tieghem, Ann. Sc. Nat. 6 sér.
1. 94. 1875.

Colonies pale grey ½—1 cm high. Sporangiohores sympodially branched colorless, mostly with a crosswall just above a side branch. Main threads 10—27 μ in diam. side branches 2½—7 μ in diam. Those branches often with a finely granulated wall and usually bent. Sporangia globose, erect on the large threads, mostly nodding on the side branches at first pale yellow, at maturity dark murky yellow; wall with very delicate spines; 14—99 μ in diam. Columella globose till oval, with distinct collar at the base, 14—58 μ in diam. Spores rather regular elliptic, colorless 6—7½ \times 4—5 μ . Chlamydo spores not frequent, mostly intercalary, colorless till pale yellow with slightly thickened wall, globose, oval till cylindric, isolated or sometimes in chains, 10—24 μ in diam. or 14—27 \times 7—17 μ .

Java, Bogor, on rabbit dung. Isolated from the leaves of *Butea*.

Bobr-Tylingo (15) mentions our species from Madagascar. However the accompanying description, which f. i. states that the spores are angular does not fit *Mucor circinelloides* at all. Most probably we have to deal here with another perhaps a new species.

Mucor hiemalis Wehmer. Ann. Mycol. 1. 39. 1903.

Colonies pale grey, about pale olive buff till olive buff Ridgway or white with a yellowish hue according to the strain; up till 2 cm high. Sporangiphores simple at first, afterwards more or less sympodially branched. Main threads often with a crosswall above the side branches. Wall often finely granulated; contents sometimes with yellow oil, 5—17 μ in diam. Sporangia dark, globose 22—130 μ usually 58—72 μ in diam. Columella globose, short cylindric, sometimes suboviform, often with more or less truncated base, with a distinct collar 7—55 μ in diam. or 20—44 \times 17—27 μ . Spores elliptic, very variable in shape and dimensions, brownish in mass, singly hyaline 2½—8 \times 1½—3½ μ . Chlamyospores especially in old cultures, yellowish in color, isolated or in short chains, globose or elongated 9—32 μ in diam. or 10—36 \times 6—18 μ . Wall 1—2½ μ thick. Zygosporangia dark brown, covered by pyramidal warts, 51—88 μ in diam. Suspensors often unequal, short, hardly swollen.

Java, Bogor, very common. Isolated from soil, fructifications of *Hirneola delicata*, bread, rubber sheets, potatoes, dung from *Paradoxurus hermaphroditus*.

Mucor inaequisporus Dade. Transact. Brit. Mycol. Soc. 21. 51. 1937.

Colonies up till 2 cm or more high, yellowish or orange yellow, about buff yellow, orange buff, light orange yellow Ridgway, in some strains with a greenish hue. Sporangiphores at first unbranched, later sparingly branched, with yellowish or orange droplets, later hyaline and with some septae, 14—58 μ in diam. the side branches 4—20 μ in diam. Sporangia dark brown, about buffy olive Ridgway, globose 29—290 μ in diam. Sporangial wall delicately spinulose, soon diffluent. Columella pyriform till subglobose, sometimes with distinct constriction near the base; with a collar and usually an orange colored contents; variable in dimensions 17—153 \times 14—119 μ . Spores extremely variable as to shape and dimensions, yellowish till orange in mass, singly hyaline till pale yellowish, the smallest elliptic or oval, the intermediate types elliptic or broadly elliptic, the largest ones globose till subglobose. The small and intermediate spores 4—24 \times 2½—14 μ the large spores 14—27 μ in diam. Chlamyospores not found. Zygosporangia on the mycelium, globose, at first brown, later opaque blackish brown 37—61 μ in diam. covered by irregular shaped warts 3—7 μ in diam.

Java, Bogor, on fruits of *Artocarpus glaucus*, *Flacourtia inermis*, *Musa paradisiaca*, *Diospyros Kaki*, *Bouea macrophylla*.

Mucor Mucedo Fres. Beitr. z. Mycologie 7. 1850.

This species is rather common on dung of herbivores. Typical are the regular, cylindric spores $11-19 \times 5\frac{1}{2}-11 \mu$.

Sumatra, Medan, between grass on indeterminable organic material. — Krakatau isles, isolated from soil by D. F e h e r. — Java, Bogor, on dung of cows and horses.

Mucor albo ater Naumov. Petersb. Pilze 1915.

Colonies several cm high, whitish. Sporangioophores unbranched, $17\frac{1}{2}-85 \mu$ in diam. Sporangia dark, globose up till 350μ in diam. Columella typical cylindric, seldom pyriform, with a small collar at the base $80-285 \times 42-135 \mu$. Spores oblong, colorless $8-14 \times 5\frac{1}{2}-9\frac{1}{2} \mu$.

Verlaten eiland (Krakatau group) on rotten fruit of *Carica Papaya*. Java, Tjibodas on dunged soil, Bogor on excrements of *Paradoxurus hermaphroditus*.

Circinella.

Circinella muscae (Sorokine) Berlese et De Toni in Saccardo Syll. Fung. 7. 216. 1888.

Colonies 2 mm till 2 cm high, grey, about between drab and hair-brown R i d g w a y. Sporangioophores erect, $14-34 \mu$ in diam. at first hyaline later pale brownish, often undulating, ending either sterile or with a sporangium. At rather regular intervals short lateral branches are formed on the mainthread. Those side branches $85-122 \times 10-20 \mu$ ending with a blunt tip. Near the base of those branches an usually strongly incurved side branch $7-17 \mu$ in diam. and bearing a sporangium is originating. The sterile branch provided with a cross-wall. Sometimes the sporangia bearing threads are originating directly from the mainthread or both branches are ending with a sporangium. Later septae are also formed in the sporangia bearing threads. Sporangia globose dark, nearly black, $29-145 \mu$ in diam. Sporangial wall subhyaline finely granulated, fragmentating. Columella grey, mostly cylindric, often more or less strongly constricted in the middle. At the rounded top often provided with some short appendages or delicate spines. Very small columellae sometimes strongly attenuated near the tip; $20-85 \times 10-61 \mu$ appendages $2-3 \mu$ long. Spores globose till subglobose, dirty brown in mass, singly subhyaline $5-7 \mu$ in diam.

Java, Bogor, on dung, isolated from soil and from the bark of *Murraya paniculata*.

In a culture of this species a sector appeared, where instead of sporangia, empty vesicles were formed, which often proliferated to produce new threads with vesicles.

Circinella mucoroides Saito Zentralbl. f. Bakt. etc. Abt. II, 17. 159. 1907 seems hardly distinct from the above mentioned species and may be considered a synonym.

Circinella umbellata v. Tieghem et Le Monnier, Ann. Sc. Nat. 5 sér. 17. 300. 1873.

Colonies 1 till several cm high, pale grey in color. Sporangio-phores erect not bearing a terminal sporangium, at first hyaline afterwards pale brown, 10—30 μ in diam. On short, sometimes more or less swollen side branches 17—34 μ in diam. 1 till 10 mostly 6 till 8 short strongly incurved sporangiophores are originating, with granulated walls 7—14 μ in diam. Sporangia globose, grey 30—109 μ in diam. with granulated fragmenting sporangial wall, Columella very variable in shape and dimensions, hyaline till pale brown, cylindric, obovate, sometimes weakly constricted in the middle or subpyriform, tip smooth or provided with a few appendages 24—68 \times 17—47 μ . Spores hyaline, glistening, globose or subglobose 4—10 μ in diam.

Java, Bogor, on dung, especially of rabbits. In Bogor nearly every batch of rabbit dung yields this species.

In one collection a number of sporangia was found with much larger spores. The sporangia about 90 μ in diam. the spores globose till elongated 9—18 μ in long axis. This form agrees with *Circinella umbellata* var. *Moreliae* Berk. et Br. Transact. Linn. Soc. 83. 406. 1878. As in several of the *Mucorales* occasionally very large spores may be found, a separate name for such forms seems superfluous.

Rhizopus.

Rhizopus oligosporus Saito Zentralbl. f. Bakt. etc. Abt. II, 14, 624. 1905.

Colonies pale brownish grey, 1 mm or more high. Mycelium creeping, colorless, the separate threads 2—12 μ in diam. On the trailing hyphae the sporangiophores are arising, borne in fascicles of 2 till 6. Under those fascicles short rhizoids are to be found. Sporangio-phores subhyaline till brown, becoming colorless near the top; often incrustated with delicate crystals, 5—22 μ in diam. Sporangia globose dark 50—102 μ in diam. Columella globose till short cylindrical, hyaline with very low collar and a broad funnel-shaped apophyse; 14—73 μ in diam. or 15—78 \times 12—73 μ . Spores brownish grey in mass singly subhyaline till very pale greyish, smooth, subangular, very irregular as to shape and dimensions, globose, oval, broad elliptic, elongated and many irregular shapes with undulating outline or sometimes even furcated; 5—7 μ in diam. or 7—24 \times 6—10 μ . Most common dimensions 7—12 \times 6—9 μ . The aberrant spores much larger. Chlamydospores abundant, colorless, produced everywhere in the mycelium, sporangiophores and even in the sporangia, suppressing the formation of sporangiospores partly

or entirely. In the hyphae they are singly or in short rows. Shape and dimensions very variable; globose, elliptic citriform, cylindrical. When formed opposite a side branch, often with a short appendage. Wall slightly thickened in old specimens, contents coarse granular, mostly with oildrops, 7—30 μ in diam. or 12—43 \times 7—34 μ . Wall up till 1½ μ thick.

Java, In Bogor this mold can always be isolated from "tempeh", cakes made from the seeds of *Soja Max* (*Glycine max*). Also isolated from "Bungkil" (cattle cakes) and fermenting tobacco.

A very typical species, well characterised by its smooth spores, with many bizarre aberrations and the fact that soon the formation of sporangiospores is much reduced and replaced by abundant chlamydospores.

Rhizopus Cohnii Berlese et De Toni in Saccardo Syll. Fung. 7. 213. 1888.

Colonies up till about 1 cm high, pale grey in color, dotted by the dark sporangia or darker and about deep grayish olive Ridgway. Sporangiphores sometimes single but mostly in fascicles of 2—6, usually 2—3, often sprouting from a short trunklike base 14—17 μ broad from the underside of which the rhizoids 3—7 μ broad are originating. Occasionally brown colored vesicles 27—68 μ in diam. sometimes incrustated with needle-like crystals are formed in the hyphae. From those vesicles 2 till more sporangiphores are arising. Sporangiphores subhyaline till brownish 4—25 μ broad; usually 10—14 μ in diam. Sporangia globose, dark 17—240 μ mostly 87—100 μ in diam. Sporangial wall covered by fine needle-like crystals. Columella subhyaline till pale brown, usually semiglobose but also globose till oval, with a broad apophyse and often an indication of a collar; 10—173 μ in diam. Spores globose, subglobose till oval, subangular, grey, striate, the striae representing low, white sparingly anastomosing ribs; 3½—10 μ in diam. or 5—10 \times 3½—7 μ . Chlamydospores very abundant mostly singly, intercalary in the mycelium, but also in the sporangiphores and in the sporangia; usually globose or subglobose but also oval, oviform till cylindrical; wall only slightly thickened, contents granular, 14—41 μ in diam. or 18—46 \times 10—27 μ .

Sumatra, Kampong Baru, on rotten seeds of *Indigofera endecaphylla*. — Java, Bogor, Isolated from tomato, seeds of *Arachis hypogaea* and old paper.

A very large number of *Rhizopus* species has been described, which are showing nearly the same morphology as the above mentioned species, including also the well known *Rhizopus arrhizus* Fischer in Rabenhorst Kryptog. Flora 1. 233. 1892 and *Rhizopus Oryzae* Went et Prinsen Geerlings Kon. Akad. Wetensch. Amsterdam 4. 16. 1895. Most of those forms are distinguished chiefly on physio-

logical characters. But as the classification of Fungi is based on morphology they can hardly be considered to represent different species, but only strains of one very variable species. So we have to look for the oldest name, which is *R. Cohnii* and it seems therefore advisable that all those forms exhibiting nearly the same morphology have to be assembled under this name.

Rhizopus stolonifer (Ehrenb.) Lind Danish Fungi 72. 1913.

This very common species has fascicles of 2—7, usually 3—4 sporangiophores up till 4 mm high. The grey spores $7-18 \times 5-11 \mu$ are very clearly provided with low anastomosing white ribs. Chlamydospores never observed.

Sumatra, Kampong Baru near Medan, on seeds of the oilpalm, *Elaeis guineensis*; on decomposing casein. — Java, everywhere, especially on decaying fruits.

Rhizopus Artocarpi (Berk. et Br.) Boedijn nov. comb.

Mucor Artocarpi Berk. et Br. Journ. Linn. Soc. 14. 137. 1873.

Rhizopus Artocarpi Raciborski Par. Alg. u. Pilze Javas 1. 11. 1900.

Colonies brownish grey, up till $\frac{1}{2}$ cm high. The sporangiophores often not so clearly fasciculated as in *R. stolonifer*; brown, wall often finely granulated; at the base sometimes with crosswall, $10-47 \mu$ in diam. sometimes branched, each branch ending in a sporangium. Sporangia globose, dull black, $72-290 \mu$ in diam. Most common dimensions $217-232 \mu$. Columella subhyaline till brown, semiglobose till cylindric, apophyse funnel-shaped, collar as a distinct line, $27-221 \times 27-204 \mu$. Spores subangular, grey with low anastomosing white ribs; very variable as to shape and dimensions; globose till elongated, $7-17 \mu$ in diam. or $14-20 \times 10-14 \mu$. Chlamydospores not frequent, intercalary in the mycelium, cylindric with slightly thickened wall and granular contents $41-64 \times 14-20 \mu$. Zygospores globose till subglobose, blackish brown wall coarsely warty $125-280 \mu$ in diam. Suspensors swollen $126-184 \mu$ in diam. at the broadest place.

Java, Very common on the male inflorescences of *Artocarpus* species, often covering them wholly with a blackish felt.

Rhizopus megasporus Boedijn nov. spec. (Fig. 1).

Coloniae 5 mm altae, colore sordide albae. Sporangiophorae dilute brunneae, $10-17 \mu$ in diam. 2—5, plerumque 2—3 ad marginem, fasciculatum supra truncum $20-27 \mu$ diam. geruntur. Rhizoideae 10μ diam. Sporangia globosa in maturitate obscura, $37-153 \mu$ diam. Columellae semiglobosae $29-81 \mu$ longae. Sporae subhyalinae vel griseae, globosae vel elongatae subpolygoniae, vix striatae $5-7 \mu$ diam. vel $5\frac{1}{2}-10 \times 5-7 \mu$.

Chlamydosporae copiosae, globosae, cylindraceae, plerumque ampullaceae vel lageniformes; 10–61 μ diam. vel 24–95 \times 14–54 μ , tunica 1½–3 μ diam.

Colonies up till 5 mm high, dirty white of color with much aerial mycelium. Sporangiphores in fascicles of 2–5, mostly 2–3, especially near the border of the colony. Rhizoids under the fascicles up till 10 μ diam. Sporangiphores pale brown, 10–17 μ diam. originating from a short stemlike base 20–27 μ in diam. Sporangia globose, dark 37–153 μ in diam. Columella more or less

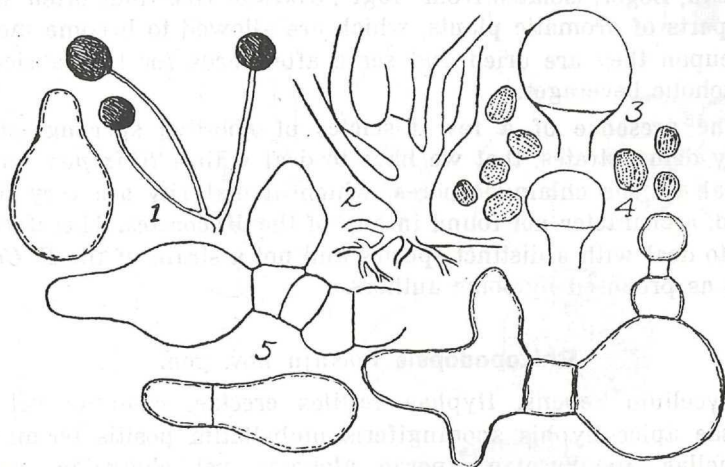


Fig. 1. *Rhizopus megasporus*. — 1. fascicle of sporangia. 2. base of such a fascicle. 3. columellae. 4. Sporangiospores. 5. Chlamydospores.

semiglobose 29–81 μ in long axis. Spores subhyaline till pale grey, globose till elongated, subangular, very indistinctly ribbed, 5–7 μ in diam. or 5½–10 \times 5–7 μ . Chlamydospores in the mycelium exceedingly abundant, nearly always in long often branched chains, as whole mycelial threads including the branches are transformed into chlamydospores; Globose, cylindric often one side attenuated or club-shaped till flask-shaped. Wall thickened, contents granular, 10–61 μ in diam. or 24–95 \times 14–54 μ , wall 1½–3 μ thick.

Java, Malang, isolated from soil.

This species, which is related to the *Rhizopus Cohnii* group, may be easily distinguished from members of that group by its nearly smooth sporangiospores and its peculiar shaped chlamydospores.

***Rhizopus chlamydosporus* Boedijn nov. nom.**

Amylomyces Rouxii Eykman Centralbl. f. Bakt. etc. **16**. 97. 1894.

Chlamydomucor Oryzae Went et Prinsen Geerlings Verh. Kon. Akad. Wetensch. Amsterdam **4**. 14. 1895.

Colonies up till 4 mm high, of a dirty white color. Mycelium richly developed. Only a very few fascicles of 2—3 abortive brown colored sporangiophores may be found. They are 11—23 μ in diam. bearing at the top an empty vesicle 46—103 μ in diam. Afterwards practically the whole mycelium is transformed into chlamydospores, either singly or in chains. They are exceedingly variable as to shape and dimensions globose, elliptic till cylindric. The cellwall increasing in thickness with age, becoming very thick in old specimens; 9—44 μ in diam. or 21—77 \times 13—39 μ . Wall 1—10½ μ thick.

Java, Bogor, isolated from "ragi", cakes of rice-flour often mixed with parts of aromatic plants, which are allowed to become mouldy whereupon they are dried and serve afterwards for the fabrication of alcoholic beverages.

The presence of a few fascicles of abortive sporangiophores clearly demonstrates, that we have to deal with a *Rhizopus* species. Typical are the chlamydospores, which at maturity are very thick-walled, a character not found in any of the *Mucorales*. Therefore we have to deal with a distinct species and not a strain of the *R. Cohnii* series as proposed by some authors.

Rhizopodopsis Boedijn nov. gen.

Mycelium repens. Hyphae fertiles erectae, ramosae vel non ramosae apice hyphis sporangiferis umbellatim positae terminatae. Columellae apophysatae, sporae globosae vel elongatae, pallide griseae, paululum asperulatae. Zygosporae nigrae, verrucosae.

Vegetative mycelium creeping. Sporangiohores erect, high, branched or unbranched; all ending in an umbel of spreading branches, in the middle of which the mainstem ends as a short appendage. The branches of the umbel all ending in sporangia. Columella large with apophyse by drought collapsing in the shape of a toadstool. Spores subhyaline till pale grey, globose till elongated, with finely granulated cell wall. Zygosporae formed on the creeping mycelium, black with coarse pyramidal warts.

This genus is nearly related to *Rhizopus*. It differs from this genus chiefly in its mode of growth; for the sporangiophores are borne directly on the long erect branches, whereas in *Rhizopus* they originate in groups on long creeping stolones. The fact that our form in contact with some object may form rhizoids at the top of the mainstem instead of an umbel of sporangia is a further proof for the said relationship. One may compare the long erect mainstem of our form directly with the creeping stolones and the umbel of sporangia with the fascicles of sporangia in *Rhizopus*. Also the ornamentation of the spore wall is different.

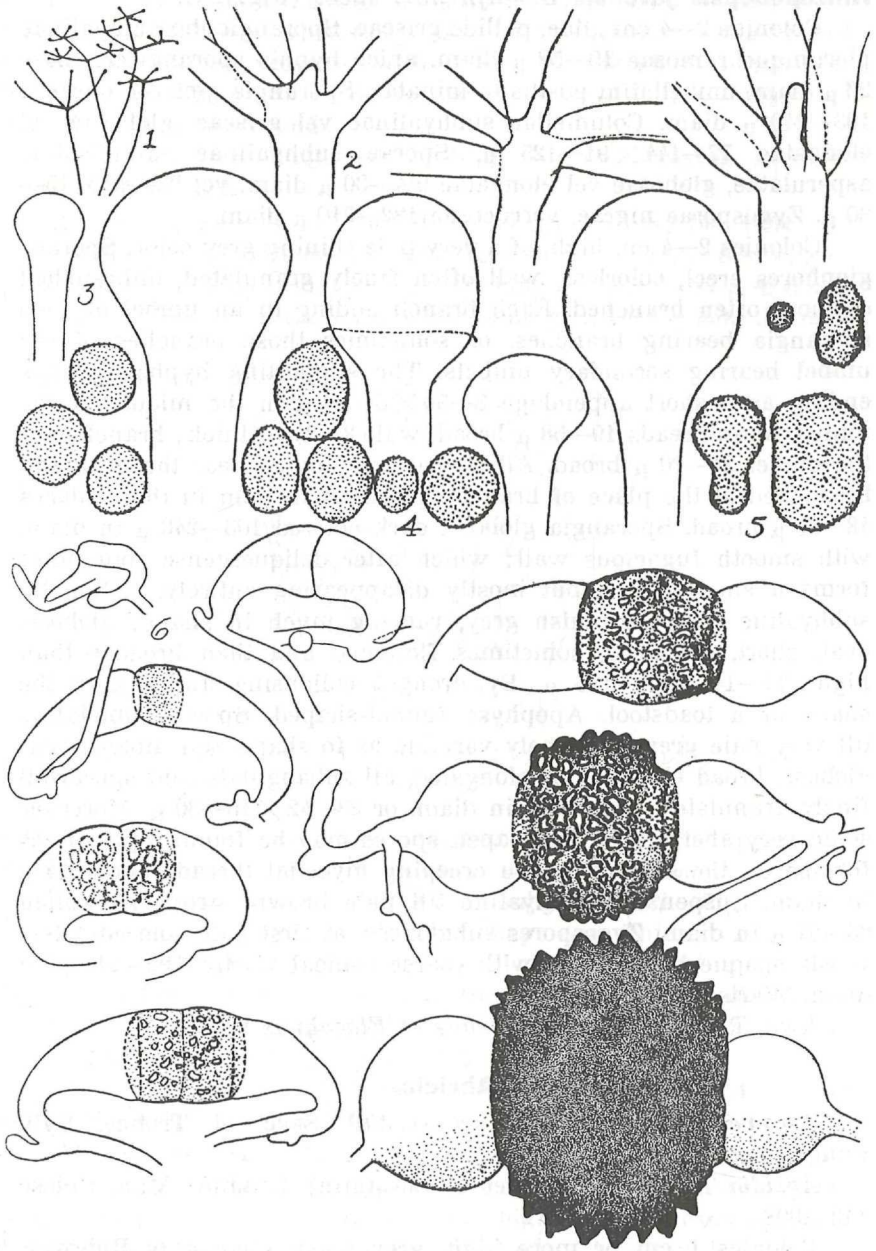


Fig. 2. *Rhizopodopsis javensis*. — 1. Habitus semidiagrammatic. 2. Centre of an umbel to show the tip of the main stem. 3. columellae. 4. sporangiospores. 5. aberrant sporangiospores. 6. stages in the formation of zygospores.

Rhizopodopsis javensis Boëdijn nov. spec. (Fig. 2).

Coloniae 2—4 cm altae, pallide griseae. Sporangiophorae hyalinae plerumque ramosae 19—58 μ diam. apice hyphis sporangiferis 24—26 μ diam. umbellatim positae terminatae. Sporangia globosa, obscura 103—240 μ diam. Columellae subhyalinae vel griseae, globosae vel elongatae 77—144 \times 91—125 μ , Sporae subhyalinae minutissime asperulatae, globosae vel elongatae 9½—30 μ diam. vel 23—42 \times 15—30 μ . Zygosporae nigrae, verrucosae 122—210 μ diam.

Colonies 2—4 cm high, of a very pale shining grey color. Sporangio-phores erect, colorless, wall often finely granulated, unbranched or more often branched. Each branch ending in an umbel of 2—6 sporangia bearing branches, or sometimes those branches of the umbel bearing secondary umbels. The supporting hyphae always ending as a short appendage 8—50 \times 3—16 μ in the middle of the umbel. Mainthreads 19—58 μ broad, wall 2—3½ μ thick; branches of the umbel 24—26 μ broad. All threads attenuated near the base and broadened at the place of branching. The mainstem in those places 48—84 μ broad. Sporangia globose, dark colored 103—240 μ in diam. with smooth fugacious wall; which after deliquescence sometimes forms a small collar, but mostly disappearing entirely. Columella subhyaline till pale bluish grey, varying much in shape; globose, oval, short, cylindric, sometimes flattened and then broader than high; 77—144 \times 91—125 μ . By drought collapsing and taking the shape of a toadstool. Apophyse funnel-shaped. Spores subhyaline till very pale grey, extremely variable as to shape and dimensions; globose, broad elliptical or elongated, all subangulate and sporewall finely granulated; 9½—30 μ in diam. or 23—42 \times 15—30 μ . Moreover some very aberrant or misshapen spores may be found. Zygosporae formed on the substratum on creeping mycelial threads about 14 μ in diam. Suspensors subhyaline till pale brown, strongly swollen 68—91 μ in diam. Zygosporae subglobose, at first pale colored afterwards opaque black; wall with coarse conical warts; 122—210 μ in diam. Warts 10—16 μ high.

Java, Tjibodas, on fallen fruits of *Elaeagnus* spec.

Absidia.

Absidia corymbifera (Cohn) Sacc. et Trotter, Syll. Fung. 21. 825. 1912.

Absidia Lichtheimi (Lucet et Costantin) Lendner Muc. Suisse 143. 1908.

Colonies 1 cm or more high, grey about olive gray Ridgway. Mycelium forming branched arching stolones, 7—20 μ in diam. mostly sympodially branched near the tips or bearing some whorls of sporangio-phores 3—7 μ in diam. Sporangia globose, rather pale colored 30—80 μ in diam. Columella very variable as to shape and

dimensions, with or without an indistinct collar; the large ones semi-globose with funnel-shaped apophyse, the smaller ones cylindrical till conical, sometimes provided with one or a few short, blunt protuberances, 7—59 μ broad. Spores colorless, oval 3—5½ × 2½—4 μ . No chlamydo spores found.

Java, Bogor, on dung, isolated from soil, on decaying seeds of *Phaseolus radiatus*.

Absidia ramosa (Lind) Lendner Muc. Suisse 144. 1908.

Colonies white, afterwards grey, about 1 cm high. Sporangio-phores borne on long arching and branching threads 3—17 μ in diam. They are on the end of those threads in whorls of 2—4; along the bent

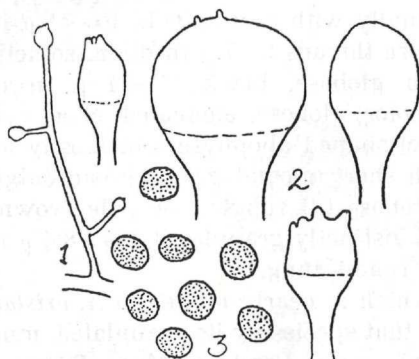


Fig. 3. *Absidia merdaria*. — 1. Side branch. 2. Columellae. 3. sporangio-spores.

threads single sometimes with branched stalk. Often the stolon-like hyphae forming fascicles of rhizoids where they touch the substratum. Sporangia dark grey till black, subglobose 14—87 μ in diam. Columella grey in color variable as to shape and dimensions, mostly subglobose sometimes somewhat elongated, in the small specimens subconical 10—58 μ broad. Apophyse funnel-shaped, grey colored, the color also later in the upperpart of the sporangiophore. Spores colorless, regular, cylindric 2½—5 × 2—2½.

Sumatra, Kampong Baru, as contaminant in a culture of *Monilia sitophila*. Java, Bogor on dung.

Absidia cristata Dade Transact. Brit. Mycol. Soc. 21 : 26. 1937.

Colonies at first pale grey, afterwards grey about olive gray till deep olive gray Ridgway; up till 1 cm high. Main threads bending, branched, occasionally with a septum, 7—24 μ in diam. bearing the sporangiophores 3—10 μ in diam. Sometimes the sporangiophores in whorls of 2—6. Sporangia globose, black, 10—90 μ in diam. Sporangial wall smooth, diffluent, leaving a distinct collar at the base of the columella. Columella grey till pale brown, with apophyse, globose,

oval, cylindric till conical; the smaller specimens often with papillae or short, broad outgrowths; $14-68 \times 7-65 \mu$. Spores globose, slightly subangular, greyish brown, dark in mass, with a suggestion of a punctation, only visible with a high power lens, $3-7 \mu$ in diam.

Java, Bogor, isolated from soil and mouldy paper.

Absidia merdarla Boedijn nov. spec. (Fig. 3).

Coloniae ad 5 mm altae, hyphae fertiles elongatae, sporangia in ramis lateralibus $2-7 \mu$ diam. gerentes. Sporangia globosa, nigra $34-54 \mu$ diam. Columellae fuliginosae, globosae vel elongatae, apicibus papillatis $17-34 \times 11-30 \mu$. Sporae globosae vel subglobosae, fuliginosae, asperulatae $6\frac{1}{2}-8\frac{1}{2} \mu$ diam.

Colonies grey, 5 mm or more high. Hyphae arching, strongly branched, occasionally with a crosswall, $10-14 \mu$ in diam. Sporangiophores along those threads $2-7 \mu$ in diam. sometimes in fascicles of 2-3. Sporangia globose, black $34-54 \mu$ in diam. Columella greyish brown in color, globose, elongated, short cylindric till about conical, with funnel-shaped apophyse and mostly a low collar. Top often provided with short appendages or broad outgrowths, $17-34 \times 11-30 \mu$. Spores globose till subglobose, pale brownish, brown grey in mass, finely but distinctly granulated, $6\frac{1}{2}-8\frac{1}{2} \mu$ in diam.

Java, Bogor on rabbit dung.

This species, which is nearly related to *A. cristata*, can be easily distinguished from that species by its granulated, much larger spores.

Absidia spinosa Lendner Muc. Suisse 132. 1908 var.

azygospora Boedijn nov. var. (Fig. 4).

A *Absidia spinosa* differt azygosporis copiosis; absentia zygosporarum.

Colonies greyish brown, about mouse grey Ridgway, $1\frac{1}{2}-2$ cm high. Hyphae arching, brown colored $6-15 \mu$ in diam. bearing the sporangiophores $1\frac{1}{2}-8 \mu$ in diam. usually provided with a crosswall near the apophyse. Sporangia brown, globose $10-39 \mu$ in diam. Columella semiglobose, hyaline $8-25 \mu$ in diam. usually with a short, slender appendage $2-6\frac{1}{2} \mu$ long and a funnel-shaped apophyse. A collar is often present. Spores rather regular cylindric, colorless, $3\frac{1}{2}-5 \times 1\frac{1}{2}-2 \mu$. Azygospores abundant. Short outgrowths are formed on the hyphae, which are broadening more or less funnellike near the tip, to give rise to a kind of suspensor. On the broad portion the azygospore is originating. Sometimes the suspensors are branching, each branch bearing 1-2 spores, or 2-3 spores are formed on one suspensor. Occasionally 2 or even 3 spores on a suspensor may fuse to form one irregular spore. In all cases $8-14$ hyphae are growing out of the suspensor and are more or less surrounding the spores. In some cases those threads are straight instead of incurved. Azygospores globose, red-brown, the wall covered by rather flat

pyramidal warts with fringed border; 70—107 μ in diam. Circinate hyphae 4—9 μ in diam.

Java, Malang, isolated from the soil of a coffee garden.

This variety is characterised by the abundance of azygospores, while real zygospores are wholly lacking. The peculiar mode of formation of those spores is also noteworthy.

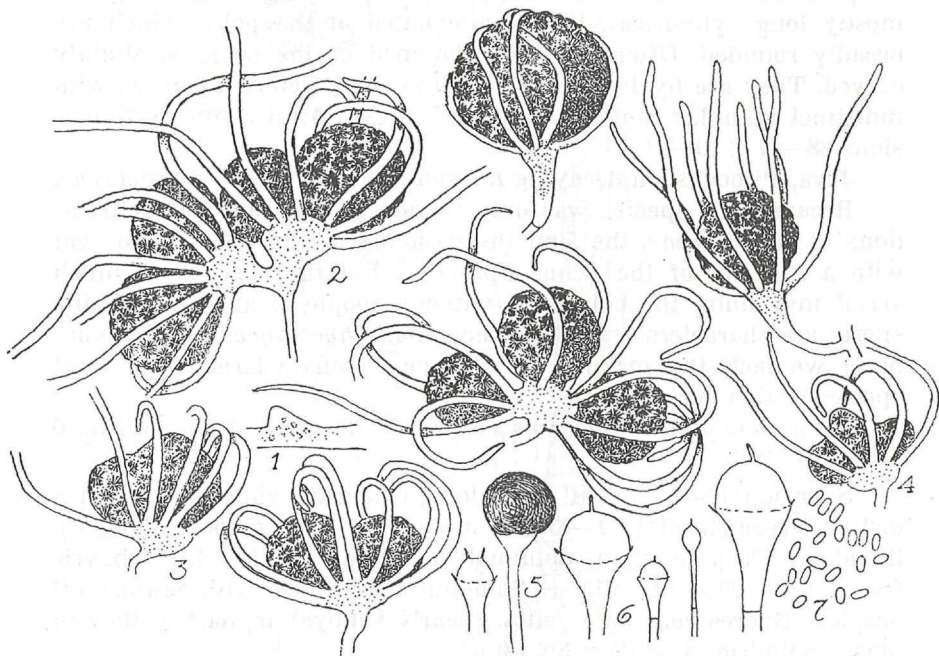


Fig. 4. *Absidia spinosa* var. *azygospora*. — 1. Early beginning of an azygospore. 2. different modes of azygospore formation. 3. two partly fused azygospores. 4. three partly fused azygospores. 5. sporangium. 6. columellae. 7. sporangiospores.

Phycomyces.

Phycomyces agaricicola Boedijn nov. spec. (Fig. 5).

Mycelium ramosum, septatum compositum ex hyphis 7—20 μ diam. Sporangiphorae 1—2½ cm altae, pallide brunneae, infra 84—140 μ diam. supra 65—100 μ diam. Sporangia globosa, in juventute flavida, in maturitate nigrescentia 150—400 μ diam. cum membrana fragmentata. Columellae hemisphaericae vel cylindricae, fuliginosae 100—208 × 96—182 μ . Sporae hyalinae vel subhyalinae, cylindricae, interdum inaequilaterales vel leviter curvulae 21—54 × 7—17 μ .

In and on the substratum a colorless branched and septated mycelium with threads 7—20 μ broad. From this mycelium the sporangiophores are arising, which are 1—2½ cm high, with inflated base

and attenuated near the apex. They are 84—140 μ in diam. near the base, 65—100 μ in diam. in the middle, the wall pale brown, sometimes with septae near the base. Sporangia globose, at first yellow, afterwards becoming very dark nearly black, 150—400 μ in diam. Sporangial wall smooth, fragmentating. Columella hemisphaerical or cylindric with broadly rounded apex, sometimes subpyriform, dirty brown in color, 100—208 \times 96—182 μ . Spores very irregular, mostly long cylindrical, hardly attenuated at the poles which are broadly rounded. Often one side flattened or the spore is slightly curved. They are hyaline till subhyaline, dirty yellow in mass, with indistinct granular contents; 21—54 \times 7—17 μ . Most common dimensions 38—47 \times 10—12 μ .

Java, Tjibodas, on decaying *Russula* spec. and other *Agaricaceae*.

Because this species was only found growing on the fructifications of *Agaricaceae*, the first impression was that we had to deal with a member of the genus *Spinellus*. But the absence of much aerial mycelium, the columella without apophyse and the hyaline spores are characters typical for the genus *Phycomyces*. On the other hand we lack the metallic iridescence so characteristic for most species of this genus.

Phycomyces microsporus V. Tieghem Ann. Sc. Nat. 6 sér. 1. 64. 1875.

Sporangiophores up till 5 cm long, of a dark violet color with a distinct greenish hue; 60—75 μ in diam. Sporangia globose, dark, up till about 500 μ in diam. Columella oval, subcylindric till subpyriform, 270—306 \times 200—250 μ . Sometimes provided with orange oil droplets. Spores very pale yellow, nearly subhyaline, dark yellow in mass, cylindric 11—17½ \times 5½—9 μ .

Java, Bogor, on rabbit dung.

Sporodiniella Boedijn nov. gen.

Hyphis fertilibus erectis, supra in formam umbellae digestis. Hyphae umbellae dichotome ramosae. Furca ultima ex hyphis sporangiferis et sterilibus composita. Sporangia globosa, brunnea. Columellae globosae. Sporae subglobosae, hyalinae.

Sporangiophores long, erect, ending in an umbel of many equal spreading branches. Those threads branching dichotomously one or a few times. Last branching consisting of a sporangium bearing and a sterile thread, which is growing mostly longer than the other. Sporangia globose, brown, wall very fugacious. Columella globose, without collar Spores subglobose, colorless.

Sporodiniella umbellata Boedijn nov. spec. (Fig. 6).

Coloniae pallide brunneae, 12 mm altae. Sporangiorum erectae 36—56 μ diam. saepe septatae, interdum ramosae. Apice hyphis um-

bellatim digestae. Hyphae umbrallarum 20—36 μ diam. dichotome ramosae, rami ultimi sporangiferi sive steriles. Sporangia globosa brunnea, 28—50 μ diam. Columellae globosae 17—32 μ diam. Sporae subglobosae, hyalinae subpolygoniae.

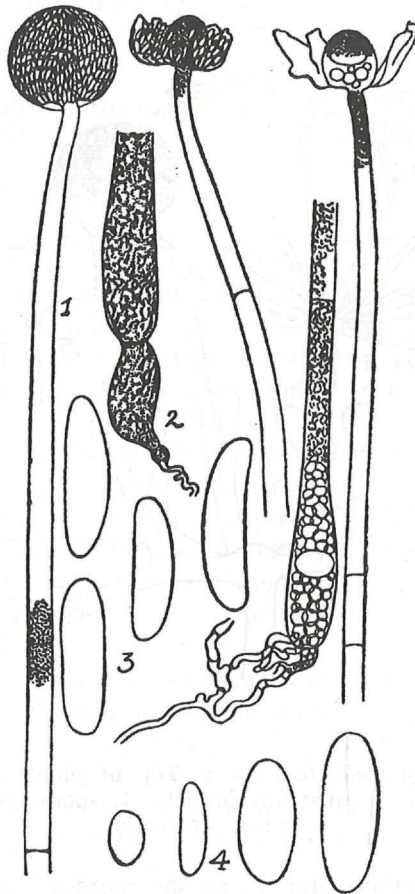


Fig. 5. *Phycomyces agaricicola*. — 1. Tops of sporangiophores with sporangia. 2. Bases of sporangiophores. 3. sporangiospores. 4. aberrant sporangiospores.

Colonies pale brown, consisting of erect sporangiophores up till 12 mm long. Mainstem 36—56 μ broad, pale brown, often with septae, sometimes branched, ending in an umbel of equal spreading branches 20—36 μ in diam. In small specimens a few, in well developed material many such branches. Those secondary threads dichotomously branching one till several times. The last furcation consisting of a sporangium bearing and a sterile often longer thread. Sometimes

both threads bearing a sporangium. Sporangia, globose, brown 28—50 μ in diam. Wall very fugacious. Columella globose, with apophyse, but without collar 17—32 μ in diam. Spores colorless, very variable as to shape and dimensions, globose, subglobose till elongated, somewhat subangular smooth, 4—8 μ in diam.

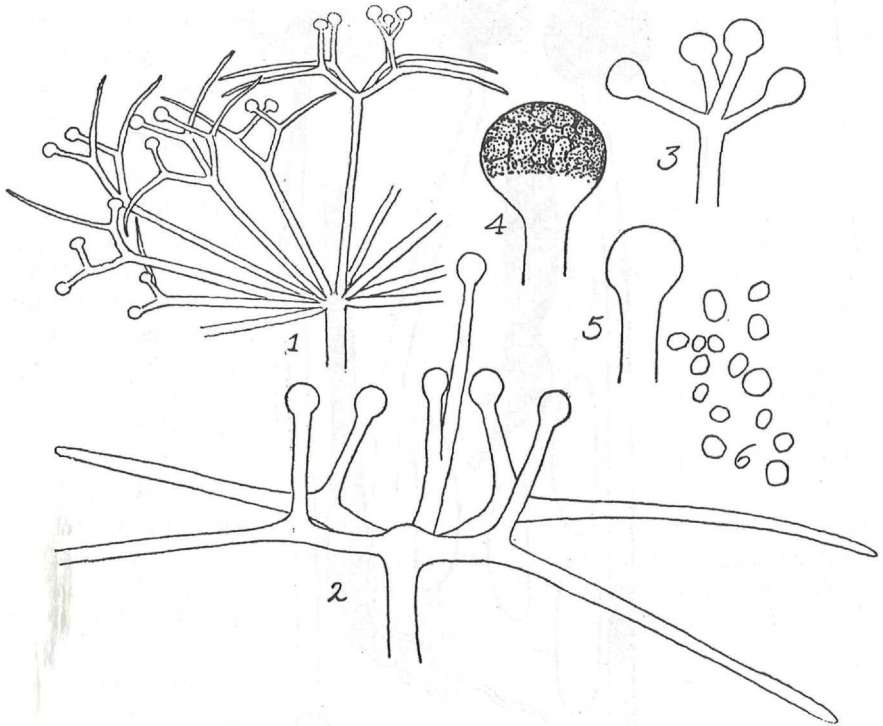


Fig. 6. *Sporodiniella umbellata*. — 1. Top of plant, semidiagrammatic, 2. End of a branch. 3. aberrant branch. 4. sporangium. 5. columella. 6. sporangiospores.

Sumatra, Pematang Siantar, on the remnants of a small insect, probably a member of the *Microlepidoptera*.

Pilobolaceae.

Pilobolus, *Pilaira*, *Utharomyces*.

Pilobolus.

Pilobolus crystallinus v. Tieghem. Ann. Sc. Nat. sér. 6, 4. 335. 1876.

Trophocyst with apophyse, oblong 500—575 \times 200—230 μ . Sporangiohores 5—15 mm long, 115—160 μ broad. Subsporangial vesicle oviform, colorless except for an orange ring at the base 400—920 \times

350—720 μ . Sporangia semiglobose, more or less flattened, black, sometimes with a network of pale lines, 138—345 μ high, 287—529 μ broad near the base. Columella broadly conical, 92—287 μ high, 172—345 μ broad below. Spores elliptic, hyaline, dark yellow in mass, 7—10 \times 4—6 μ .

Java, Bogor, common on dung of herbivores.

Pilobolus Kleinii v. Tieghem. Ann. Sc. Nat. sér. 6, 4. 337. 1876.

Trophocyst elliptic, hyaline with pale orange colored apophyse 400—460 \times 200—250 μ . Sporangiphores 1—6 mm high, usually 4—5 mm, 34—126 μ broad, usually 92—115 μ in diam. Subsporangial vesicle more or less oviform, hyaline except for an orange colored ring at the base, 414—805 \times 333—595 μ . (In dwarf specimens 161—241 \times 113—160 μ). Sporangia semiglobose, more or less flattened, black 126—240 μ high, 276—356 μ broad at the base. (In dwarf specimens 46—80 μ high, 57—149 μ broad). Columella nipple-shaped, 160—185 μ long, 149—182 μ broad at the base, attenuated part 46—70 μ broad. Spores elliptic very pale yellow, dark yellow in mass, 11—13 \times 5½—7 μ .

Java, Bogor, very common on dung of herbivores.

On dung of pigs a strain was found with sporangiphores 5—12 mm high, characterized by the presence of the orange color in the whole subsporangial vesicle as well as in the upper part of the stipe. The spores 9—12 \times 6—8 μ are singly darker yellow and a trifle broader as in our species. These differences however are hardly sufficient to establish a new variety.

On a few occasions in dense growths of *P. Kleinii*, some sporangia were found, containing large, globose till subglobose spores 11—17 μ in diam. This form wholly agrees with *Pilobolus sphaerosporus* (Grove) Palla, Oesterr. Bot. Zeitung 50. 365. 1900. As this species as far as I know is always found in company of *P. Kleinii* it may well be only a form of this species with abnormally large spores. Such cases are now known to occur in many of the *Mucorales*. Anyhow it is questionable whether *P. sphaerosporus* can be considered to represent a valid species.

Pilobolus Morinii Sacc. Syll. Fung. 17. 505. 1905.

Trophocyst oval, hyaline, apophyse with granular contents, sometimes yellowish, 322—494 \times 184—310 μ . Sporangiphores 1—5 mm high, 23—161 μ broad, orange colored near the tip. Subsporangial vesicle oviform, orange colored at the base, pale orange till subhyaline in the upper part; 356—713 \times 322—632 μ . Sporangia semiglobose, flattened, black, sometimes provided with a network of pale lines, 138—253 μ high, 253—460 μ broad near the base. Columella conical, with rounded top and a suggestion of a constriction in the middle 92—195 μ

high, 126—230 μ broad near the base. Spores round, yellow, dark yellow in mass, $5\frac{1}{2}$ —7 μ in diam.

Java, Bogor, on rabbit dung.

This species is well defined by its round yellow spores.

Pilobolus hyalosporus Boedijn nov. spec. (Fig. 7).

Trophocystis subglobosa vel elongata, cum apophysi, pallide aurantiaca 494—575 \times 253—322 μ . Sporangiphorae 5—10 mm altae, concolorae, 80—115 μ diam. Vesiculae subsporangiolae, oviformes, concolores 517—630 \times 340—494 μ . Sporangia hemisphaerica, nigra

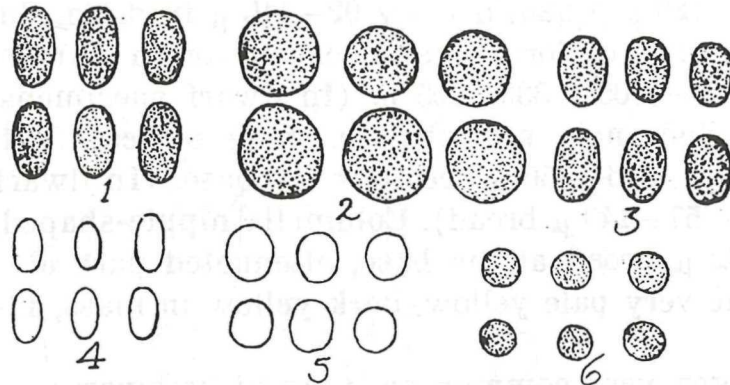


Fig. 7. Sporangiospores of *Pilobolus* species. — 1. *P. Kleinii*. 2. *P. sphaerosporus*. 3. *P. Kleinii*, strain from hogs dung. 4. *P. crystallinus*. 5. *P. hyalosporus*. 6. *P. Morinii*. The stippling of the spores indicates yellow color.

216—276 μ alta, 264—356 μ lata. Columellae conicae 160—180 μ altae, infra 184—207 μ latae. Sporae hyalinae, in cumulo flavidae, subglobosae vel elongatae 7—9 $\frac{1}{2}$ \times 6—8 μ .

Trophocyst subglobose till broadly elliptical; with apophyse, pale orange in color; 494—575 \times 253—322 μ . Sporangiphores 5—10 mm high, pale orange, 80—115 μ broad. Subsporangial vesicle oviform, pale orange, 517—630 \times 340—494 μ . Sporangia hemisphaerical, not much flattened black, sometimes provided with a network of pale lines, 218—276 μ high, 264—356 μ broad near the base. Columella conical, 160—180 μ high, 184—207 μ broad near the base. Spores hyaline, yellow in mass, subglobose till broad oval, 7—9 $\frac{1}{2}$ \times 6—8 μ .

Java, Bogor, on sheeps dung.

Utharomyces Boedijn nov. gen.

Trophocystis apophysatis aut sine apophysis. Sporangiphorae rectae demum decumbentes. Vesiculae subsporangialae subglobosae, Hyphis apicis vesiculae crasse tunicatis et nigro brunneis. Sporangia globosa, nigra. Columellae superne globosae, inferne constrictae. Sporae globosae vel subglobosae, dilute griseae, glabrae.

Trophocyst with or without apophyse. Sporangiphores erect, later toppling over. At first diameter of stipe the same over its whole

length; afterwards at some distance of the sporangium a swelling is starting, which becomes large and subglobose. The part of the stalk above this vesicle becomes thick-walled and dark brown in color. Sporangium globose, somewhat flattened at the base, black, not shot away, but opening in a star-shaped manner. Columella globose, deeply constricted near the base, which is broad and truncated. Spores pale grey, dark grey in mass, globose till subglobose, smooth.

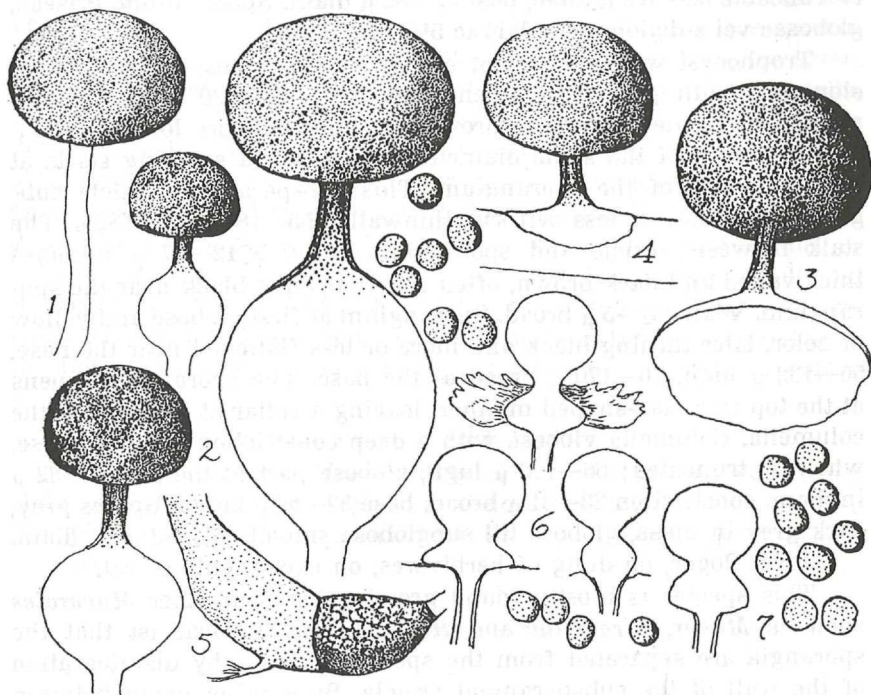


Fig. 8. *Utharomyces epallocalus*. — 1. Top of young plant before formation of the subsporangial vesicle. 2. Sporangia with subsporangial vesicles. 3. detached sporangium with part of subsporangial vesicle. 4. such a sporangium attached to a thread of *Mucor mucedo*. 5. trophocyst. 6. columellae. 7. sporangiospores.

This genus certainly belongs in the *Pilobolaceae*. It shows all the typical characters of this family; viz. a trophocyst, subsporangial vesicle, persistent sporangial wall. Even the prismatic crystals of calcium oxalate, always found in *Pilobolus* are also present, though not so much and smaller in size. But as in *Pilaira* the sporangium is not forcibly shot away. It is set free by the disintegration of the subsporangial vesicle and growing mostly intermixed with other *Mucorales*, may cling to the hyphae of those plants. Afterwards the sporangium opens at the top, so the spores may be dispersed.

Utharomyces epallocaulus Boedijn nov. spec. (Fig. 8).

Trophocystis subglobosis 96—200 × 63—120 μ. Sporangiorum rectae, usque ad 5 mm longae, 14—34 μ crassae. Vesiculae subsporangialae, subglobosae vel oviformes 55—187 × 55—182 μ. Hyphis apicis vesiculae 20—85 × 12—27 μ; crasse tunicatis et nigro brunneis. Tunica 2½—5 μ diam. Sporangia globosa, nigra, basi subtruncata, 55—132 μ alta, 70—170 μ lata. Columellae superne globosae, inferne constrictae et truncatae 66—120 μ altae, basi 52—82 μ diam. Sporae dilute griseae, globosae vel subglobosae, glabrae 5½—8 μ diam.

Trophocyst with or without apophyse, subglobose till somewhat elongated with granular contents, 96—200 × 63—120 μ. Sporangio-phores erect, later becoming prostrate, 5 mm or more long, 14—34 μ broad, at first of the same diameter, afterwards a swelling starts at some distance of the sporangium. This subsporangial vesicle subglobose till more or less oviform, thinwalled 55—187 × 55—182 μ. The stalk between vesicle and sporangium 20—85 × 12—27 μ becomes thickwalled and dark brown, often nearly opaque black near the sporangium. Wall 2½—5 μ broad. Sporangium at first globose and yellow of color, later turning black and more or less flattened near the base, 55—132 μ high, 70—170 μ broad at the base. The sporangium opens at the top in a star-shaped manner, leaving a collar at the base of the columella. Columella globose with a deep constriction near the base, which is truncated; 66—120 μ high, globose part at the top 52—82 μ in diam. constriction 23—31 μ broad, base 39—62 μ broad. Spores grey, dark grey in mass, globose till subglobose smooth, 5½—8 μ in diam.

Java, Bogor, on dung of herbivores, on excrements of rat.

This species is mostly found growing between other *Mucorales* such as *Mucor*, *Circinella* and *Helicostylum*. Typical ist that the sporangia are separated from the sporangio-phores by disintegration of the wall of the subsporangial vesicle. By sinking down between the surrounding *Mucorales*, part of the subsporangial vesicle bearing the sporangium may attach itself to the threads of those fungi. In one instance, viz. on the excrements of rats, the species was growing in pure stand.

Thamnidiaceae.

Thamnidium, *Helicostylum*, *Dicranophora*, *Chaetocladium*, *Cokeromyces*.

Helicostylum.

Helicostylum nigricans v. Tieghem. Ann. Sc. Nat. 6 sér. 4. 374. 1876.

Helicostylum piriforme Bainier. Ann. Sc. Nat. 6 sér. 15. 85. 1883.
Colonies up till 6 cm high, at first white, later with brownish hue. Sporangio-phores erect, sometimes branched 15—50 μ in diam.

with root-like threads at the base 6—24 μ broad; forming short stolones which may root at their tips and give rise to new sporangio-phores. Along the mainstem 1 till 6 compact bundles of sporangiola 115—500 μ in diam. are to be found. They are surrounding the stem completely or are only attached on one side. They originate from short, very crowded, more or less dichotomously branched threads, which are much flattened near the junction with the mainstem, 6—18 μ in diam. forming a compact rozette-like structure. The last branches of the rozette are giving rise to the long stalks of the sporangiola, 2—5 μ broad. Sporangiola subglobose or subpyriform, incurved, cut off from the stalk by a crosswall or with a very flat columella, many spored, 15—32 μ in diam. or 19—41 \times 18—37 μ . They are detached with the stalk. Spores hyaline elliptic 6½—9 \times 4—5 μ . Mainstem closing with a large sporangium, a bundle of sporangiola or a sterile point. Terminal sporangium globose dark, 75—250 μ in diam. Sporangial wall very fugacious, provided with fine needles of calcium oxalate. Columella subglobose till cylindric with a collar at the base; 35—128 \times 30—92 μ . Apophyse funnelshaped of a pale brown color. The brown color extending downwards in the threads and even in the sporangiola. Sporangiospores colorless, elliptic 7—9½ \times 4—5½ μ .

Java, Bogor, common on dung of herbivores.

The only species of *Helicostylum*, which is described as forming stolones is *Helicostylum repens* v. Tieghem, Ann. Sc. Nat. 6 sér. 4: 389. 1876. But the spores in that species are said to be globose and 12 \times 10 μ .

Choanephoraceae.

Blakeslea, *Choanephora*.

Blakeslea.

Blakeslea trispora Thaxter, Bot. Gaz, 58. 353. 1914.

Sporangiolophores 4 till 5 mm long, 10—30 μ broad. At the top subdichotomously branching, the separate branches typically constricted at regular intervals 5—10 μ broad. All branches ending in vesicular swellings 20—38 μ in diam. Those heads wholly covered by the sporangiola, which are attached with a short stalk and are oval 14—18 \times 12—16 μ , containing 2—6, mostly 3 spores. After the sporangiola are shed, the vesicles are showing semiglobose protuberances 1—2 μ in diam. Spores from the sporangiola dull brown, with a slight violet tinge, elliptic, mostly unequal-sided, striate by the presence of very low longitudinal ribs, 11—16 \times 5—7 μ , provided at both poles with a bundle of very delicate, radiating threads 11—13 μ long. Those threads often originating from a very small hyaline mucro.

Sporangiophores up till 3 mm long, 6—30 μ broad, more or less strongly curved at the tip, sometimes nearly straight and bearing a globose sporangium 39—148 μ in diam. which at first is yellowish brown, turning nearly black at maturity. Sporangial wall, colorless or weakly tinted covered by very short needles of calcium oxalate, often nearly smooth. Columella subglobose till pear-shaped, with a distinct collar at the base, 18—36 μ in diam. or 8—36 \times 5—28 μ . Sporangiospores yellowish brown in mass, singly very pale ochraceous brown, sometimes nearly subhyaline elliptic, often unequal-sided, provided with a striation consisting of very low ribs 9—16 \times 4½—6 μ , at both poles with a bundle of radiating delicate threads 8—20 μ long, mostly originating from a small hyaline mucro. Zygosporos on strongly bent, sometimes nearly parallel suspensors. Both or sometimes only one of them with a pale orange contents. Zygosporos broadly oval or elongated dome-shaped 90—140 \times 62—97 μ . Wall finely striate in longitudinal direction, at first pale colored and with a coarse, granular contents, later turning brown, with a large central gutta, finally when fully mature opaque black. Chlamydosporos intercallary in the mycelium, with slightly thickened cellwall and bright yellow contents, very variable as to shape and dimensions, globose till elongated 12—30 μ in diam. or 14—45 \times 7—29 μ .

Sumatra, Medan, as a weak parasite on various plants; on coagulated latex from *Hevea brasiliensis*. — Java, Bogor, on fading plant material; isolated from soil and from the air.

Recently the genus *Blakeslea* has been incorporated into the genus *Choanephora*. The chief reason being, that the conidia of *Choanephora* are considered to represent one spored sporangiola. However there is not much conclusive evidence to substantiate this theory. And as genera are differentiated on real and not on theoretical characters we still can maintain the genus *Blakeslea*. The principal characters are a repeatedly subdichotomously branched sporangiophore. All branches ending in vesicles bearing the mostly 3 spored sporangiola. The spores are striate and provided at both poles with a bundle of delicate threads. In *Choanephora* the unbranched conidiophore ends in a vesicle from which mostly unbranched threads are originating, which are ending in vesicles bearing the conidia. Conidia either smooth or striate, without the bundles of threads.

Choanephora.

Choanephora infundibulifera (Currey) Sacc. Syll. Fung. 9. 339. 1891.

Choanephora conjuncta Couch Journ. Elisha Mitchell Sc. Soc. 41. 143. 1925.

Conidiophores up till 7 mm high, 6—45 μ broad, ending with a more or less distinct swelling 24—60 μ in diam. From this swelling

simple or forked sometimes even bifurcated branches arise, the longer ones often slightly constricted at regular distances, $18-70 \times 5-10 \mu$, often somewhat attenuated near the base. All branches ending in globose till oval vesicles $15-39 \mu$ in diam. or $29-41 \times 22-31 \mu$. On those heads the conidia are borne on short sterigmata. Conidia brown with a violet tinge, oval or suboviform, smooth, broadly rounded at the poles, slightly but distinctly attenuated near the place of attachment, with or without a hyaline mucro, $9-23 \times 8-13 \mu$. Sporangio-phores unbranched sometimes decumbent, up till 1 mm long, $7-15 \mu$ broad; top curved and bearing a globose sporangium $15-90 \mu$ in diam. which at maturity is nearly black. Sporangial wall subhyaline till brownish, finely warty by the presence of crystals of calcium oxalate. The warty incrustation often also on the top of the stipe. Wall not diffluent but splitting in an irregular way. Columella subglobose till hemisphaerical sometimes broader than high, with or without a collar, $7-37 \mu$ in diam. or $17-19 \mu$ high, $14-27 \mu$ broad. Very small sporangia containing only a few spores often present. Sporangiospores very variable as to shape and dimensions, mostly more or less elliptic but often broadly elliptic till oval, sometimes even subglobose or with irregular outline; $8-21\frac{1}{2} \times 7-17 \mu$. Most common dimensions $16-18 \times 8-12 \mu$, greyish brown in color, finely striated in longitudinal direction. This striation sometimes indistinct or even wanting. At both poles there is a bundle of very delicate, hyaline threads $20-32 \mu$ long. Zygospores very variable mostly globose till subglobose, with the base more or less distinctly truncated, often somewhat broader than high; at first pale brown, when fully mature dark yellowish brown, but always translucent, with a large central gutta and a thick cellwall, which is finely horizontally or somewhat obliquely striated, $49-85 \mu$ in diam. or $41-75$ high, $59-82 \mu$ broad. Frequent dimensions $56-63 \mu$ in diam. Chlamydospores rather rare originating as elongated, slightly thickwalled cells in the mycelium $24-54 \times 10-17 \mu$.

Sumatra, Medan, on fading flowers of *Hibiscus rosa sinensis*. — Java, Bogor, on fading flowers of *Hibiscus rosa sinensis* and other *Malvaceae*. This species is so common, that practically every batch of flowers yields this fungus.

Giant conidia are sometimes met with, especially in material on natural substrata. Sometimes all the conidia of a vesicle are of this type or they are intermingled between normal conidia. They are more or less eggshaped and measure $21-38 \times 9\frac{1}{2}-24 \mu$.

The existing descriptions of this very common species are mostly inaccurate. In Zycha (101) the conidia are even said to be striate and his incomplete description clearly indicates *Ch. cucurbitarum*.

Choanephora cucurbitarum (Berk. et Rav.) Thaxter
Rhodora **5**, 97. 1903.

Choanephora manshurica (Saito et Naganishi) Tai, Sinensia 4: 219. 1934.

Conidiophores 7 mm or more long, 12–61 μ broad; ending in a more or less distinct swelling 24–80 μ in diam. From this swelling simple or in robust specimens one or two times branched threads are arising; 17–68 \times 5–20 μ . At the base they are sometimes slightly swollen and 17–22 μ broad. All branches ending in vesicular swellings 20–51 μ in diam. On those vesicles the conidia are borne on short sterigmata. Conidia violet brown, elliptic, acuminate obtuse, longitudinal striate by low sparingly anastomosing white ribs, with or without a mucro; 10–27 \times 7–14 μ . Sporangiohores unbranched, mostly shorter than the conidiophores, 9–34 μ broad, more or less strongly bent at the tip. Sporangia globose, black when fully ripe, 27–200 μ in diam. Sporangial wall colorless or pale brownish, wholly covered by short needles of calcium oxalate, 1–1½ μ long; rather persistent, splitting at maturity. Columella subglobose till pearshaped, with a distinct collar at the base, 18–36 μ in diam. or 27–119 \times 24–98 μ .

Sporangiospores very variable as to shape and dimensions, mostly more or less elliptic, sometimes unequal-sided, one pole slightly drawn out, broadly oval or with irregular outline; violet brown usually paler than the conidia, finely striate in longitudinal direction or striae very indistinct and sometimes spores wholly smooth, 15–27 \times 6–10 μ , with a bundle of very delicate threads 15–36 μ long at both poles. Zygosporos very variable, subglobose, depressed globose, sometimes with one or two appendages, formed by the elongation of the zygote into one or both suspensors; at first brown, wall finely horizontally or somewhat obliquely striate; 54–95 μ in diam. or 37–50 μ high, 45–57 μ broad. When fully mature opaque brownish black till black. One or both suspensors sometimes with yellow contents. Chlamydospores intercalary, sometimes in short rows, colorless, with slightly thickened cellwall and granular contents, subglobose till elongated 14–50 \times 9–25 μ .

Sumatra, Medan, as a weak parasite on several plants; on coagulated latex from *Hevea brasiliensis*. — Verlaten eiland (Krakatau group) on a rotten fruit. — Java, Bogor, as a weak parasite on *Lactuca sativa*, *Phaseolus vulgaris*, *Asclepias curassavica*. Also common on fading flowers of *Malvaceae*.

Giant conidia as in the preceding species up till 40 μ long, 25 μ broad.

Cunninghamellaceae.

Cunninghamella, *Phascolomyces*, *Thamnocephalis*.

The genus *Mycotypha* placed by Hesseltine (51) in this family, in my opinion is no Phycomycete and has to be inserted into the *Moniliales*.

Cunninghamella.

Cunninghamella Bainieri Naumov Clé d, Mucorinées
107. 1939.

Colonies white till pale grey, somewhat glossy, up till 3 cm high. Conidiophores erect, sometimes branched near the base, 5—20 μ in diam. forming creeping stolones up till 24 μ broad, from which new conidiophores may arise. All erect stems ending in a capitate vesicle 30—60 μ in diam. Along the main threads 1 till 6 whorls of side branches $2\frac{1}{2}$ —45 \times $2\frac{1}{2}$ —5 μ are to be found. On the place where those branches are originating the mainstem is mostly swollen and 10—27 $\frac{1}{2}$ μ broad. The side branches 2—12 in number, usually 3—5 are attenuated near their base and often gradually increasing in diameter near the elongated end vesicle, which is 7—55 μ broad. The whole branch including vesicle therefore often clubshaped. Cross-walls in all threads very rare. On all vesicles the conidia are originating on short sterigmata. After they are shed, only small inconspicuous scars are left. Conidia usually globose, with rather long echinulation, colorless, 8—14 μ in diam. Most common dimensions 9—11 μ . Giant conidia globose till subglobose, with much shorter echinulation, 14—28 \times 10—20 μ , often on separate heads. Sometimes the giant conidia are found singly on short irregular branches 10—28 \times $1\frac{1}{2}$ —5 $\frac{1}{2}$ μ , directly on the mainthread. Heads with conidia intermediate between the normal and the giant conidia may also be observed.

Java, Tjampea, on rotten wood in a cave. — Bogor, isolated several times from the soil. Also often as a contaminant in mould cultures.

Cunninghamella Blakesleeana Lendner, Bull. Soc. Bot. Geneva **19**. 234. 1927.

Colonies white, sometimes with a yellowish hue, about ivory yellow Ridgway, 1 $\frac{1}{2}$ cm or more high. Rhizoidal tufts are abundantly formed on the aerial threads. Conidiophores erect 7 $\frac{1}{2}$ —25 μ in diam. ending with a capitate vesicle 57—80 μ in diam. Side branches irregular placed, not in whorls, often dichotomously branched, 3 $\frac{1}{2}$ —12 $\frac{1}{2}$ μ broad. All branches ending in globose vesicles 15—43 μ in diam. Conidia ovoid with short echinulation 9—24 \times 7—13 μ . Most common dimensions 15—16 \times 11—12 μ .

Java, Bogor, isolated from the soil.

Cunninghamella Bertholletiae Stadel, Diss. Kiel **1**. 35. 1911.

Colonies 2 cm or more high, of a pale grey color. Conidiophores erect 6—10 μ broad, ending with a capitate vesicle 25—37 μ in diam. Side branches in a few whorls 5—25 \times $2\frac{1}{2}$ —7 $\frac{1}{2}$ μ , ending also in vesicles 10—27 μ in diam. Conidia predominantly ovoid, with short echinulation, 8—14 \times 6—11 μ . All hyphae containing much oil.

Chlamydo-spores common usually intercalary in the mycelial threads, mostly, cylindric, with granular contents and slightly thickened cell-wall, $9\frac{1}{2}$ — $43 \times 5\frac{1}{2}$ — 17μ .

Sumatra, Medan, isolated from the air. — Java, Bogor, isolated from the soil and from a branch of *Derris elliptica*.

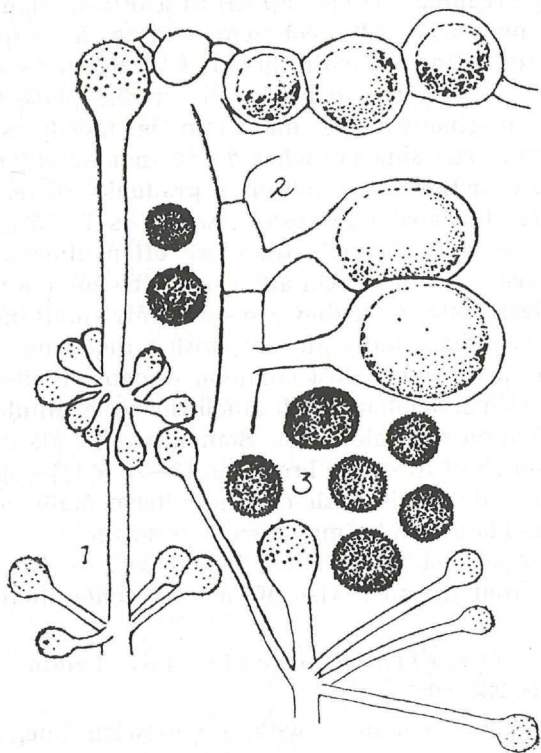


Fig. 9. *Cunninghamella phaeospora*. — 1. Conidiophores. 2. Mycelium with oil containing cells. 3. conidia.

***Cunninghamella phaeospora* Boedijn nov. spec. (Fig. 9).**

Coloniae 2 cm altae, colore sordide albae, deinde griseae. Mycelio hyalino, repente, hyphis ramosis $6\frac{1}{2}$ — 14μ diam. cum cellulis inflatis 14 — 53μ diam. et vesiculis lateralibus 56 — 61×40 — 47μ , repletis guttulis oleosis majusculis praeditis. Conidiophorae erectae $7\frac{1}{2}$ — 18μ diam. apice in vesiculam $27\frac{1}{2}$ — 55μ diam. terminatae. Rami laterales verticillati 5 — 112×2 — $8\frac{1}{2} \mu$ plerumque 15 — $37 \times 5 \mu$ in vesiculae, globosae vel subglobosae 10 — 30μ diam. terminati. Conidia globosa vel subglobosa, breviter echinulata, pallide fusca 9 — 15μ diam. in cumulo sordide brunnea.

Colonies up till 2 cm high, at first white, later pale grey, finely dotted with dark specks under a hand lense. Reverse of colonies pale

yellow, about between Mustard yellow and amber yellow Ridgway. All hyphae containing much oil, especially the mycelium in the substratum, $6\frac{1}{2}$ — $14\ \mu$ in diam., which is forming globose or subglobose vesicles, either intercalary or on short side branches, 14 — $53\ \mu$ in diam. or 56 — 61×40 — $47\ \mu$; wholly filled with oil. Conidiophores erect, $7\frac{1}{2}$ — $18\ \mu$ in diam. ending with a capitate vesicle $27\frac{1}{2}$ — $55\ \mu$ in diam. Side branches in 2—3 whorls along the mainstem, 5 — 112×2 — $8\frac{1}{2}\ \mu$, usually 15 — $37 \times 5\ \mu$ mostly 3—9 branches in a whorl. All ending in globose till subglobose heads 10 — $30\ \mu$ in diam. Conidia globose till subglobose, with short echinulation, 9 — $15\ \mu$ in diam. Dull brown in mass, singly brown about woodbrown Ridgway.

Java, Malang, isolated from the soil of a coffee garden.

Phascolomyces Boedijn nov. gen.

Mycelium ex hyphis inflatis, brunneis, intus granulatis compositum. Conidiophorae erectae, sympodialiter ramosae, leviter granulatae, apice in vesiculam inflatae. Vesiculae laterales breviter stipitatae vel sessiles, semiglobosae aut irregulares. Conidia globosa, hyalina, glabra, in apice sterigmatorum longorum nascentia. Conidia libera parte sterigmatis auctae.

Mycelium in substratum forming intercalary, single or in short rows irregular much swollen, brown colored cells with coarse granular contents. Conidiophores erect, sympodially branched, with finely granulated cellwall. All branches ending in capitate vesicles. Along the threads also lateral vesicles, shortly stalked or sessile and semiglobose. Conidia on long sterigmata on the vesicles, globose, colorless, smooth. When shed part of sterigma mostly adhering.

Phascolomyces articulatus Boedijn nov. spec. (Fig. 10).

Mycelium ex hyphis ramosis, plerumque inflatis compositum. Cellulae inflatae solitariae vel catenulatae, globosae, subglobosae, elongatae vel irregulares, brunneae intus granulosae 108 — 380×72 — $180\ \mu$. Conidiophorae erectae, sympodialiter ramosae, leviter granulatae $3\frac{1}{2}$ — $20\frac{1}{2}\ \mu$ diam. plerumque 10 — $12\ \mu$ diam. in vesiculam 20 — $85\ \mu$ diam. dilatatae. Vesiculae laterales breviter stipitatae vel sessiles, globosae, subglobosae vel irregulares; 4 — $36\ \mu$ diam. Sterigmata 7 — $20\frac{1}{2} \times 1\ \mu$. Conidia globosa, hyalina, glabra, plerumque pedicellata 7 — $12\ \mu$ diam.

Colonies pale grey, $1\frac{1}{2}$ — 3 cm high. Reverse of cultures darkly mottled becoming nearly black in old cultures. Mycelium in substratum much branched 12 — $50\ \mu$ in diam. forming intercalary, single or in short rows globose, subglobose, elongated till irregular shaped, much swollen brown colored cells with coarse granular contents, 108 — 380×72 — $180\ \mu$. On natural substrata mostly much smaller. Conidiophores sympodially branched, wall usually finely granulated,

occasionally with a septum near the base of a side branch, contents often with oil, measuring $3\frac{1}{2}$ – $20\frac{1}{2}$ μ , usually 10–12 μ in diam. Rhizoidal tufts on the aerial threads not rare. All threads ending in capitate vesicles 20–85 μ in diam. Along the threads also lateral vesicles, either short stalked or wholly sessile 4–36 μ in diam. The sessile heads semiglobose or irregular shaped. Conidia formed on the

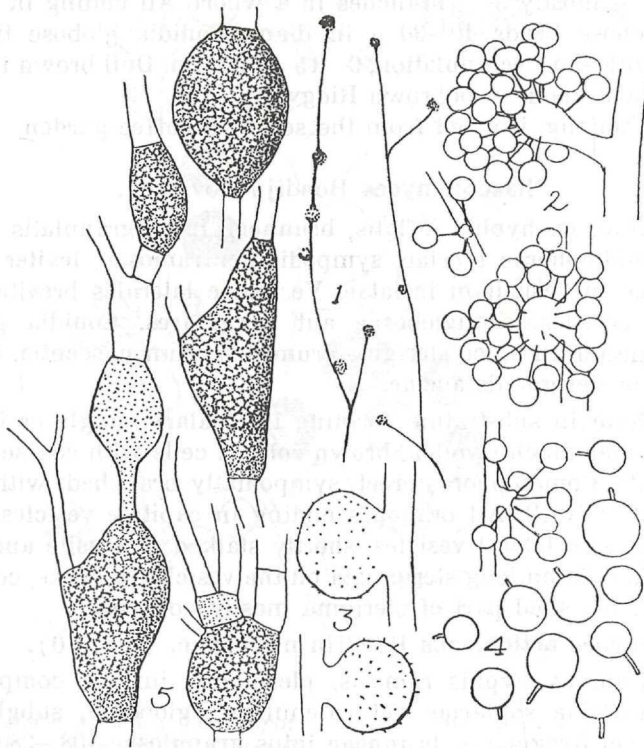


Fig. 10. *Phascolomyces articulosus*. — 1. conidiophores. 2. different types of lateral vesicles with conidia. 3. sessile vesicles without conidia. 4. conidia. 5. giant cells of mycelium filled with reserve food.

vesicles on very long sterigmata, 7 – $20\frac{1}{2} \times 1$ μ . They are globose, hyaline, smooth, 7 – 17 μ in diam. When shed usually with part of the sterigma.

Java, Malang, isolated from the soil of a coffee garden. — Bogor, on the excrements of rats.

Piptocephalidaceae.

Piptocephalis, *Syncephalis*, *Syncephalopsis*, *Syncephalastrum*, *Dimargaris*, *Dispira*.

Piptocephalis.

Piptocephalis Tieghemiana Matruchot Bull. Soc. Myc. France **16**. 58. 1900.

Sporangiophores 300 μ and more long, beautifully repeatedly dichotomously branched, occasionally with a septum, subhyaline till pale brown. Mainstem 4–7 μ , the other branches $1\frac{1}{2}$ –5 μ in diam. Ultimate branches bearing a globose, colorless cell $2\frac{1}{2}$ – $5\frac{1}{2}$ in diam. From this cell rod like part-sporangia 8–12 \times 2–4 are radiating. Each part-sporangium containing only 2 spores. Spores cylindrical, smooth, colorless 4–6 \times $2\frac{1}{2}$ –4 μ . Together with the spores the basal cells are also shed.

Java, Bogor, parasitic on *Circinella umbellata* and *Rhizopus stolonifer*.

Our species is listed by Z y c h a (101) as a synonym of *Piptocephalis cylindrospora* Bainier Ann. Sc. Nat. sér. **15**. 92. 1883. But this species is described as possessing 6 spored part sporangia. The rich material which I was able to study always showed only 2 spored part sponrangia. So in my opinion *P. Tieghemiana* may be considered a distinct species.

Syncephalis.

Syncephalis cornu V. Tieghem et Le Monnier Ann. Sc. Nat. 5 sér. **17**. 376. 1873.

Sporangiophores 90–150 μ long, 4–7 μ broad near the base. Near the top strongly bent and stem gradually broadened here, reaching 14–22 μ in diam. Above this broad part diminishing in diameter and forming abruptly a globose head 21–30 μ in diam. Upperpart of this vesicle covered by the part sporangia 30–40 \times 4–6 μ , containing 4–6 spores. When the spores are ripe they have a yellow color in mass. Spores elliptic, smooth 8–13 \times 4–5 μ . Zygo-spores formed on parallel suspensors 5– $6\frac{1}{2}$ μ in diam., which are not different from the ordinary hyphae and from which they are cut off by a crosswall. Often from the part under the septum, short irregular branches are sprouting. Zygosporos globose, yellow, wall provided with blunt pyramidal warts; 10–25 μ in diam.

Java, Bogor, common as a parasite on the larger *Mucorales*.

Syncephalis nodosa V. Tieghem Ann. Sc. Nat. 6 sér. **1**. 131. 1875.

Sporangiophores 150–170 μ long, 4–8 μ broad, hyaline except for the spore chains, which are yellowish. Stem provided with 1 till 2 faint swellings 8–9 μ in diam. Near the top stem dilating gradually, forming a head 11–14 μ in diam., which is flattened at the top. Here the part sporangia 25–30 \times 2–4 μ are formed, which at first are nearly parallel and contain 5 spores. Later more or less spreading. The part sporangia are once till twice branched near the base. When

later the spores are delimited, 2 till 3 spore chains are seen originating from a basal cell. Often however it is the second cell from below, which is bearing the spore chains. All spores including the basal cells are shed, leaving no scars on the top of the head. Spores elliptic, colorless, smooth, $6\frac{1}{2}$ — 10×3 — 5μ .

Java, Tjampea, on *Helicostylum nigricans*. — Bogor, on *Circinnella umbellata*.

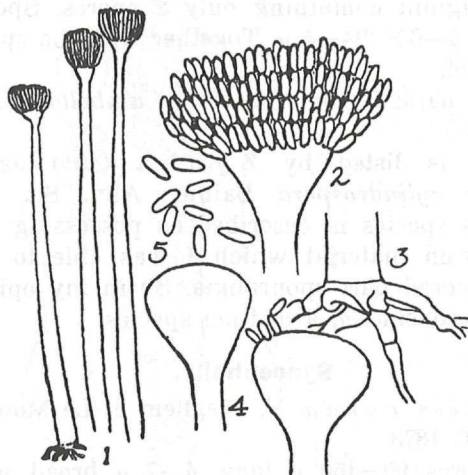


Fig. 11. *Syncephalis truncata*. — 1. whole plants. 2. head of plant with part sporangia. 3. base of plant. 4. heads without part sporangia. 5. spores.

It seems that in the genus *Syncephalis* undue importance is attached to the so-called basal cells. At first the part sporangia are unseptated. Later when septae are formed, the parts under the branching may become 1 celled or 2 celled. At the place of branching those cells often show short protuberances. But in no other way are they different from the common spores.

Syncephalis asymmetrica V. Tieghem et Le Monnier
Ann. Sc. Nat. 5 sér. **17**. 375. 1873.

Syncephalis Tengi Ou Sinensia **11**. 48. 1940.

Sporangiophores up till 1 mm high, at first yellow, afterwards transparent brown. Rhizoids at base 3 — 6μ broad. Mainstem 18 — 25μ broad near the base, 5 — 10μ near top, which bears a subglobose vesicle 35 — 67μ in diam. From this head except for an apophyse-like part at the base the part sporangia are radiating; 30 — $38 \times 2\frac{1}{2}$ — 5μ , containing 4—6 spores. They are either single or branched near the base. The cell bearing the 2 chains of spores provided with a lateral protuberance. When all spores are shed, the vesicle is densely

covered by flat warts $1-1\frac{1}{2}$ μ in diam. Spores more or less cylindric, colorless, smooth $4-6\frac{1}{2} \times 2-3$ μ .

Java, Bogor, on *Circinella umbellata* and *Helicostylum nigricans*.

Syncephalis truncata Boedijn nov. spec. (Fig. 11).

Sporangiophorae pallide luteae $540-720$ μ longae, inferne $15-31$ μ superne $9-12$ μ in diam. Rhizoideae $3-6$ μ diam. Vesiculae infundibuliformes in apicibus subtruncatis $35-40$ μ diam. Sporangia cylindracea tetrasporacea, parallelis $26-39 \times 3$ μ . Sporae cylindraceae, hyalinae, glabrae $5\frac{1}{2}-8 \times 1\frac{1}{2}-2\frac{1}{2}$ μ .

Sporangiophores pale yellow $540-720$ μ long. Rhizoids at the base $3-6$ μ in diam., sometimes septated. Stem at the base $15-33$ μ broad, gradually attenuated near the top, which is $9-12$ μ broad. Here the stem widens funnel-like, while the apex is subtruncate and $35-40$ μ broad. Part sporangia only on the flat top, typical parallel $26-39 \times 3$ μ , containing 4 spores. Spores cylindric, colorless, smooth $5\frac{1}{2}-8 \times 1\frac{1}{2}-2\frac{1}{2}$ μ .

Java, Bogor, parasitic on *Pilobolus Kleinii*.

Syncephalopsis Boedijn nov. gen.

Sporangiophorae rectae, basi plerumque septatae et rhizoideis praeditae, apice vix inflatae. Sporangia longe cylindracea, supra sporifera, infra sterilia.

Sporangiophores with rhizoids and often a septum at the base. Apex only slightly swollen. Part sporangia long cylindrical, forming only spores in the upper half. The lower half functioning as a supporting thread for the spores. Those threads remaining when the spores are shed.

Syncephalopsis bispora (Rac.) Boedijn nov. comb.

Syncephalis bispora Rac. Bull. Acad. Sc. Cracovie 347. 1909.

Sporangiophores $426-744$ μ long, subhyaline, with rhizoids $3-8$ μ broad and often a septum at the base; $13-33$ μ broad at the base, slightly attenuated near the top, which is $10-18$ μ broad. Vesiculae more or less hemisphaerical, only weakly developed, $16-27$ μ in diam. From this head the part sporangia are radiating, which are long cylindrical. The upper part forms 2 sometimes 3 large spores. The lower part remains a colorless supporting hypha $17-26 \times 2\frac{1}{2}-4$ μ . Spores cylindric, colorless, smooth $13\frac{1}{2}-25 \times 6\frac{1}{2}-8\frac{1}{2}$ μ . The supporting hyphae remaining when the spores are shed.

Java, Bogor, parasitic on *Circinella umbellata* and *Helicostylum nigricans*.

Syncephalastrum.

Syncephalastrum racemosum (Cohn) Schroeter Kryptog. Flora Schlesiens 3. 1. 217. 1886.

Colonies grey, at last very dark, about between deep olive gray and dark olive gray Ridgway; up till 1 cm high. Mycelium with short stolones provided with branched rhizoids $2\frac{1}{2}$ – $7\frac{1}{2}$ μ in diam. Sporangio-phores with many rather short lateral and some longer repeatedly branched side branches. Many branches strongly bent, Mainstem and branches $1\frac{1}{2}$ – 30 μ in diam. ending in globose till subglobose vesicles 5 – 75 μ in diam. or 41 – 69×38 – 55 μ . Just under the vesicles or on a short distance from it, a septum is nearly allways present. Sometimes the vesicles are elongated, elliptical till nearly cylindrical, 39 – $67 \times$

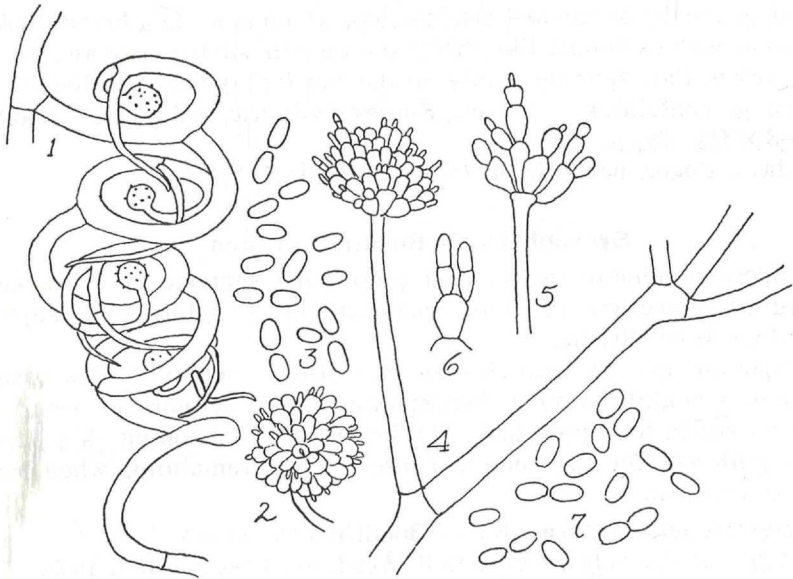


Fig. 12. 1. *Dispira cornuta*. 2. head enlarged. 3. spores. 4. *Dimargaris cristalligena*. 5. small head enlarged. 6. two part sporangia. 7. spores.

26 – 53 μ . Part sporangia radiating from the vesicles, 20 – 50×3 – 6 μ , containing 6 – 10 spores. Spores subhyaline dark in mass, globose, smooth 3 – 5 μ in diam. When all spores are shed, the vesicles are showing a pitted appearance.

Java, Bogor, isolated from the soil and from the air. A common contaminant in mold cultures.

*Syncephalastrum javanicum*⁴. Rac. Bull. Acad. Sc. Cracovie 347. 1909.

Java, Since Raciborski collected this species, no new material could be procured, so I cannot give any comment.

Dimargaris.

Dimargaris cristalligena V. Tieghem Ann. Sc. Nat. 6 ser. 1. 154. 1875 (Fig. 12).

Whole plant about 1 mm or more high; subhyaline, subdichotomously branched, with septae at the base of the branches. All branches straight and 4—12 μ broad. Top of branches hardly broadened, bearing a fascicle of branched threads 20—39 μ in diam. the cells of which are swollen and constricted at the septae. Basal cells 9—11 \times 4—7 μ , top cells 4—7 \times 3—5 μ . On the top cells the part sporangia are borne. They are cylindric, containing only 2 spores. Spores elliptic, colorless 3—4 \times 1½—2½ μ .

Java, Tjampea on *Helicostylum nigricans*.

In Zycha (101) this monotypic genus is considered to be synonymous with *Dispira*. However our material though scanty does not bear out this conception. The spore formation is much like that in *Dispira*, but the habitus of our plant is totally different. All hyphae are straight, terminating in a bundle of sporangiferous threads. In *Dispira* on the other hand, the hyphae are strongly spirally coiled, often over long distances. They bear on short side branches, overtopped by an incurved sterile thread, the sporangiferous threads on a typical globose vesicle. So it seems advisable to maintain our genus, until more and better material may be available.

Dispira.

Dispira cornuta V. Tieghem Ann. Sc. Nat. 6 sér. 1. 160. 1875.

Dispira americana Thaxter Bot. Gaz. 20. 517. 1895.

Whole plant 1 mm or more high, much depending on the length of the host plant; hyaline, subdichotomously branched. Main hyphae 6½—13 μ in diam. Branches spirally coiled, each branch delimited by a crosswall. Some branches 2½—5½ μ in diam. ending in a globose vesicle 8—12 μ in diam. Nearly always a branch 3—7 μ in diam. tapering into a pointed tip, is more or less overtopping the fertile branch. From the vesicle the sporangiferous threads are radiating; the whole head 28—39 μ in diam. The sporangiferous threads 2 celled, the cells constricted at the septae. Basal cells 4—5 \times 2—3 μ , top cells 3½—4 \times 2—3 μ . On those cells the part sporangia are arising, which are cylindric and containing 2 spores. Spores elliptic, colorless 3—4 \times 2—2½ μ .

Java, Bogor on *Pilobolus Kleinii* and other *Mucorales*, no rare. — Tjampea on *Helicostylum nigricans*.

Helicocephalidaceae Boedijn nov. fam.

Coeloblastus, Mycelio hyphis ultimo gracilibus, ramosis composito. Conidiophorae erectae, non ramosae, ad apicem conidia soli-

taria vel catenulata gerentes sive apice vesiculoso inflatae et conidia in apice sterigmatorum solitaria acrogena. Conidia majuscula, continua, brunnea.

Mycelial threads very thin, branched, coenocytic. Conidiophores unbranched, coenocytic, ending either with some conidia, a spirally coiled chain of conidia or a globose vesicle bearing on short sterigmata the conidia. Conidia one celled, relatively large, brown colored.

The representatives of this new family were unanimously considered by their authors to belong to the Mucorales. Yet no definite place was ever indicated. It is especially their coenocytic organization which led to the supposition, that we have to deal with members of our order.

Helicocephalum, *Rhopalomyces*.

Rhopalomyces.

Rhopalomyces elegans Corda Prachtflora 3. 1839.

Mycelial threads thin, branched, unseptated. Conidiophores erect, unbranched, unseptated, about 1 mm high $7\frac{1}{2}$ —20 μ in diam. At the top ending in a globose vesicle 30—60 μ in diam. The surface of this vesicle more or less distinctly areolated, with a sterigma bearing a conidium in the centre of each areole. Head with conidia 112—132 μ in diam. Conidia long elliptic, brown colored, 32 — $41(59) \times 13$ — $15(20)$ μ .

Sumatra, Medan, on rotten coffee seeds.

Java, Bogor, not rare on rotten branches and fruits.

This species is always growing in very foul environment, together with Bacteria, other moulds, eelworms etc. From the species of *Rhopalomyces* as well as those of *Helicocephalum* no one has ever succeeded in growing them in pure culture. Thaxter already mentions, that from our species, *R. strangulatus* and *Helicocephalum*, he failed to germinate the conidia in water or nutrient solutions. All my own attempts with *R. elegans* were also in vain. The conidia never germinated in water, decoctions of the substrata, nutrient agar etc. When inoculated in other mould cultures, trying to reproduce the natural environment, no growth could ever be observed. From one species of *Helicocephalum* it is known, that it grows on the eggs of Nematodes. So it may be possible that *Rhopalomyces* prefers a similar substratum, but I was unable to prove this.

Mortierellaceae.

Mortierella, *Haplosporangium*, *Dissophora*.

Mortierella.

Mortierella polycephala Coemans Bull. Acad. R. Belg. 2 sér. 15. 536. 1863.

From a white creeping mycelium the sporangiophores are arising, which are up till 2 mm high, but mostly shorter and 17—25 μ in diam. At the base rhizoids $2\frac{1}{2}$ — $7\frac{1}{2}$ μ in diam. are present; in old specimens sometimes with some septae. Sporangiophores more or less cymosely branched, showing often some whorls of side branches 4— $7\frac{1}{2}$ μ in diam. All threads ending in globose sporangia 50—87 μ in diam. Sporangial wall very delicate, soon diffluent, leaving a cup-shaped collar at the tops of the branches, which are slightly rounded and broadened 9—22 μ in diam. Spores variable as to shape and dimensions, globose till oval, colorless, smooth, 11—19 μ in diam. or 21 — 26×15 —19 μ . When germinating the spores are forming up till 7 germtubes.

Java, Tjampea, in a cave upon the excrements of bats.

Kickxellaceae.

Kickxella, *Coemansia*, *Martensella*, *Linderina*, *Martensiomycetes*.

Coemansia.

Coemansia reversa V. Tieghem et Le Monnier Ann. Sc. Nat. 5 sér. **17**. 392. 1873.

Colonies yellow, up till 3 mm high. Conidiophores septate, 9—10 μ in diam. near the base; above mostly ending in 3 branches $2\frac{1}{2}$ —5 μ in diam. which are bearing the sporocladia. Sporocladia shortly stipitate, sickleshaped, recurved, sometimes nearly horizontal, 3—5 septate, 20 — 24×4 —5 μ , stipe 1 celled, 5 — 6×2 —3 μ . Apical cell sterile. Phialides in 4—5 rows on the under surface, elliptic 2 — $4 \times 1\frac{1}{2}$ —2 μ . Conidia fusoid 8 — $11\frac{1}{2} \times 2$ —3 μ .

Java, Bogor, on a white species of *Isaria*, on rabbit dung.

Coemansia erecta Bainer Bull. Soc. Myc. France **22**. 220. 1906.

Colonies sulphur yellow, 1—2 mm high. Conidiophores septate, 8—16 μ in diam. near the base; above mostly furcate or bifurcate, the branches $5\frac{1}{2}$ —9 μ in diam. and bearing the sporocladia. Sporocladia stalked, straight curved upwards and nearly parallel with the supporting hypha, 5—9 septate, 26 — 37×4 —6 μ , stipe one celled 4 — 8×3 —4 μ . Terminal cell sterile. Phialides elliptic, in about 5 oblique rows 3 — $5 \times 1\frac{1}{2}$ —2 μ . Conidia subcylindric 9 — $10\frac{1}{2} \times 2$ — $2\frac{1}{2}$ μ .

Java, Tjampea, in a cave upon the excrements of bats.

Literature.

1. Ajrekar, S. L. & Dharmarajulu, K., A study of the *Mucorales* of the city of Bombay Journ. Indian Bot. Soc. **10**, 1931 p. 29—34, 1 pl.
2. Alcorn, G. D. & Yeager, Ch. C., A monograph of the genus *Cunninghamella* with additional descriptions of several common species Mycologia **30**, 1938 p. 653—658, 2 fig.

3. Ayers, Th. T., Parasitism of *Dispira cornuta*. *Mycologia* **27**, 1935 p. 235—261, 4 fig.
4. Bakerspiegel, A., *Haplosporangium* in Saskatchewan rodents. *Mycologia* **48**, 1956 p. 568—572, 2 fig.
5. Barnes, B., On variation in *Thamnidium elegans* Link induced by the action of high temperature. *Transact. Brit. Myc. Soc.* **19**, 1935 p. 291—314
6. Barnett, H. L. & Lilly, V. G., Nutritional and environmental factors influencing asexual sporulation of *Choanephora cucurbitarum* in culture. *Phytopathology* **40**, 1950 p. 80—89.
7. Barnett, H. L. & Lilly, V. G., The effects of humidity, temperature and carbon dioxide on sporulation of *Choanephora cucurbitarum* *Mycologia* **47**, 1955 p. 26—29.
8. Barnett, H. L. & Lilly, V. G., Factors affecting the production of zygospores by *Choanephora cucurbitarum*. *Mycologia* **48**, 1956 p. 617—627, 5 fig.
9. Benjamin, Ch. R. & Hesseltine, C. W., The genus *Actinomorcor*. *Mycologia* **49**, 1957 p. 240—249, 7 fig.
10. Berry, Ch. R. & Barnett, H. L., Mode of parasitism and host range of *Piptocephalis virginiana*. *Mycologia* **49**, 1957 p. 374—386, 12 fig.
11. Bessey, E. A., Studies on *Pilobolus*. *P. Kleinii* and *P. longipes* *Papers Michigan Acad. Science, Arts and Letters* **32**, 1946 p. 15—25, 3 pl.
12. Bessey, E. A., *Morphology and Taxonomy of Fungi*, 1950, p. 150—170.
13. v. Beyma Thoe Kingma, F. H., Beschreibung einiger neuer Pilzarten aus dem Centraalbureau voor schimmelcultures, Baarn (Nederland) *Piptocephalis macrospora* nov. spec. *Leeuwenhoek* **10**, 1944 p. 42—44.
14. Björling, K., Über die Gattungen *Mortierella* und *Haplosporangium* *Bot. Not.* 1936, p. 116—126.
15. Bobr-Tylingo, H., Deux Mucorinées de Madagascar. *Revue de Mycologie, suppl. colonial* **19**, 1954 p. 20—27, 4 fig.
16. Boedijn, K. B., Beitrag zur Kenntnis der Pilzflora von Sumatra. *Recueil d. Trav. Bot. Néerl.* **26**, 1929 p. 400.
17. Boedijn, K. B., The Mycetozoa, Fungi and Lichenes of the Krakatau group. *Bull. d. Jard. Bot. de Buitenzorg ser. III* **16**, 1940 p. 365.
18. Bünning, E., Phototropismus und Carotinoide. I. Phototropische Wirksamkeit von Strahlen verschiedener Wellenlänge und Strahlungsabsorption im Pigment. bei *Pilobolus*. *Planta* **26**, 1937 p. 719—736.
19. Burnett, J. H., Carotene and sexuality in *Mucoraceae*, especially in *Phycomyces Blakesteenanus*. *The New Phytologist* **55**, 1956 p. 45—49, 1 fig.
20. Burnside, C. E., A disease of young bees caused by a *Mucor*. *Americ. Bee Journ.* **25**, 1935 p. 75—76.
21. Butler, E. E., A new species of *Mucor*. *Mycologia* **54**, 1952 p. 561—563, 1 fig.
22. Callen, E. O., The morphology, cytology and sexuality of the homothallic *Rhizopus sexualis* (Smith) Callen. *Ann. of Bot.* **4**, 1940 p. 791—818.
23. Callen, E. O., Notes on *Circinella simplex* v. Tieghem. *Transact. Brit. Myc. Soc.* **32**, 1949 p. 337—340, 2 fig.

24. Campbell, M. E., An investigation of the *Mucorales* in the soil. *Transact. Roy. Soc. Edingburgh* **59**, 1938 p. 411—436, 15 fig., 3 pl.
25. Carmichael, J. W., The pulmonary fungus *Haplosporangium parvum* — II. Strain and generic relationships. *Mycologia* **43**, 1951 p. 605—624.
26. Castle, E. S., Spiral growth and reversal spiraling in *Phycomyces*, and their bearing on primary wall structure. *Americ. Journ. of Bot.* **29**, 1942 p. 664—672, 10 fig.
27. Chaves Batista, A. & Fernadqs Vital, A., Notas sobre *Syncephalastrum racemosum* Cohn e sua constalação em Pernambuco. *Anais da Sociedade de biologia de Pernambuco* **14**, 1956 p. 54—57, 2 fig.
28. Christenberry, G. A., A taxonomic study of the *Mucorales* in the Southeastern United States. *Journ. Elisha Mitchell Sc. Soc.* **56**, 1946 p. 333—366, 7 pl.
29. Cutter, V. M., Nuclear behavior in the *Mucorales*. I The *Mucor* pattern. *Bull. Torrey Bot. Club* **69**, 1942 p. 480—508, 66 fig.
30. Cutter, V. M., Nuclear behavior in the *Mucorales*. II The *Rhizopus*, *Phycomyces* and *Sporodinia* pattern. *Bull. Torrey Bot. Club* **69**, 1942 p. 592—616, 21 fig.
31. Cutter, V. M., The genus *Cunninghamella* (*Mucorales*) Forlowia **2**, 1946 p. 321—343, 2 pl.
32. Cutter, V. M., A survey of the carbohydrase systems of *Syncephalastrum racemosum* Cohn. *Farlowia* **4**, 1950 p. 1—13, 3 fig.
33. Dade, H. A., New Gold Coast Fungi I, *Transact. Brit. Myc. Soc.* **21**, 1937 p. 16—28, 4 fig.
34. Dantas, B., Sobre *Choanephora conjuncta* no Brasil. *Anais do IV Congr. Nac. da Soc. Bot. do Brasil* 1953, p. 177—185.
35. Dantas, B., A situacao atual do genero *Choanephora* (*Mucorales*) *Anais do IV Congr. Nac. da Soc. Bot. do Brasil* 1953, p. 333—350.
36. Dobbs, C. G., A coremial stage of *Mucor*. *Journ. Micros. Soc.* **57**, 1937, p. 8—10.
37. Dobbs, C. G., The life history and morphology of *Dicranophora fulva* Schroet. *Transact. Brit. Myc. Soc.* **21**, 1938, p. 167—192, 80 fig. 2 pl.
38. Dobbs, C. G., Spore dispersal in the *Mucorales*. *Transact. Brit. Myc. Soc.* **25**, 1942, p. 441.
39. Dobbs, C. G., A Mucorine parasite on *Penicillia*. *Nature, London* **CL**, 3802, 1942, p. 319, 1 fig.
40. Dobbs, C. G. & English, M. P., *Piptocephalis xenophila* sp. nov. parasitic on non Mucorine hosts. *Transact. Brit. Myc. Soc.* **37**, 1954, p. 375—389, 3 fig., 1 pl.
41. Dowding, E. S., The pulmonary fungus *Haplosporangium parvum* and its relationship with some human pathogens. *Can. Journ. Res.* **25**, 1947, p. 195—206.
42. Drechsler, Ch., A new species of *Helicocephalum*. *Mycologia* **26**, 1934, p. 33—37, 1 pl.
43. Drechsler, Ch., A new non-helicoid bisporous *Helicocephalum* parasitising Nematode eggs. *Mycologia* **35**, 1943, p. 134—141, 1 fig.
44. Emmons, C. W. & Ashburn, L. L., The isolation of *Haplosporangium parvum* n. sp. and *Coccidioides immitis* from wild rodents. *Publ. Health Rep.* **57**, 1942, p. 1715—1727.
45. Flint, L. H., Note on phototropism in *Pilobotus*. *Americ. Journ. of Bot.* **29**, 1942, p. 672—674, 1 fig.

46. Goldring, D., The effect of environment upon the production of sporangia and sporangioles in *Blakeslea trispora* Thaxter. Ann. Missouri Bot. Garden **23**, 1936, p. 527—542, 1 pl.
47. Hesseltine, C. W., A revision of the *Mucorales* based especially upon or study of the representatives of this order in Wisconsin. Thesis 1950, 570 pp., 27 pl.
48. Hesseltine, C. W., A survey of the *Mucorales*. Transact. New-York Acad. Sc. **14**, 1952, p. 210—214.
49. Hesseltine, C. W., A revision of the *Choanephoraceae*. Americ. Midland Nat. **50**, 1953, p. 248—256.
50. Hesseltine, C. W., The section *genevensis* of the genus *Mucor*. Mycologia **46**, 1954, p. 358—366, 1 fig.
51. Hesseltine, C. W., Genera of the *Mucorales* with notes on their synonymy. Mycologia **47**, 1955, p. 344—363.
52. Hesseltine, C. W., The genus *Syzygites* (*Mucoraceae*). Lloydia **20**, 1957, p. 228—237.
53. Hesseltine, C. W. & Anderson, R. F., The genus *Thamnidium* and a study of the formation of zygospores. Americ. Journ. of Bot. **43**, 1956, p. 696—703.
54. Hesseltine, C. W. & Anderson, R. F., Microbiological production of carotenoids. I. Zygospores and carotenes produced by intraspecific and interspecific crosses of *Choanephoraceae* in liquid media. Mycologia **49**, 1957, p. 449—452.
55. Hesseltine, C. W. & Benjamin, C. R., Notes on the *Choanephoraceae*. Mycologia **49**, 1957, p. 723—733, 9 fig.
56. Hesseltine, C. W. & Fennell, D. I., The genus *Circinella*. Mycologia **47**, 1955, p. 193—212, 2 fig.
57. Hesseltine, C. W., Whitehill, A. R., Pidacks, C., Ten Hagen, M., Bohonos, N., Hutchings, B. L. & Williams, J. H., Coprogen, a new growth factor present in dung, required by *Pilobolus* species. Mycologia **45**, 1953, p. 7—19, 8 fig.
58. Ito, S., Mycological flora of Japan, I. Phycomycetes. Tokyo 1936, 340 pp., 125 fig.
59. Jackson, H. S. & Dearden, E. R., *Martensella Corticii* Thaxter and its distribution. Mycologia **40**, 1948, p. 168—176, 11 fig.
60. Jochems, S. C. J., Een interessante schimmel (*Choanephora infundibulifera*) op de Kembang Sepatoe. De Tropische Natuur **15**, 1926, p. 7—9.
61. Jochems, S. C. J., Parasitaire stengelverbranding bij Delitabak. Mededeelingen Deliproefstation 2e ser. **44**, 1927, 35 pp.
62. Kiyosi Kominami, Yosio Kobayasi, & Keisuke Tubaki. Enumeration of the moulds of Japan. II. Species of *Mucorales*. Nagaoa **1**, 1952, p. 14—25, 18 fig.
63. Kiyosi Kominami, Yosio Kobayasi, & Keisuke Tubaki. Enumeration of the moulds of Japan III. Nagaoa **2**, 1952, p. 52—61, 7 fig.
64. Krafczyk, H., Die Bildung und Keimung der Zygosporen von *Pilobolus crystallinus* und sein heterokaryotisches Myzel. Beitr. Biol. Pflanzen **23**, 1935, p. 349—396.
65. Leadbeater, G. & Mercer, C., Zygospores in *Piptocephalis cylindrospora* Bain. Transact. Brit. Myc. Soc. **39**, 1956, p. 17—20, 1 fig., 1 pl.
66. Lefebvre, C. L. & Weimer, J. L., *Choanephora cucurbitarum* attacking cowpeas. Phytopathology **29**, 1939, p. 898—901, 2 fig.

67. Linder, D. H., The genera *Kickxella*, *Martensella* and *Coemansia*. *Farlowia* **1**, 1943, p. 49—77, 4 pl.
68. Ling-Young, M., Etude biologique des phénomènes de la sexualité chez les Mucorinées. *Rev. gen. de Bot.* **42**, 1930, p. 144—158, 205—218, 283—296, 348—365, 409—428, 491—504, 535—552, 618—639, 681—704, 722—752, 36 fig.
69. Ling-Young, M., *Rev. gen. de Bot.* **43**, p. 30—43.
70. Linnemann, G., Beitrag zu einer Flora der *Mucorineae* Marburgs. *Flora, neue Folge* **30**, 1935/36, p. 176—217, 25 fig.
71. Linnemann, G., Die Mucorineen-Gattung *Mortierella* Coemans. *Pflanzenforschung* **23**, 1941, p. 1—64, 8 pl.
72. Lyr, H., Zur Kenntnis der Sexualverhältnisse der Gattung *Pilobolus*. *Arch. f. Protistenkunde* **99**, 1954, p. 253—293.
73. Lythgoe, J. N., Taxonomic notes on the genera *Helicostylum* and *Chaetostylum*. (*Mucoraceae*). *Transact. Brit. Myc. Soc.* **41**, 1958, p. 135—141, 3 fig.
74. Meyer, J., *Martensiomycetes pterosporus* nov. gen. nov. sp. nouvelle Kickxellacée isolée du sol. *Bull. Soc. Myc. France* **73**, 1957, p. 189—201, 16 fig.
75. Moreau, M., Quelques Mucorinées de Madagascar. *Bull. Soc. Myc. France* **65**, 1949, p. 142—151, 4 fig.
76. Moreau, C. & M., Une curieuse Mucorinée; *Choanephora cucurbitarum* (Berk. et Rav.) Thaxter. *Bull. Soc. Myc. France* **66**, 1950, p. 226—227.
77. Moreau, F., Les Champignons Tom. I 1953, Tom. II 1954, p. 1164—1230.
78. Naganishi, H. & Kawakami, N., On *Blakeslea* Thaxter in Japan II. *Bl. circinans* sp. nov. *Bull. Fac. Eng. Hiroshima Univ.* **4**, 1955, p. 183—187.
79. Naumov, N. A., Clés de Mucorinées. 1939. XXXVI & 137 pp. 82 fig.
80. Nicot-Toulouse, J., *Cunninghamella echinulata* Thaxter et *C. elegans* Lendner. *Bull. Soc. Myc. France* **66**, 1950, p. 21—30, 2 fig.
81. Nicot, J., Deux Mucorales du sol; additions au genre *Haplosporangium* Thaxter. *Bull. Soc. Myc. France* **73**, 1957, p. 83—93, 4 fig.
82. Niethammer, A., Die Mucorineen des Erdbodens. *Zeitschr. f. Pflanzenkrankh.* **45**, 1935, p. 241—280.
83. Ou, S. H., Phycomyces of China I. *Sinensia* **2**, 1940, p. 33—57, 5 pl.
84. v. Overeem, C. & D., Verzeichnis der in Niederländisch-Ost-Indien bis zu dem Jahre 1920 gefundenen Myxomycetes, Fungi und Lichenes. *Bull. d. Jard. Bot. de Buitenzorg* **4**, 1922, 146 pp.
85. Page, R. M., Studies in the development of asexual reproductive structures in *Pilobolus*. *Mycologia* **48**, 1956, p. 206—224, 13 fig.
86. Poitras, A. W., Observations on asexual and sexual reproductive structures of the *Choanephoraceae*. *Mycologia* **47**, 1955, p. 702—713, 17 fig.
87. Raper, K. B. & Fennell, D. I., Two noteworthy fungi from Liberian soil. *Americ. Journ. of Bot.* **39**, 1952, p. 79—86, 21 fig.
88. Saccardo, P. A., *Sylloge Fungorum* **9**, 1891, p. 339, **14**, 1899, p. 432, **16**, 1902, p. 383, **17**, 1905, p. 507—508, **19**, 1910, p. 275, **24**, 1926, p. 6.
89. Saksena, S. B., A new genus of the *Mucorales*. *Mycologia* **45**, 1953, p. 426—436, 50 fig.
90. Schmidle, A., Die Tagesperiodizität der asexuellen Reproduktion von *Pilobolus sphaerosporus*. *Archiv Mikrobiol.* **16**, 1951, p. 80—100.

91. Shanor Leland, Poitras, A. W., & Benjamin, R. K., A new genus of the *Choanephoraceae*. *Mycologia* **42**, 1950, p. 271—278, 12 fig.
92. Sinha, S. A., On the characteristics of *Choanephora cucurbitarum* Thaxter on Chillies (*Capsicum* sp.). *Proc. Indian Acad. Sc. Sect. Bot.* **11**, 1940, p. 162—166, 10 fig.
93. Sinha, S. A., A wet rot of leaves of *Colocasia antiquorum* due to secondary infection by *Choanephora cucurbitarum* Thaxter and *Choanephora trispora* Thaxter sp. (= *Blakeslea trispora* Thaxter). *Proc. Indian Acad. Sc. Sect. B.* **11**, 1940, p. 167—176.
94. Sjöwall, M., Studien über Sexualität, Vererbung und Zytologie bei einigen diözischen Mucoraceen. *Lund* 1945, 97 pp. 27 fig.
95. Sjöwall, M., Über die zytologischen Verhältnisse in den Keimschläuchen von *Phycomyces Blakesleeanum* und *Rhizopus nigricans*. *Bot. Not.* **3**, 1946, p. 331.
96. Tai, F. L., A species of *Choanephora* with dichotomously branched conidiophores. *Sinensia* **4**, 1934, p. 215—224, 14 fig.
97. Mc Vickar, D. L., The light controlled diurnal Rhythm of asexual reproduction in *Pilobolus*. *Americ. Journ. of Bot.* **29**, 1942, p. 372—380, 7 fig.
98. Viegas, A. P. & Teixeira, A. R., Alguns fungos do Brasil (Phycomycetos). *Bragantia* **3**, 1943, p. 223—245, 4 fig. 22 pl.
99. Zach, F., Zur Kenntnis der Formenkreise von *Mucor plumbeus* Bonorden. *österr. Bot. Zeitschr.* **84**, 1935, p. 117—122, 1 fig.
100. Zach, F., Beitrag zum Formenkreis von *Mucor plumbeus* Bonorden. *österr. Bot. Zeitschr.* **85**, 1936, p. 151—153.
101. Zycha, H., *Mucorineae* in Kryptogamenflora der Mark Brandenburg **6a**, 1935, 264 pp. 114 fig.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Sydowia](#)

Jahr/Year: 1958/1959

Band/Volume: [12](#)

Autor(en)/Author(s): Boedijn K. B.

Artikel/Article: [Notes on the Mucorales of Indonesia. 321-362](#)