Critical revision of Botrytis-like genera leads to recognition of Botrytis, Chromelosporium, Glischroderma and Ostracoderma. Phymatrichum is synonymized with Botrytis, and previously assigned species are reconsidered. Six new genera are recognized: Pulchromyces (for Phymatrichum fimicola Dring); Phymatrichopsis (for Phymatrichum omnivorum Duggar); Streptobotrys, Amphobotrys, and Verrucobotrys (for conidial states of the Sclerotiniaceae); Dichobotrys (for the conidial state of Operculate Discomycetes of the genus Trichophaeae).

Hyphelia terrestris Fr. and related species, including conidial states of some Operculate Discomycetes of the genus Peziza, are placed in Chromelosporium. Peridiate fungi with a similar conidial apparatus, described in Lycoperdellon, are transferred to Ostracoderma, while Glischroderma is kept distinct.

Thirteen new species are proposed, and 16 new combinations are made for the species discussed.

The aim of this paper is to review the existing genera and to propose new ones in the classification of the Botrytis-like fungi. These fungi, including Botrytis, produce simultaneous, solitary, holoblastic conidia at the ends of conidiophore branches. All belong to Hughes’ (1953) conidiogenetic section IB.

Micheli's old genus, validated by Persoon (1801) under the name Botrytis Pers., and lectotypified by B. cinerea Pers. (Clements & Shear, 1931), has accommodated a still increasing number of related as well as unrelated fungi, exhibiting almost all of the kinds of conidiogenesis described by Hughes (1953) and Tubaki (1958). The number of taxa which have been assigned to the genus has increased from 5 originally (Persoon, 1801) to 128 (Saccardo, 1886), and has reached 380 today.

The need for a revision of the genus has been pointed out and initiated by several workers already. Even Nees (1817) described two new genera, Virgaria and Cladobotryum, to accommodate two species Link (1809) had erroneously referred to Botrytis. De Bary (1863) excluded from Botrytis most of the members that actually belong to

1 Based in part on a paper presented in a symposium at the First International Mycological Congress, Exeter, September, 1971.

2 I am reviving Hughes’ (1958) proposal to begin nomenclature of the Hyphomycetes with Dec. 31, 1801, if May 1, 1753 is not to be chosen.
the Peronosporales that Persoon and others had included. He transferred them to *Peronospora* Corda and to *Phytophthora* De Bary. In more recent times, Hughes (1958) removed from the genus a number of species belonging to his sections II, III, and IV, and to section IX of Tubaki (1958).

The segregation of *Botrytis*-like fungi from *Botrytis* Pers. requires an exact understanding of the type species of that genus, *Botrytis cinerea*. De Bary (1864) demonstrated the connection of *B. cinerea* with its sclerotial state, *Sclerotium durum* Pers., and with its apothecial state, *Peziza fuckeliana* De Bary, a member of the Sclerotiniaceae. De Bary (1869) then provided the earliest complete description of the conidial apparatus, as well as of the other states. The same author (De Bary, 1884) finally pointed out the production by the same fungus of a spermatial state. Whetzel (1945, completed by Fitzpatrick) intended, on principle, to accept in *Botrytis* only those species which are, according to Smith's (1902) expression, "*Botrytis* of the *cinerea* type." He thus excluded intentionally from that restricted concept of *Botrytis* the group of "strepitiform" *Botrytis* species and the "botryose conidiophores" of *Seaverinia*. Buchanan (1949) adopted almost exactly Whetzel's view, still calling for exclusion of any unrelated species, and particularly such species as *B. epigaea* Link (= *Hyphelia terrestris* Fr.).

From the early stage of development of its conidiophore to the point of full maturity, *Botrytis cinerea* presents many different aspects. These have even been taken for representatives of distinct genera. *Polyactis* Link and *Phymatotrichum* Bon. (lectotypified by *P. gemellum* Bon.) are both based on an immature stage of development of the first conidial head, still showing turgescent ampullae bearing conidia. *Hapalaria* Link, on the contrary, is based on mature conidiophores, bifurcate or trifurcate by proliferation of branches from the first mature head, with several, successively developed clusters of conidia borne along these proliferations. *Hapalaria* and *Polyactis* were correctly merged in *Botrytis* by Fries (1832), this synonymy confirmed by Hughes (1958) after study of the type material, and *Phymatotrichum* was correctly synonymized in *Botrytis* by Saccardo (1886). Since *Phymatotrichum* was recently revived by Bloss (1970), who seems to accept any assigned species, a critical consideration of the species formerly placed in that genus is also presented in this paper. Two of these serve as the type species of two new genera, *Phymatotrichopsis* and *Pulchrophyces*.

Data published after De Bary's studies demonstrate that a number of other *Botrytis* and *Botrytis*-like fungi are states of Discomycetes. Here two groups are to be distinguished. In the first group, all members of the Sclerotiniaceae (Inoperculate Discomycetes), *Botrytis*, *Streptobotrys* and *Amphobotrys* produce true plano-convex sclerotia, while *Verrucobotrys* produces a substratal stroma. The other group is representative of the Pezizales (O perculate Discomycetes). Two kinds of conidial states are distinguished and connect to distinct perfect genera. The new genus *Dichobotrys*, with globose conidiogenous cells, has its perfect state in *Trichophaeae* in the broad sense (Korf, 1972), inclusive of *Sphaerospora* (= *Sphaerosporella*), while
Chromelosporium Corda, with cylindrical conidiogenous cells, connects to some species of Peziza. *

Those Botrytis-like fungi having a close similarity to Chromelosporium in producing numerous conidia on cylindrical, dichotomous conidiogenous cells have often been assigned to Botrytis, Phymatotrichum, Hyphelia Fr. 1825 or 1849, or Ostracoderma Fr. The genus Hyphelia Fr. 1825, based on Trichoderma roseum Pers., does not belong to this group. Hyphelia Fr. 1849 (lectotype, H. terrestris Fr.) and Ostracoderma (type, O. pulvinatum Fr.) are very close, having similar fertile hyphae, but are dissimilar in that the latter has a true peridiate fruitbody. This is precisely the distinction already made by Fries (1825, 1829, 1849). Juel (1920) merged the two genera under the name Hyphelia Fr. 1849, stressing the similarity in fertile hyphae. Hughes (1958) and Lundell & Nannfeldt (1959) adopted Ostracoderma as the correct name since Hyphelia Fr. 1849's illegitimate. The oldest generic name available for H. terrestris and its non-peridiate allies is Chromelosporium Corda (type, C. ochraceum Corda). Ostracoderma is retained for the peridiate species, and Lycoberdellon Torrend is treated as a synonym of it. Another peridiate genus, Glischroderma Fuckel, though closely related to Ostracoderma, is provisionally kept separate.

Species of Chromelosporium, as understood here, have also been thought to be connected with Basidiomycetes of the genus Tomentella Bref. (Brefeld, 1888; von Höhnel, 1907). Ostracoderma (= Lycoberdellon) species have been presumed members of the Gasteromycetes (Heim & Malençon 1933; Heim, 1949), and Glischroderma was originally assigned to the Gasteromycetes by Fuckel (1870). Phymatotrichum omnivorum Duggar, here referred as Phymatotrichopsis omnivora, has been said to connect to Hydnum omnivorum Shear (Shear, 1925), or to Trechispora brinkmannii (Bres.) Rogers & Jackson (Baniecki & Bloss, 1970). None of these assumptions has been confirmed.

The segregation presented here of new form genera for the Botrytis-like fungi is primarily based on the morphology of the conidial state, in which sufficient diagnostic features can be observed even in the absence of other imperfect or perfect states. Such accompanying states (stromata, apothecia, spermatia), cultural characters, or any ecological features may serve, however, as additional guides. These corroborate the classification to the point that, I believe, natural genera have been segregated. These genera can be grouped as follows, in part based on their connection to known perfect state families: —

I. Form genera of the family Botrytidaceae Lindley (Section IB)
   A. Genera connected to Inoperculate Discomycetes of the family Sclerotiniaceae
      Whetzel
      1. Botrytis Pers. — Botryotinia Whetzel
      2. Streptobotrys n.g. — Streptotinia Whetzel
      3. Amphobotrys n.g. — Botryotinia Whetzel
      4. Verrucobotrys n.g. — Seaverinia Whetzel

* Other Peziza species are known to produce an Oedoecephalum conidial state; although it also belongs to Hughes' section IB, that genus is not considered here, the conidiophore being unbranched.
B. Genus connected to Operculate Discomycetes of the family *Pyronemataceae* Corda
   5. *Dichobotrys* n.g. — *Trichophaca* Boud.

C. Genus connected to the Operculate Discomycetes of the family *Pezizaceae* Fries

D. Genera with no known perfect state
   7. *Pulchromyces* n.g.
   8. *Phymatotrichopsis* n.g.

II. Form genera of the family *Glischrodermataceae* Rea (Section IB); with no known perfect state
   9. *Ostracoderma* Fries
   10. *Glischroderma* Fuckel

To aid in the rapid keying out of specimens to the correct genus, a synoptic key and a schematic chart (Figs. 1–10) are presented, based on the most useful generic characters. Korf (1972) indicated the way of using such a key. Each character is a possible first entry leading to candidate genera listed by the same numbers as above. The examination of additional characters finally selects one particular genus. I am following Leenhouts’ (1973) modified method, in which boldface type is used to indicate genera showing only one of the alternatives in any character grouping.

**Synoptic key to the genera**

**Criteria of the conidial state.**

- Peridium enclosing conidiophores: present, non-ostiolate: 9
  present, ostiolate: 10
  absent: 1 2 3 4 5 6 7 8

- Arrangement of conidiophores: mononematous, solitary or in groups: 1 2 3 4 5 6 7 8
  synnematous: 6 8 9 10

- Branching of conidiophores: alternate: 1 2 4
  regularly dichotomous: 3 5 6 7
  irregularly dichotomous or coralloid: 6 9 10
  absent to irregularly alternate: 8

- Contour of branches: straight: 1 3 4 5 6 7 8 9 10
  twisted: 2

- Proliferation of conidiophores: present: 1 4
  absent: 2 3 5 6 7 8 9 10

- Conidial shape: globose: 1 2 3 4 5 6 7 8 9 10
  ovate or elliptical: 1 4 6 8 9
  napiform: 5

- Conidial wall ornamentation: absent: 1 2 3 5 6 8 9
  verrucose or spinulose: 4 6 10
  reticulate: 7

- Colour of spore mass: grey turning brown: 1 2 3 4
  white turning ochre-yellow to tawny or clay-brown: 5 6 7 8 9 10
  rose, violet or blue when young: 6 9 10

**Characters of the stromatal state.**

- Stroma: sclerotial: 1 2 3
  substratal: 4
  absent: 5 6 7 8 9 10
Each generic name is provided below with its synonymy, a description and a Latin diagnosis or a redescription, a list of selected known species, with Latin diagnoses if newly named, and finally a list of excluded species. These lists of excluded and accepted species, as well as the synonymies, do not pretend to be exhaustive now. More species of which I am aware have to be described or redescribed in most of these genera, and will be included in a more detailed monograph.


Colonies effuse, at first white to greyish, then dark brown; hyphae hyaline to brown, septate. *Conidiophores* erect, solitary or in groups of 2 to 5 borne on a cluster of hyphal cells, basal cell often inflated; stipe straight, subhyaline to brown, septate, branched towards the apex, branches lateral, alternate, at a wide angle to the axis, successively developed from the base to the apex, branching again alternately, forming at each end a globose, swollen conidiogenous cell bearing simultaneous conidia on pedicels, becoming septate and collapsing accordion-like at conidium maturity, after abscission leaving a prominent, flat, rounded scar at the apex of the stipe or the ends of the branch stumps; stipe and branch stumps proliferating from scars into new branches, septate, brown, producing new conidial heads; at maturity of these, proliferations occur again, making the resulting conidiophore monopodial, dichotomous or trichotomous, bearing one or more series of conidial clusters along the stalks. *Conidia* holoblastic, globose, obovate or elliptical, continuous, subhyaline to brown, with smooth walls, separated from the pedicel by a transverse septum, breaking off with a frill. Abnormal conidia with a median septum and a broadened base.

*Sclerotial state* referred to *Sclerotium* Pers. *Sclerotia* black, plano-convex, flattened or pulvinate or cerebriform, rounded, lobate or elongate, with the surface smooth.

4 Rudakov’s (1959) new infrageneric categories of *Botrytis* are not validly published, nor is it now possible to assign them their correct positions in the synonymies.
nodulose or echinulate; cortex of textura angularis, cells polygonal with walls thick and brown; medulla of textura intricata, interwoven hyphae with hyaline and gelatinous walls. *Appressoria* dark brown to black, developed by repeated division of the growing hyphae as a flat, palmate body of rectangular cells with walls becoming thick and brown, forming a cortex without a medulla.

*Spermatial state* referred to *Myriocinum* H. Sydow. *Spermochium* developed from sclerotia or hyphae, sometimes in collapsed hyphal cells, white to isabellinous, typically composed of a sessile or stalked, compact, penicillate cluster of phialides or even of only a single phialide, phialides short, inflated towards the base, tapering at the apex, with or without a collarlette; spermatia phalidic, hyaline, globose, minute, thick-walled, uniguttulate, developed in chains and forming mucilaginous masses.

*Perfect state* referred to *Botryotinia* Whetzel.

*Cultures* are readily obtained on standard culture media. Glucose favours stromatic production, while asparagine, hay extract, moderate temperature and near-ultraviolet light favour conidio genesis. Apothecia form in culture under special conditions.

**SELECTED KNOWN SPECIES**


*Botrytis byssoidea* Walker in Phytopathology 15: 799. 1925.


*Botrytis croci* Cooke & Massee in Cooke in Grevillea 16: 6. 1887.

*Botrytis elliptica* (Berk.) Cooke in Grdnrs' Chron. 30: 58. 1901.


*Botrytis globosa* Raabe in Hedwigia 78: 71. 1938; conidial state of *Botryotinia globosa* Buchw. in Phytopath. Z. 20: 250. 1953.


*Botrytis perlargonii* Roed in Blyttia 7: 77. 1949; conidial state of *Botryotinia perlargonii* Roed in Blyttia 7: 77. 1949.


Botrytis squamosa Walker in Phytopathology 15: 710. 1925; conidial state of Botryotinia squamosa Viennot-Bourgin in Annls Epiphyt. 4: 38. 1953.


Some names to be excluded

Botrytis carnea Schum., Enum. Pl. Saell. 2: 278. 1803 is Chromelosporium carneum (Pers.) Hennebert.

Botrytis carnea (Ehrenb.) Spreng. in L. Syst. Veg., Ed. 16, 4(1): 551. 1827 (later homonym) is Chromelosporium carneum (Pers.) Hennebert.

Botrytis crystallina (Bon.) Sacc., Syll. Fung. 4: 135. 1886 is Chromelosporium ollare (Pers.) Hennebert.

Botrytis dichotoma Corda, Icon. Fung. 1: 18. 1837 is Chromelosporium ochraceum Corda.


Botrytis epigaea Link var. ochracea D. Sacc., Mycoth. Ital. 1178. 1903 is Chromelosporium ochraceum Corda.


Botrytis terrestris (Link) Pers., Mycol. eur. 1: 38. 1822 is Costantinella terrestris (Link) Hughes.

Botrytis terrestris Brunaud in Annls Acad. Sci. nat. Char. Inf. 24: 71. 1888 (later homonym) is Chromelosporium tuberculatum (Pers.) Hennebert.

Botrytis terrestris Jensen in Bull. Cornell agric. Exp. Stn 315: 489. 1912 (later homonym) is Chrysosporium pennorum (Link) Hughes.

A taxonomic redisposition of the species assigned to Phymatotrichum Bon.


Phymatotrichum compactum Pat. in Bull. Soc. mycol. Fr. 7: 162. 1891 = Botrytis compacta (Pat.) Sacc., Syll. Fung. 10: 536. 1892 is Nodulisporium compactum (Pat.) Hennebert, comb. nov.

**Phymatotrichum epigaeum** (Link) Oud. in Verh. K. Akad. Wet. (Nat. II) 11: 493. 1904 = *Botrytis epigaea* Link 1824 is *Chromelosporium tuberculatum* (Pers.) Hennebert.


*Phymatotrichum fungicola* Zeller in Mycologia 21: 110. 1929 is *Aegerita fungicola* (Zeller) Hennebert, comb. nov.

*Phymatotrichum gemellum* Bon., Handb. Mykol. 116. 1851 = *Botrytis gemella* (Bon.) Sacc. in Michelia 2: 258. 1881 (iconotype: Bon., loc. cit. f. 138; lectotype species of *Phymatotrichum* is *Botrytis cinerea* Pers.)


*Phymatotrichum paeonae* (Oud.) Oud. in Verh. K. Akad. Wet. (Nat. II) 11: 493. 1904 = *Botrytis paeonae* Oud., an accepted species of *Botrytis*.


*Phymatotrichum tilletii* (Desm.) Oud. in Verh. K. Akad. Wet. (Nat. II) 11: 493. 1904 = *Botrytis tilletii* Desm. in Annls Sci. nat (Bot.) II 10: 308. 1890 ("tilletii") is *Costantinella terrestris* (Link) Hughes.

### 2. Streptobotrys Hennebert, gen. nov.

**Type species:** *S. streptothrix* (Cooke & Ellis) Hennebert.

Coloniae effusae, griseae deinde brunneae, hyphis hyalinis seu brunneis, septatis, ramosis. Conidiophori erecti, solitarii vel caespitosi, magni, laxos racemos conidiiorum ferentes; stipites cylindrici, brunnei, septati, stricti, sursum ramosi, ramis longis, tortilibus, iterum ramosis, ramulis extremis in apice conidiogenis, non inflatis, simul conidia ad pediculos producentibus, tarde dilabentibus. Conidia holoblastica, globosa, subhyalina vel brunnea, laevia, cum basali vestigio pediculi. Sclerotia minuta. Spermatia phialidica hyalina. Species typica, *Streptobotrys streptothrix* (Cooke & Ellis) Hennebert.

Colonies effuse, grey turning soon to dark grey and dark brown; hyphae hyaline to brown, septate, branched and anastomosing. *Conidiophores* erect, single or in groups of 2 or 3, tall, with large, lax conidial heads; stipes cylindrical, brown, septate, often with a slightly swollen basal cell, wall straight, at about half height alternately branched at a wide angle, branches long, with the wall tightly twisted and branched again several times, the last branchlets at right angles near the ends, each apical cell of branches and branchlets delimited by a septum, remaining unswollen, conidiogenous, producing 2 to 6 simultaneous conidial buds on short pedicels, and collapsing at maturity, leaving the branches with terminal, perpendicular stumps which do not proliferate. *Conidia* holoblastic, regularly globose, subhyaline to brown, smooth, bearing an inconspicuous frill at the basal septum.

*Sclerotial state* referred to *Sclerotium Pers*. *Sclerotia* of small size and similar to those of *Botrytis*.
Spermatial state referred to Myrioconium Sydow. Spermodochium similar to that of Botrytis.
Perfect state referred to Streptotinia Whetzel.

Cultures are readily obtained, fast growing, developing both conidia and sclerotia on most standard media under daylight or near-ultraviolet light and moderate temperature. Perfect states have been obtained in culture (Elliott 1962, 1969).

**Described species**

**Streptobotrys arisaemae** Hennebert, sp. nov.; Latin diagnosis in Whetzel in Mycologia 37: 686. 1945; holotype: Herb. CUP 8377; conidial state of Streptotinia arisaemae Whetzel, loc. cit.


**Streptobotrys streptothrix** (Cooke & Ellis) Hennebert, comb. nov. = Polyactis streptothrix Cooke & Ellis in Grevillea 7: 39. 1878 = Botrytis streptothrix (Cooke & Ellis) Sacc., Syll. Fung. 4: 127. 1886.

**3. Amphobotrys** Hennebert, gen. nov.


Coloniae effusae, ochro-griseae deinde bruneae, hyphis hyalinis, septatis, ramosis. Conidiophori erecti, solitarii, magni, laxos racemos conidiorum ferentes; stipites cylindrici, pallide brunnei, septati, sursum dichotomice bifurcati, ramis symmetricis, divaricatis, longis, cylindricis, repetito bifurcati, in apice geminatis globosis, inflatis cellulis conidiogenis, simul conidia ad pediculos ferentibus et deinde dilabentibus. Conidia holoblastica, globosa, subhyalina vel brunnea, laevia, cum basali vestigio pediculi. Sclerotia media et spermatoria phialidica hyalina. Species typica, Amphobotrys ricini (Buchw.) Hennebert.

Colonies effuse, white turning grey-ochraceous to brown, hyphae hyaline, septate, branched. Conidiophores erect, single, tall, with large, lax conidial heads; stipe cylindrical, light brown, septate, at about half height bifurcate at a wide angle, branches almost symmetrical, long, cylindrical, repetitively bifurcating at shorter intervals to produce groups of paired, globose, inflated, terminal conidigenous cells, each developing simultaneous conidial buds on short pedicles, then collapsing at maturity. Conidia holoblastic, regularly globose, subhyaline to brown, smooth, bearing an inconspicuous frill at the basal septum.

Sclerotial state referred to Sclerotium Pers. Sclerotia of small size, similar to those of Botrytis.

Spermatial state referred to Myrioconium Sydow, similar to that of Botrytis.
Perfect state referred to Botryotinia Whetzel.

Cultures readily obtained on standard culture media. Perfect state unknown in culture.

**Described species**

4. *Verrucobotrys* Hennebert, gen. nov.


Coloniae effusae, brunneae, hyphis subhyalinis vel brunneis, septatis, ramosis. Conidiophori erecti, singuli, apice ramosi; stipes cylindrici, septati, brunnei, crasso pariete; rami racemum conidiorum formantes laterales, alternati, terminalibus cellulis non inflatis, conidiogenis, simul paucus conidia ad pediculos producens, rami tarde pro magna parte dilabentes, stipites e cicatricibus apicalibus et lateralibus deinde proliferantes. Conidia holoblastica, pyriformia vel subglobosa, brunnea, basi applanata, crasso et interna valde punctato pariete, cum obscuro vestigio pediculi dilabentia. Stromata in substrato delineata. Species typica, *Verrucobotrys geranii* (Seaver) Hennebert.

*Colonies* effuse, white turning brown, hyphae subhyaline to brown, branched, septate. *Conidiophores* erect, single, stipe cylindrical, septate, brown, thick-walled, with lateral, alternate branches near the apex, forming a tree-like conidial head, successively developed from the base to the apex and branched again as in *Botrytis*, each terminal cell of branches unswollen, conidiogenous, producing 2 to 3 simultaneous conidial buds on short pedicels, the greater part of the branches collapsing and breaking off at conidium maturity leaving scars on the main axis, which may proliferate axially and laterally to produce new conidial heads. *Conidia* holoblastic, pyriform to subglobose, with a flattened base, mostly without a frill, brown, with thick walls, an inner wall layer heavily punctate.

*Stromatal state* not a true sclerotium but a substratal stroma, delimited by a black line formed of rind-like, dark, thick-walled cells and filled with medullary, interwoven, thin-walled hyphae mixed with host tissues; developing in *vitro* in irregular large areas of subhyaline to brown hyphae delineated with a dark line of compacted, thick-walled, brown hyphal cells.

*Spermatial state* not observed.

*Perfect state* referred to *Seaverinia* Whetzel.

*Cultures* readily obtained on standard culture media. Perfect state unknown in culture.

**Described species**


5. *Dichobotrys* Hennebert, gen. nov.

Type species: *D. abundans* Hennebert.


*Colonies* large, effuse, pale to dark ochraceous, creeping hyphae hyaline, loose. *Conidiophores* erect, tall, dichotomously furcate at about half height, branches long, symmetrical, divergent, and furcating symmetrically several times at shorter lengths
up to the apex, terminal branches each bearing paired, round, inflated conidiogenous cells developing simultaneous conidial buds, then collapsing at maturity. *Conidia* holoblastic, single, sessile or on pedicels, subglobose to napiform with an equally thick wall or with a thicker wall on the upper half than on the lower half, wall smooth, with the basal septum often at some distance down in the pedicel, breaking off at maturity by rupture of the pedicel under the septum, leaving a conspicuous frill.

*Perfect state* referred to *Trichophaea* Boudier.

* Cultures* readily obtained on standard culture media, both conidial and perfect states being produced.

**Described species**

**Dichobotrys abundans** Hennebert, *sp. nov.;* conidial state of *Trichophaea abundans* (Karst.) Boud., Hist. class. Discomyc. Eur. 61. 1907.


**Misapplied name.** — *Sphaerospora himulea* (Berk. & Br.) Masseo *sensu* Wolf in J. Elisha Mitchell scient. Soc. 79: 159. 1963 (fide R. P. Korf., *pers. comm.*).


Colonies effuse or in small patches, velvety or tufted, at first white, then diversely coloured, rose, purple, violet, lilac, blue, yellow, ochraceous, grey or brown, developing on the substratum either a dense subiculum or a loose network of creeping, hyaline to fulvous, often broad, thin-walled, simple or aggregated, fast growing hyphae, soon collapsing at maturity. Conidiophores erect, either mononematous, solitary or caespitose, or in fasciculate synnemata, very short to long, apically developing small, individual, radiate or pulvinate to larger, compacted conidial heads; stipes hyaline to ochraceous fulvous, cylindrical, septate, thin-walled, anastomosing when synnematoth, dichotomously furbate at the apex; branches short or longer, repeatedly branched, regularly dichotomous to irregularly coralloid, with or without symmetrical septation, parallel or divergent, cylindrical, straight, or slightly inflated with blunt tips, hyaline, thin-walled, conidiogenous either on their terminal cell or along several dichotomies backwards, producing numerous, simultaneous, well-spaced conidial buds on conspicuous pedicels, collapsing almost entirely at conidium maturity. Conidia holoblastic, borne singly on pedicels, globose, subglobose or ovate, at first smooth and hyaline, diversely coloured in mass, with the inner wall finely punctate, verrucose, echinulate or coarsely warted, ornamentation cyanoephilic, and external wall smooth and translucid.

Perfect state referred to Peziza Pers.

Cultures readily obtained from ascospores, conidia and hyphae on standard media from species with known perfect states; from most unconnected species, germination of conidia fails to occur, as also reported by Brefeld (1888), but growth from hyphal transfers has been obtained.

Notes: Brefeld (1888) described and illustrated basidial fungi observed by Johan-Olsen, his assistant, in connection with some of the species assigned here. Tomentella flava Bref. (= Botryohyphochnus isabellinus (Fr.) J. Erikss.) was said to be associated with Botrytis argillacea Cke. or B. gemella (Bon.) Sacc. sensu Sacc. (i.e. Chromelosporium carneum of this treatment), and T. granulata Bref. with B. epigaea Link (i.e., C. tuberculatum). He confessed explicitly not to have seen conidial and basidial states in direct connection on the same hypha, but assumed their mutual relationship from the striking similarities of their hyphae and spores and from their regular concomitance in nature. Von Höhnel (1907) added to these observations, connecting B. isabellina Preuss (i.e. C. ochraceum) to T. isabellina (Fr.) Höhn. (= T. flava), and B. carnea Schum. (≡ C. carnea) with T. fusca (Pers.) Höhn. No demonstration of these connections has ever been provided.

However, several authors have assumed the correctness of Brefeld's and von
Höhnel's assertions. Juel (1920), while describing the similar conidial apparatus in *Chromelosporium* (as *Hyphelia*) and in *Ostracodera* (also as *Hyphelia*) indicated the presumed basidial state, following Brefeld. Heim & Malençon (1933), and Malençon (1960), with the same faith in Brefeld's statements, concluded these fungi were basidiomycetous.

As Lohwag (1934) already foresaw, it is now established that a number of species of this genus are conidial states of Opeckulate Discomycetes. All fall in the genus *Peziza* in its broad sense, including spherical- and elliptical-spored species (Schneider, 1954; Wolf, 1955, 1958; Korf, 1961; Paden, 1972).

Details of the conidial apparatus as seen under the electron microscope have been provided for *Chromelosporium ollare* (conidial *Peziza ostracodera*) by Hughes & Bisalputra (1970).

**Described species**

*Chromelosporium arenosum* Hennebert, *sp. nov.*

Fungus imperfectus. Coloniae pellucidae, sporulantes arenosae, primum albae, demum cretaceae, hyphis teneribus, sparsis, araneosis, parce septatis, 7-9 μm crassis, facile evanescentibus, saepe regenerantibus. Conidiophori mononemati, brevissimi, erecti, sparsi, solitarii, stipes 70-100 μm longi, 8-9 μm crassi, basi inflata, cylindracei sed ad septos constricti, 2 septati, in apice 1-3-dichotomice furcati; rami breves, intermedii 10-15 μm longi, 6-7 μm crassi, terminales usque ad 50 μm longi, 13 μm crassi, in tota longitudine conidiogeni. Conidia singula ad denticulum, globosa vel ovata, 3.5—5.5 X 3.5-6.5 μm, crasso pariete, externo laevi et hyalini, interno tuberculato cum 6-10 rotundis cyanophilis verrucis in mediano visu. Habitat in putrido ligno. Holotypus: Herb. K., Flora Venezuelae 2474, ad lignum putridum Espeletiae, 355° m. alt., Mucudaji, Sanide Santo Domingo, Estado Mesida, Venezuela, 22 Julio 1958, leg. R. W. G. Dennis; isotypus: Herb. G.L.H. 2298, DAOM 83359.

*Chromelosporium canadense* Hennebert, *sp. nov.*


**Note:** The fungus has been obtained several times in culture on Hagem's Medium, but remained sterile.

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**Note:** This species forms synnematous conidiophores, and commonly develops on dead leaves in Europe, more rarely in America. A perfect state is unknown.


**Notes:** This species is synnematous, and is intermediate between *C*. *carneum* and *C*. *tuberculatum*. It is remarkable for its bright, crystal blue color, turning rose violet. It grows in large patches on decayed wood and mosses in the forest, and is common in America, rare in Europe. A perfect state is unknown.

**Chromelosporium macrospermum** Hennebert, *sp. nov.*


**Notes:** This species differs from *C*. *ollare* in having conidia twice the diameter of those in that species. The perfect state material represents an apparently undescribed species, but is perhaps too fragmentary to serve as a type specimen (R. P. Korf, *pers. comm.*).

**Chromelosporium ochraceum** Corda in Sturm, Deutschl. Fl. III (Pilze), 3(13): 81, t. 41. 1833.

**Notes:** The species is characterized by mononematous conidiophores with long, dichotomous branches and verrucose conidia. It commonly develops on litter materials in deciduous forests. A perfect state is unknown, and attempts to culture it have failed.


**Note:** The conidial state of this common greenhouse fungus has, following the classification of Hughes (1958), been assigned to *Ostracoderma* (Korf, 1961; Fergus, 1961; Barron, 1968; von Arx, 1970).

**Chromelosporium trachycarpum** Hennebert, *sp. nov.* = *Rhinotrichum trachycarpum* Wolf in J. Elisha Mitchell scient. Soc. 74: 166. 1958 (type not indicated); conidial state of *Peziza trachycarpa* Curr. y.


**Notes:** This common species develops byssoid patches on naked, loamy soil in the forest, and is characterized by synnematous, compacted conidiophores of variable colour, bearing verrucose conidia. A perfect state is unknown.


**Note:** The state developed in artificial culture consists of compacted patches of conidiophores bearing globose to obovate, verruculose conidia in strains received from Dr. J. W. Paden.


**Type species:** *P. fmicola* (Dring) Hennebert.


**Colonies** effusae, at first white, then ferrugineous when sporulating, fast growing, petaloid to zonate, hyphae hyaline, septate, often aggregated. *Conidiophores* mononematos, erect, very tall, single or caespitose, hyaline turning brown, sparingly septate, thick-walled, producing spirally at the apex of the stipe numerous lateral branches; branches of equal length, radiate, 2 to 4 times dichotomously furcate, with terminal cells longer, cylindrical, conidiogenous, producing almost simultaneous conidia on pedicels, except at the sterile, tapered and acute end, branches collapsing and breaking off from the stipe at conidium maturity. *Conidia* holoblastic, single on a pedicel, sphaerical, hyaline and smooth when young, then ferrugineous and reticulate, with a prominent base. Habitat in rodent dung.

**Perfect state** unknown.

**Cultures** readily obtained on standard media.


Type species: *P. omnivora* (Duggar) Hennebert


Colonies araneose, floccose, bristly, matted or compacted, yellow-ochraceous to brown, persistent. Mycelium composed of septate hyphae, without clamps, branched, often anastomosing, more closely septate and aggregated into funicles, provided with aerial, cruciate, hair-like setae. Conidiophores borne laterally on hyphae, simple or branched, moniliform, with terminal and subterminal cells inflated, globose, conidiogenous, producing almost simultaneously sessile conidia. Conidia holoblastic, globose or ovate, smooth, thin-walled, with a broad base and a frill of attachment. Habitat at the base of living plants in soil.

Perfect state unknown.

Cultures are readily obtained from hyphae, but sporulate sparsely on artificial media.


Notes: A "perfect state" has been described by Shear (1925) as being produced by Ozonium omnivorum, and was referred to as Hydnum omnivorum only on the basis of the external, hydnoid aspect of the mycelial state. No basidia or basidiospores were observed by Shear, nor by Dr. L. K. Weresub and myself when we studied the type collection. Another basidial state, associated with bulbils and identified as Trechispora brinkmannii [i.e., Sistotrema brinkmannii (Bref.) J. Erikss.], has been indicated by Banicki & Bloss (1970) as being connected to Phymatotrichum omnivorum. Comparison of pure cultures of S. brinkmannii and Phymatotrichopsis omnivora makes evident, as suggested by Weresub & Leclair (1972), that the connection of these two fungi is most doubtful.


Type species: *O. pulvinatum* Fries (monotype).
**Lycoperdellon** Torrend in Broteria (Bot.) **xx**: 92. 1913. — Type species: *L. torrendii* (Bres.) Torrend.

**Fruitbodies** solitary or gregarious, variable in size, emerging from a subiculum of septate hyphae, expanding from hemispherical to subglobose or globose, sessile or subpedicellate, covered with a crustaceous, diversely coloured peridium from pale grey to testaceous brown, and with a gleba composed of conidiophores which are white, rose, grey or ochre-yellow in mass. **Peridium** glabrous, pellicular, brittle, entirely covering the fruitbody, splitting or breaking down at maturity, composed of interwoven, septate, branched hyphae, the most external ones thick-walled and encrusted with some cementing material, the internal ones with a thinner wall and developing fertile branchlets inwards. **Gleba** composed of a suberial layer of branched hyphae developed from the base of the fruitbody and producing apically numerous, dichotomous to coralloid branches filling the central cavity; branches cylindrical to slightly swollen and sinuous, sparingly septate, conidiogenous much of their length, producing simultaneously numerous, well-spaced conidia on pedicels. **Conidia** holoblastic, single on each pedicel, globose, ovate or elliptical, hyaline or pale coloured, with an external, smooth, transparent wall, the inner wall not ornamented but cyanophilic, breaking off with a scar of attachment. Habitat on soil surface.

**Perfect state** unknown.

** Cultures** were not established when conidia were placed on artificial media; no germination occurred.

**Notes:** The question has been raised, for the species of *Lycoperdellon*, as to whether these fungi belong to the Basidiomycetes or the Ascomycetes. Since that genus is synonymous, the question now applies to *Ostracoderma*. Heim & Malençon (1933) first described the conidial nature of the spores in *Lycoperdellon*. They argued, however, in favour of its assignment to the Gasteromycetes, a position which was opposed by Lohwag (1933) who favour the Ascomycetes. While Fischer (1933), Heim (1949) and Malençon (1960, 1964a, 1964b) were still inclined to regard them as Basidiomycetes, Zeller (1948) simply suggested to keep them in the Fungi Imperfecti, as long as basidia or asci had not been found. Donk (1962a, 1962b) implied from the similarities between the conidial apparatus of *Lycoperdellon* and that of *Peziza ostracoderma* that *Lycoperdellon* might well prove to be the conidial state of a Discomycete.

Recent electron microscopic studies carried out by R. Bronchart and V. Demoulin of the Botany Department, University of Liège, Belgium, on *Ostracoderma torrendii* demonstrated in this fungus the existence of a septal pore characteristic of the Ascomycetes (V. Demoulin, **pers. comm.**). The paired bodies observed near the septa in *O. pulvinatum* by Juel (1920) and in *L. torrendii* by Malençon (1960) are presumably Woronin bodies like those accompanying the septal pore in Bronchart and Demoulin’s unpublished photographic documents.

**Described species**

**Ostracoderma minutum** (Heim) Hennebert, **comb. nov.** *≡* *Lycoperdellon minutum* Heim in Treb. Mus. Ci. nat., Barcelona (Bot.) **xv**: 198. 1934.


**Ostracoderma sphaerosporum** (Dissing & Lange) Hennebert, **comb. nov.** *≡* *Lycoperdellon sphaerosporum* Dissing & Lange in Bull. Jard. bot. État Brux. **32**: 408. 1962.
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Ostracoderma torrendii (Bres.) Hennebert, comb. nov. ≡ Lycogala torrendii Bres. in Torrend in Broteria (Bot.) 7: 28. 1908 ≡ Lycoperdellon torrendii (Bres.) Torrend in Broteria (Bot.) 11: 92. 1913.

NAMES TO BE EXCLUDED

Ostracoderma cameum (Ehrenb.) Hughes in Can. J. Bot. 36: 792. 1958 is Chromelosporium carneum (Pers.) Hennebert.

Ostracoderma epigaeum (Link) Hennebert ex Hellmers in Horticultura 19(5): 72. 1965 belongs in the synonymy of Chromelosporium tuberculatum (Pers.) Hennebert. The combination was made by Hellmers against my wishes, and misapplied by him to the conidial state of Peziza ostracoderma Korf, which he erroneously cited as a synonym of P. atrovinosa Cooke & Gerard.


Ostracoderma spadiceum Schw. in Trans. Am. phil. Soc. II 4: 262. 1832 is Dictydiaethalium plumbeum Rost.

Ostracoderma terrestre (Fr.) Nannf. in Lundell & Nannf., Fungi exs. succici, Fasc. 53–54, Schedae 40. 1959 is Chromelosporium tuberculatum (Pers.) Hennebert.

Ostracoderma state of Peziza ostracoderma Korf is Chromelosporium ollare (Pers.) Hennebert.


Notes: This genus is provisionally accepted for the only species to be described, G. cinctum. As far as I can understand from an examination of the type material (Fuckel, Fungi rhen. 162. 1863, as "? Ostracoderma pulvinatum Fr.," Herb. G), it differs from Ostracoderma mainly if not solely in the ornamentation of the conidial wall. Malençon (1964b), describing a recent collection as G. cinctum, pointed to the presence of an apical ostiole in the peridium, a character that Fuckel denied for his fungus. A perfect state is unknown, and cultures have apparently never been attempted.

Glischroderma, Lycoperdellon, and Ostracoderma have also served as the bases for families and orders. Rea (1922) erected the family Glischrodermataceae to include Glischroderma. Heim (1934) proposed the family name Lycoperdellaceae for Lycoperdellon. Malençon (1964b) synonymized the two families, choosing the oldest, Glischrodermataceae, to include both genera. At the same time he erected a new family, Ostracodermataceae, for non-peridiate species which are now to be classified in Chromelosporium; since the genus Ostracoderma does have a peridium, Malençon's second family is clearly synonymous with Glischrodermataceae. In the meanwhile, Zeller (1948) accepted the family Lycoperdellaceae, even though no family diagnosis has apparently ever been published, excluded it from the Gasteromycetes, and added the genus Leucophilebs Harkn. He then proposed a new order for these fungi, Lycoperdellales, which he placed in the Fungi Imperfecti. Malençon's (1964b) order Glischrodermatales will fall in synonymy if such orders were to be recognized.
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